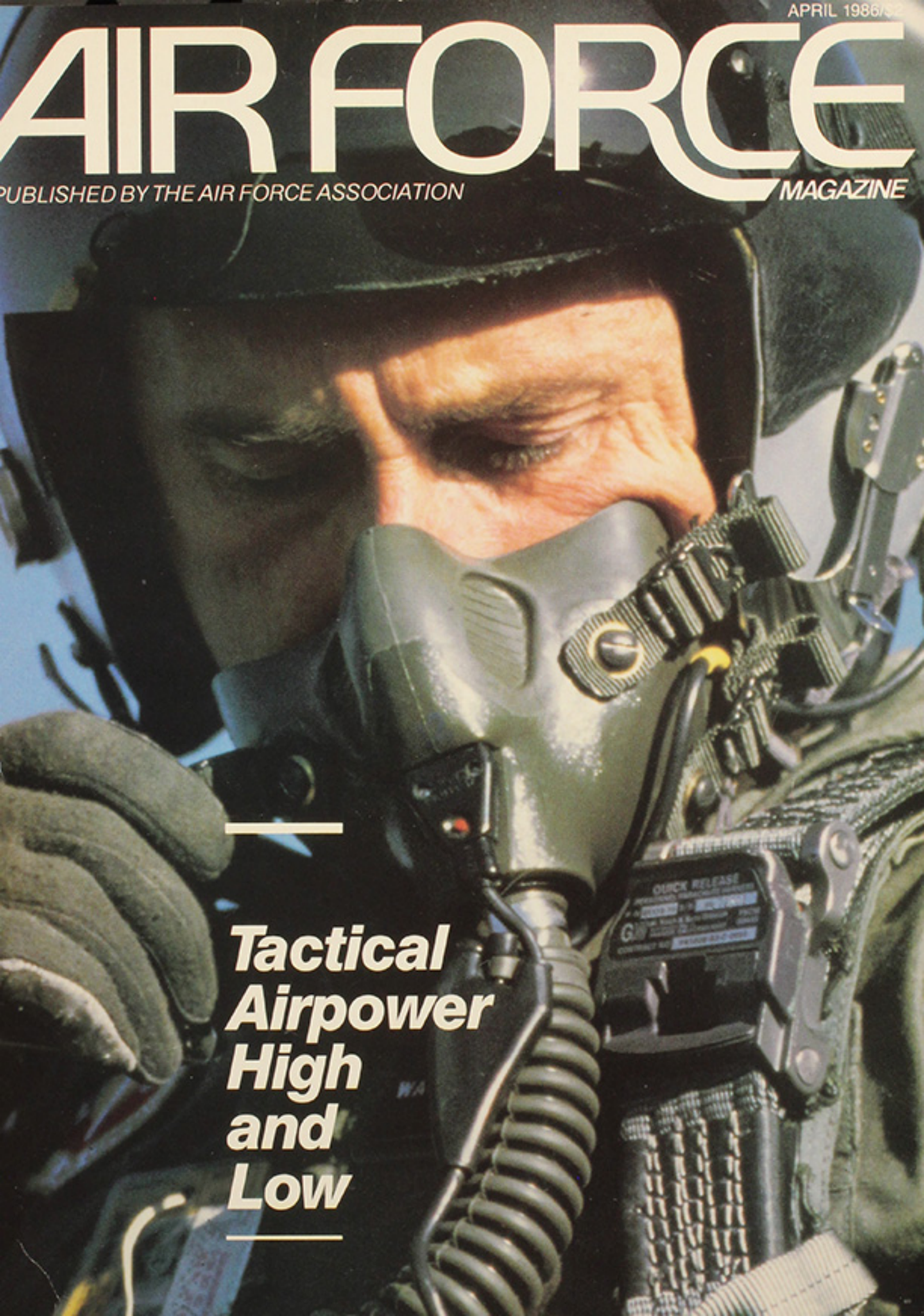
APRIL 1986/$2

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



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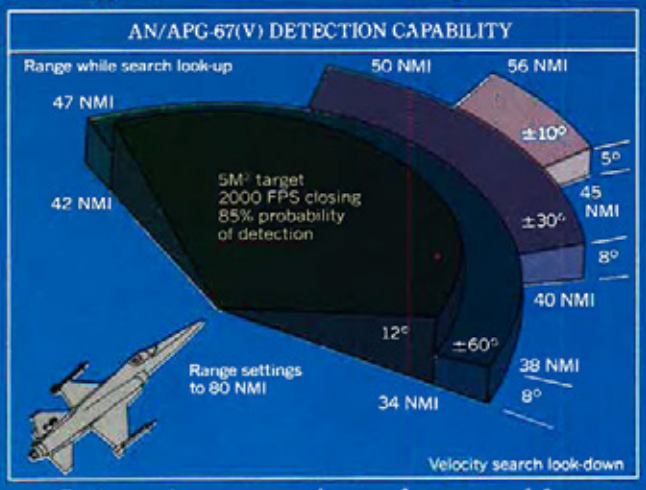

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APRIL 1986
VOLUME 69, NUMBER 4

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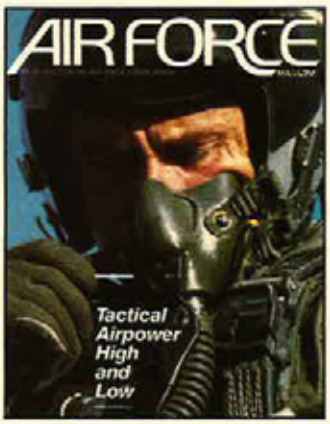

About the cover: Maj. Wayne E. Conroy of AFRES's 419th TFW at Hill AFB, Utah, mounts his F-16 for a foray to the Gunsmoke '85 air-to-ground competition at Nellis AFB, Nev. (USAF photo by SSgt. Rose Reynolds)

Special Section: Tactical Airpower

Features

Departments

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AN EDITORIAL

The Drift of Values

By John T. Correll, EDITOR IN CHIEF

THE little red booklet, lying among other curiosities in an antique shop, was still in good condition after forty years. Only its ideas had been overtaken by time.

Its preface recalls the values of a different era: "We on the home front tighten our belts, do without, make the most of what we have. But we are fortunate. Our sacrifices are small compared to those made every minute of the day by our fighting men. . . . Above all else, we must make our everyday efforts on the home front worthy of the great deeds they are performing on a hundred far-flung battle fronts."

The booklet is a guide for wartime living. It tells how to make ice cream without sugar and offers suggestions for meat-stretching menus. It was published during World War II, at a time when movie stars served in uniform and when ordinary citizens endured rationing, bought bonds, planted victory gardens, and saved scrap metal for defense production. The fighting forces were reminded constantly that their nation was behind them. Defeat of the Axis took years of this sustained commitment and mobilization, but there was a broad consensus for the worth and necessity of the effort.

Such a spirit of sacrifice and national unity would not be seen again in the forty years that followed the war. The emergence of nuclear weapons had changed the basic nature of armed conflict, and the new threats to national security were different, more ambiguous, and seemingly less immediate. But values were changing, too. The nation became richer and more comfortable in its consumerism. The oil crises of the 1970s should have taught us—but apparently did not—how suddenly our well-being can be jolted by events abroad. The ominous rise of Soviet military power does not arouse a fraction of the alarm that Hitler once inspired.

It isn't just a question of money, although long-range budget trends do reflect the drift. Americans in 1986 are on the verge of convincing themselves that the defense program is not only unaffordable but also largely to blame for the federal deficit. Currently, defense consumes less than seven percent of the gross national product, compared with 8.3 percent in 1961. Even after the "recovery" of the past five years, defense in FY '87 will represent a smaller percentage of total federal spending than it did from 1951 to 1972. If the budget burden is unbearable, then the explanation must lie elsewhere.

The budget debate is only a symptom of an evolution in popular attitudes. The public wants the national interests protected, but it also wants to put some distance between itself and the job to be done. It may support a military operation—provided it is brief, relatively bloodless, and successful. But citizens do not want to involve themselves personally in the effort.

In his annual report to Congress this year, Secretary of Defense Caspar W. Weinberger repeated a list of conditions that he felt should be met before US forces are committed to combat. The most controversial of these—and the one for which he took the most criticism when he first voiced the proposition in a 1984 speech—is that troops sent to fight in foreign lands should have some reasonable assurance of the support of the American people and Congress.

Depending on how one interprets "reasonable assurance," Mr. Weinberger's idea may be impractical. Taken to the extreme and applied inflexibly, it would tell an adversary exactly how much aggression will be tolerated without a military response. But in another sense, it is impossible to imagine the Secretary of War needing to make such a point in 1944—or his being attacked for saying that the nation owes moral support to its forces in battle.

Americans today are not asked to make sacrifices for national defense on anything remotely near the scale of World War II. In the all-volunteer era, most of them aren't even asked to serve directly.

What has been asked is their concurrence that a share of the nation's wealth, approaching the share allocated in the first year of the Kennedy Administration, be made available for defense. And although it isn't an absolute condition, it would help the troops to know that they will not be dispatched casually to die in some small, dirty war that their fellow citizens didn't care much about anyway.

It is to the shame of a great nation that this may be too much to ask.

It is also fortunate that a different set of values was in effect forty years ago. Otherwise, Hitler would have taken us. ■

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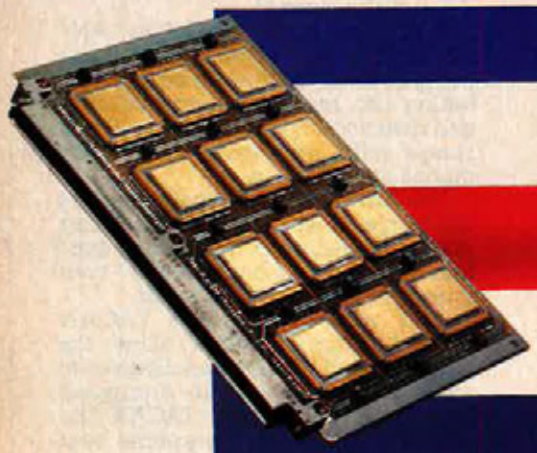

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AIRMAIL

Argentine Airpower

The quantity of available material is systematically overestimated whenever reference is made to Argentine military power. A typical example is *The Military Balance 1985/86,* as compiled by The International Institute for Strategic Studies, London, and reprinted in your February 1986 issue.

Among other overestimations, the number of A-4 attack aircraft claimed for Argentine naval aviation is grossly incorrect, suggesting a military capacity disproportionate to the present requirements of my nation. The IISS estimates almost triple the actual number of A-4s in the inventory: twenty-eight A-4Qs, plus sixteen A-4s on order and some A-4Qs in store. The actual figures are six, twelve, and none, respectively.

I believe this situation is harmful to my nation, since it spreads misgivings about the manifest decision of the Argentine government to resolve its international problems peacefully. As an immediate result concerning our defense needs, it could hinder or prevent us from obtaining from friendly nations the material we require to meet our genuine needs. . . .

Cmdr. Juan Antonio Imperiale
Assistant Naval Attaché
Argentine Embassy
Washington, D. C.

A Matter of Emphasis

Re: The "Airmail" letter from Irving Besser on page 9 of your February 1986 issue.

Mr. Besser is completely off base in challenging AIR FORCE Magazine to print unbiased articles. I'm surprised you didn't comment!

Newspapers have a responsibility to print both sides of an issue, because their readers come from all backgrounds and opinions. When a newspaper reports on military matters, its readers will be either pro- or antimilitary. Thus, unbiased and open reporting is necessary.

On the other hand, AIR FORCE Magazine serves a promilitary readership. I have no desire to read antinuclear arms, antidefense spending, or other antimilitary articles in AIR FORCE Magazine. I get enough of that from news magazines, television news, and newspapers. In fact, AIR FORCE Magazine often reports on matters that you'd never find in newspapers, etc., because their editors aren't gutsy enough to print promilitary articles.

A publication should cater to its readers. Newspapers report to the public; therefore, they should be unbiased. AIR FORCE Magazine reports to the military community and military supporters; therefore, it should emphasize promilitary subjects.

Keep up the fine reporting. Save the antimilitary stuff for the other guys.

Capt. Adele L. Fergus-O'Brien, USAF
Del City, Okla.

Phantom Feuding

I appreciate your having allowed me to state a point regarding the proposed F-4 upgrade *(see "Airmail," p. 9, January '86 issue).* I hope you will allow me this opportunity to answer Mark K. Moore's rebuttal *(see "Airmail," p. 13, February '86 issue).*

I felt bad when I read Mr. Moore's reply to my letter. I had indeed ignored the existence of the WSO aboard the F-4. But as I thought about it, I realized that Mr. Moore was addressing a different issue, even if he wasn't aware of it. I suspect that Mr. Moore feels that his position as a WSO is threatened by a replacement for the F-4 that may not include a back seat for him to ride in.

I do not wish to debate the virtues of single-seat vs. two-seat fighters. I am concerned about applying old technology in a new battlefield. If there is an F-4 *pilot* out there who would rather carry a handful of that airplane into battle instead of an F-15, F-16, F-20, or something else on the drawing board, I would like to hear about it.

We cannot continue to look at simply the acquisition cost of a weapon system. The taxpayer pays all the costs, and it is time to reduce defense spending by applying that simple principle. A new aircraft that is maintainable and dependable could be designed from scratch and could come in at a lower overall cost than the F-4—and could also do the job better.

I didn't embarrass any heavy drivers in discussing museum pieces. The C-141 is an old aircraft. We know that. It was designed to do a job, and it does that job well. (It will also beat an F-4 to 10,000 feet from a standing start.) Even with new hardware on the way, the C-141 will still be flying into the twenty-first century. By then, the F-4 will be retired to trainer status.

By the way, if you have learned to measure a man by the hardware he flies, then you are spending too much time rubbing elbows with fighter pilots in the bar.

Capt. William M. Clifford, USAF
Los Angeles, Calif.

Do you have a comment about a current issue? Write to "Airmail," AIR FORCE Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Letters should be concise, timely, and legible (preferably typed). We reserve the right to condense letters as necessary. Unsigned letters are not acceptable, and photographs cannot be used or returned.

No to Official News

Waller A. Hurtt may be an author and political writer, but, judging from his letter, he is a poor student of history *(see "Airmail," p. 9, February '86 issue).*

How any American can propose "an official government news agency" defies understanding. It was tried by Nixon, Agnew, and friends, remember?

Mr. Hurtt obviously has not had access to *Izvestia* and *Pravda,* as some of us have.

You don't hear émigrés from Russia or the Philippines making such a proposal.

Ed Schafer
Omaha, Neb.

Aeronautics Issue

Congratulations on another superb Aeronautics issue. Once again, the

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AIRMAIL

January edition of AIR FORCE Magazine served to brighten up a cold and gray month in Dayton with an appealing look at what Aeronautical Systems Division is all about. Frankly, it's the kind of thoughtful presentation that my folks and I have come to expect from the *world's best magazine.*

Senior Editor James W. Canan has a special feel for this institution—and he tells our story just right *(see "Acid Test for Aeronautical Technology," p. 38, January '86 issue).* I've really enjoyed working with him. He is the consummate professional and a good guy to boot. It occurs to me that when you find that combination in a single guy, you have a rarity. He has the knack for telling an often complex story in a way that it can be understood by the full spectrum of the magazine's readership. . . .

Thanks again!

Lt. Gen. Thomas H. McMullen, USAF
Commander, ASD
Wright-Patterson AFB, Ohio

ATBM Action

I want to thank you for AIR FORCE Magazine's January 1986 "In Focus . . ." interview of me *(p. 17)* concerning the desirability of developing anti-tactical ballistic missile (ATBM) systems.

The American Israel Public Affairs Committee (AIPAC) saw the piece and my comments concerning Israel. As a result, AIPAC offered written testimony before a hearing of the Subcommittee on Strategic and Theater Nuclear Forces that was most helpful in getting the committee's membership to consider our allies' need for defenses against missiles.

Clearly, your magazine is read and promotes action—thanks again.

Sen. Dan Quayle
Washington, D. C.

Exception to Airbus

In "Jane's Aerospace Survey 1986" *(January '86 issue, p. 68),* John W. R. Taylor says that Airbus Industrie had a "good year" in 1985 and adds: "Few people would have predicted such an impact on the air transport market by a European newcomer, and there could be no greater testimony to the money-making quality of Airbus products than to see them flying now in Pan Am livery."

Well. Given Pan Am's recent profit performance, the presence of a planemaker's product in its inventory might be taken more as testimony of the product's money-losing qualities than anything else, but let that pass. The reason that Airbus products are found in Pan Am's fleet is not their money-making qualities, but their money-conserving qualities. Pan Am didn't have to spend much to get them, because Airbus can afford to sell its planes at prices that Boeing and Douglas can't match—not all the time, anyway.

Is this because of superefficient production or low labor costs? Not at all. Airbus and its constituent members have been subsidized by various European governments to the tune of billions of dollars over the past twenty years. So much money is involved and the company's books are so badly kept that even the people running the company are unsure of the magnitude of the losses.

Mr. Taylor's evaluation of 1985 as a good year for Airbus, despite its continuing position as a financial basket case, is even stranger in light of management turmoil at the company (which he failed to mention) that saw the installation of an entirely new management team dedicated to putting Airbus's financial house in order. This, it seems to me, is the real story.

No one, I think, has seriously doubted the ability of European companies to build good commercial airliners. What has been doubted, at least since the heyday of the Vickers Viscount more than two decades ago, is the ability of a European company to market a big commercial airliner on an even footing with American companies. American companies must make money, like Boeing or Douglas, or get out of the field, like Martin, Convair, and Lockheed. In contrast, it is doubtful that a single Airbus has ever been sold at a profit to anybody, anywhere, anytime.

The performance of Airbus Industrie merely shows the extent to which European governments have been willing to take horrendous losses in order to pretend that they can compete with Boeing. Perhaps someday Airbus will pay its own way. But until that happens, Americans have a right to complain that jobs that belong in Seattle and Long Beach are in Bordeaux instead.

John Cutcher
Knoxville, Tenn.

DC-3 Flypast

I enjoyed your article on "The Grand Old Gooney Bird" on page 94 of the December '85 issue.

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AIRMAIL

I have one correction to offer, if I may. The DC-3 Airmada will be on display at Abbotsford Airport near Vancouver, British Columbia, on June 5–8, 1986, *not* in early August, as was reported in your December issue. The DC-3 Flypast will take place on June 7.

J. Stroomenbergh
Winnipeg, Manitoba
Canada

F-101 Voodoo

I am writing a book about the McDonnell F-101 Voodoo that will be brought out in 1988. The publishers and I believe that this may be the first major hardbound book about the design, development, and operational and combat use of the F-101. This will be my seventh published volume on Air Force history, and my author's proceeds will go to an Air Force-related charity.

I need to hear from anyone associated with the XF-88 and F-101 aircraft, especially any combat veterans of RF-101C Voodoo reconnaissance operations in Southeast Asia. I have a special need to locate then-Capt. Edward W. O'Neil, Jr., who flew the RF-101C with the 20th Tactical Reconnaissance Squadron.

Anyone who can help with recollections or reminiscences or by lending photos or color slides will have his assistance fully acknowledged and will receive a copy of the book. I am also hoping to assemble a reunion roster to put old friends back in touch.

Robert F. Dorr
American Embassy
Box 40
FPO New York 09510

F-4C 64-0751

I am currently looking for photos and information about an F-4 Phantom that was lost over North Vietnam on November 9, 1967, and that was occupied by posthumous Medal of Honor recipient Capt. Lance P. Sijan. Captain Sijan's heroism is well detailed in the book *Into the Mouth of the Cat.*

The aircraft of interest is F-4C 64-0751, assigned to the 480th Tactical Fighter Squadron of the 366th TFW based at Danang. This F-4 was the personal aircraft of 480th Commander Col. John W. Armstrong, pilot, who was also lost on the mission with Captain Sijan. Of primary interest is the tail code carried by -0751 at this time. I'm also looking for any information about squadron, wing, or personal markings and colors that this aircraft might have carried.

This information is being requested to enable an accurate model of this F-4 to be built and to aid in the research of MOH aircraft. I would like very much to hear from anyone with knowledge of -0751 at Danang and will quickly copy and return any material sent on loan.

Please contact me at the address below.

Charles W. Arrington
410 Oread Rd.
Louisville, Ky. 40207

P-40 44-7619

The Kalamazoo Aviation History Museum is attempting to compile a history of the Museum's P-40N-35CU, 44-7619, which served with the 372d Fighter Group. I would like to correspond with anyone who might have seen this aircraft while in military service. Its military history shows that the aircraft was assigned to Stewart Field, N. Y., Pollock Field, La., Esler Field, La., Douglas Field, Ariz., and Lawson Field, Ga. . . .

I would also be interested in hearing from any P-40s buffs who might have pictures of this aircraft after its disposal by the military. Any information would be helpful. Please contact me at the address below.

Ted Damick
Librarian
Kalamazoo Aviation History Museum
2101 East Milham Rd.
Kalamazoo, Mich. 49002

Malden AAF

I am currently collecting material for a history of Malden Army Air Field (later Malden AB) in Malden, Mo. This field was used as a basic pilot training base and a training base for troop carrier and glider pilots from 1942 through 1945. In 1950, it was reactivated as a primary pilot training base and served in this role until it was deactivated in 1960.

I would appreciate any assistance that readers could give me on this project. I am particularly interested in information concerning the construction of the base and its several phases of activation and deactivation. Also, I would like information on the various flight school classes that trained there as well as class photographs and photographs of the base.

All material and photographs will be copied and returned if the sender so desires. Any and all contributions will be appreciated.

James E. Stockman
632 Bambury Way
Kirkwood, Mo. 63122
Phone: (314) 966-4283

Crew Chiefs

I am currently gathering information for a book I am writing that will be entitled "The USAF Crew Chief and His Airplane—Forty Years of Proud Tradition." If any readers would care to help me, please send me your name and address, and I will send you a research survey.

I am seeking information from crew chiefs who are active duty, separated, or retired. I would like also to hear from flight crews as well.

I am also seeking photos for the book, and information on the requirements for these photos will be sent with the surveys. All information used will be properly credited to the contributor.

Any help that readers can provide will be greatly appreciated and will go toward the compilation of a unique book.

David T. Chamberlin
Mach Six Productions
1490 S. Reed, #205C
Lakewood, Colo. 80226

Herzo Artillery Base

I am presently researching the history of Herzo Artillery Base, which was originally built as a Luftwaffe fighter training base in 1934. After the capture of the area by the 42d Infantry Division in April 1945, it was occupied by the Air Force. The runway was reconstructed by the 819th Engineer Aviation Battalion. The 354th Fighter Group was based there from May 1945 until February 15, 1946.

I would like to contact anyone who was assigned to these units during this period and who would be willing to share some information. I would also be interested to learn of any photographs of the base from the time that it was occupied by the Air Force. Lastly, I would like to contact anyone who was assigned to the 6th SHORAN Beacon Squadron during the period from 1946 to 1972.

George T. Norris
7707 SW Beta Ave.
Lawton, Okla. 73505
Phone: (405) 536-3475

Robert Altman

For a book that I am writing about the career of film director Robert Altman, I would like to learn as much as possible about his experiences as a B-24 pilot in the South Pacific during World War II.

I would appreciate hearing from anyone with specific recollections of Mr. Altman during the years 1943–45 or of the South Pacific theater of aerial combat in general.

I would appreciate any recommendations for further reading on the subject—either history or biography. I'd also like to hear from anyone connected with a pilots' association from that era.

Please contact me at the address below.

Patrick McGilligan
2746 N. Frederick
Milwaukee, Wis. 53211
Phone: (414) 962-8988

Edwards Fire Fighters

I am presently compiling a book dealing with the history as well as the exploits of the fire fighters at Edwards AFB (Muroc Field) in California since the military's arrival in 1933. Any information, factual or humorous, about the fire protection branch at Edwards would be greatly appreciated. I am looking especially for stories from pilots who might have spent some time at Edwards.

Also, anyone with information—or who would like to request such information—about any of Edwards's past fire fighters should feel free to contact me.

Any correspondence should be sent to the address below. All material sent will be returned.

Jeffrey A. Riechmann
38511 Frontier Ave.
Palmdale, Calif. 93550

James's F-4s

We here at the USAF Museum are looking for the serial numbers of F-4s flown by Daniel "Chappie" James, Jr., while he was in Vietnam with the 8th Tactical Fighter Wing.

Does anyone out there in the reading audience have any photographs or records that would give such serial numbers? If anyone does have such documentation, we would like to borrow and copy it and would return it as soon as possible.

Responses should be directed to the address below.

Vivian M. White
USAF Museum/RD
Wright-Patterson AFB, Ohio
45433-6518

95th FITS

The 95th Fighter Interceptor Training Squadron is moving into a new facility later this year. I am trying to locate photographs of aircraft or anything else relevant to the history of this squadron. Such items will be used in decorating the new building to reflect our proud Air Force tradition.

I am also currently updating the squadron's recall roster. If you or anyone you know has been a member of the 95th, please contact me as soon as possible.

Capt. Gary Champion, USAF
Bldg. 164, Stop 38
Tyndall AFB, Fla. 32403
AUTOVON: 970-2121/3113

AIRMAIL

Republic XF-91

I would like to request the assistance of readers for an in-depth study that I am preparing on the Republic XF-91. In particular, I would like to contact any individuals who were involved in the development, assembly, and flight testing of the aircraft and who would be willing to share technical or anecdotal information.

All loaned materials will be carefully copied, returned promptly, and acknowledged in the published article.

Please contact me at the address below.

Dr. Gary L. Rochfort
426A Fort Washington Ave.
Fort Washington, Pa. 19034

F-105Ds in Thailand

I am an artist trying to gather reference material for a painting to be donated to the USAF Art Collection. I would like to contact anyone who served with USAF at Korat or Takhli RTAFBs and who took slides of F-105Ds.

I would like to borrow any such slides. They would not leave my hands. I have my own duplicating equipment, and I would duplicate your slides and return them within thirty days.

Any slides loaned will be handled with extreme care. Please contact me at the address below.

Harley F. Copic
7279 Glenmore Dr.
Lambertville, Mich. 48144

489th Bomb Group

I am looking for additional material for a forthcoming history of the 489th Bomb Group, a B-24 unit of the 2d Air Division, Eighth Air Force, World War II. Photos, diaries, personal recollections, etc., are needed to supplement stock already on hand.

Any former member of this group who can help or who is interested in having a copy of the history when it is published—probably late this year—should contact me at the address below.

Charles H. Freudenthal
8421 Berea Dr.
Vienna, Va. 22180
Phone: (703) 560-6422

Roll Call

I am trying mightily to organize a reunion of my B-17 crew from World War II. Beginning in December 1943, we flew our beloved *Janey Gal* with the 94th Bomb Group, Eighth Air Force, from Bury St. Edmonds, England.

Specifically, I am trying to locate Harry Levant, our bombardier. That good ol' boy was a used-car salesman in Chicago prior to the war.

Please contact me at the address below.

George K. Ford
401 Ford Lane
Longview, Tex. 75602

I am searching for former members of the 78th Fighter Squadron who served during the period from reactivation at Wheeler Field in February 1940 until dispersal on Iwo Jima in late September 1945.

Anyone who was a member at any time during this period or who has information on other members who were in the squadron during these years should please contact me at the address below.

James B. Tapp
4210 Constellation Rd.
Lompoc, Calif. 93436

I am desperately trying to find someone who might have known Capt. Bill Heyman, who was flying a P-47 when he was shot down in a raid on the Ploesti oil fields in August 1944.

If anyone has any information about Captain Heyman, I would greatly appreciate hearing from them. Please contact me at the address given below.

Jake Kingsbury
2106 Wesley Ave.
Collinsville, Ill. 62234

I am trying to locate James Dermott Weaver, my primary flight instructor at Fort Stockton, Tex., Class 43-J. He was last seen in January 1945 at Romulus, Mich., flying B-24s.

Please send any information to the address below.

Leo E. Smith
9233 E. 27th St.
Tucson, Ariz. 85710

I am seeking information regarding

SCIENCE/SCOPE®

From Alaska to Florida, from Labrador to Hawaii, a new air defense system helps protect North America by watching the skies far beyond U.S. and Canadian borders. The Joint Surveillance System (JSS) can detect attacks from space, by aircraft, and by missiles launched from submarines. The system is comprised of eight regional operations control centers that tie into existing civilian and military radars. Each center receives radar data through a communications network with 285 circuits. Computers process information, prepare it for display consoles, and compare it with known flight plans. When an aircraft is classified as unknown, fighter interceptors scramble and are directed to make visual identification. Hughes Aircraft Company developed and built JSS for the U.S. Air Force.

Following seven years of deliveries that were on time or ahead of schedule, Hughes has completed production of the electronic "brains" for the U.S. Navy's Trident I Fleet Ballistic Missile. The guidance electronic assemblies incorporate advanced technology to withstand harsh operating conditions underwater and in space. Since 1978, Trident guidance assemblies containing Hughes electronics have performed flawlessly in 50 test launches. This reliability record follows outstanding performances established by Hughes in the past 25 years on the Polaris and Poseidon programs. Fabrication of development guidance electronics flight hardware has begun for the Trident II missile.

The U.S. Department of Defense has given two of its four top money-saving awards to Hughes for proposals that will cut costs by nearly $275 million. The Contractor Value Engineering Achievement Awards honor defense contractors for helping to trim defense costs during 1984. The Air Force cited Hughes for saving $172.8 million on the Imaging Infrared Maverick air-to-surface missile over the life of the contract. The Navy honored the company for reducing projected costs on the UYQ-21 data display system by $101.5 million. Hughes also contributed to the savings achieved by FMC Corporation, which won the Army award for cost-cutting efforts on the Bradley Fighting Vehicle System. The Value Engineering program was created to cut production costs without affecting performance, reliability, quality, maintainability, and safety standards. The armed forces approved 34 Hughes VE proposals for total cost reductions exceeding $296 million. Since 1964, Hughes military customers have approved 705 changes on 52 programs for total savings of $887 million.

An experimental digital-to-analog converter chip is 10 times faster than the fastest conventional device. The chip, being developed at Hughes for advanced airborne radars, uses gallium arsenide as the substrate material. It has a settling time of 200 picoseconds, about an order of magnitude faster than a record-holding 6-bit Hughes silicon device. The new converter so far outdistances commercial devices that design engineers are developing special interfaces so that the device can be hooked up in data conversion systems for further testing and analysis.

The U.S. Army's Hydra 70 rocket system is being upgraded constantly to cope with changing combat conditions. The battle-proven system, mounted on attack and reconnaissance helicopters, fires 2.75-inch (70-millimeter) rockets from 7-tube or 19-tube launchers. A pilot can select from an array of warheads to meet specific threat situations—including anti-armor, anti-personnel, anti-materiel, smoke screen, and illumination applications. From a combat ordnance load of up to four 19-tube launchers, rockets may be fired singly, in pairs, in quads, or in a "quick dump" salvo of 76 rockets. The lightweight aluminum launchers are inexpensive and can be reused after as many as 60 firings. The Hughes launchers will be shared with NATO allies to help standardize weaponry.

For more information write to: P.O. Box 45068, Los Angeles, CA 90045-0068

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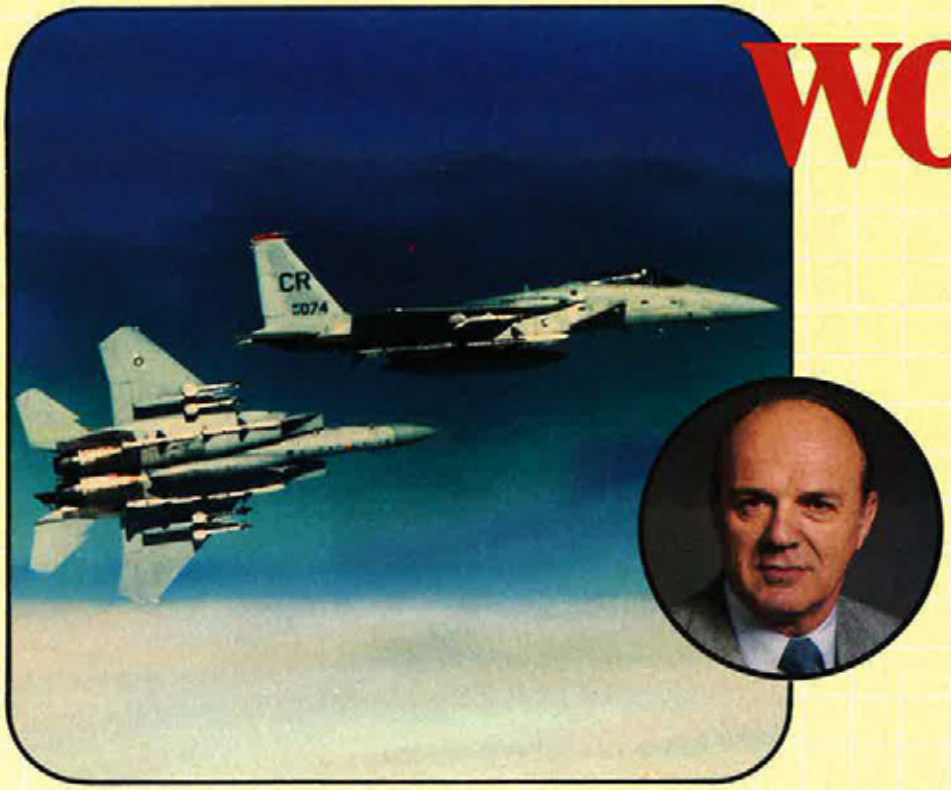

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J.A. "Bill" Saavedra
Director, Air Force
Business Development

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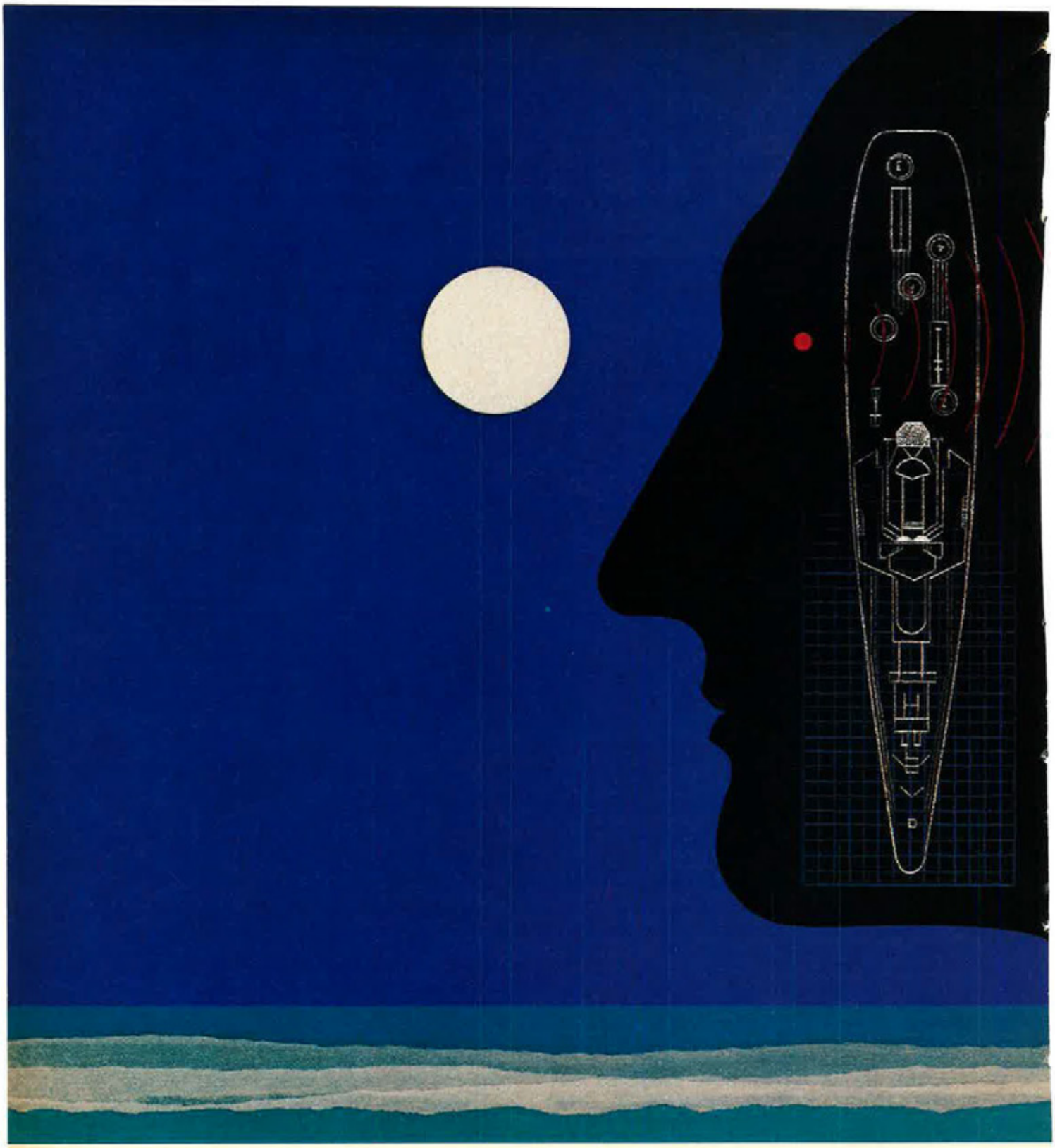
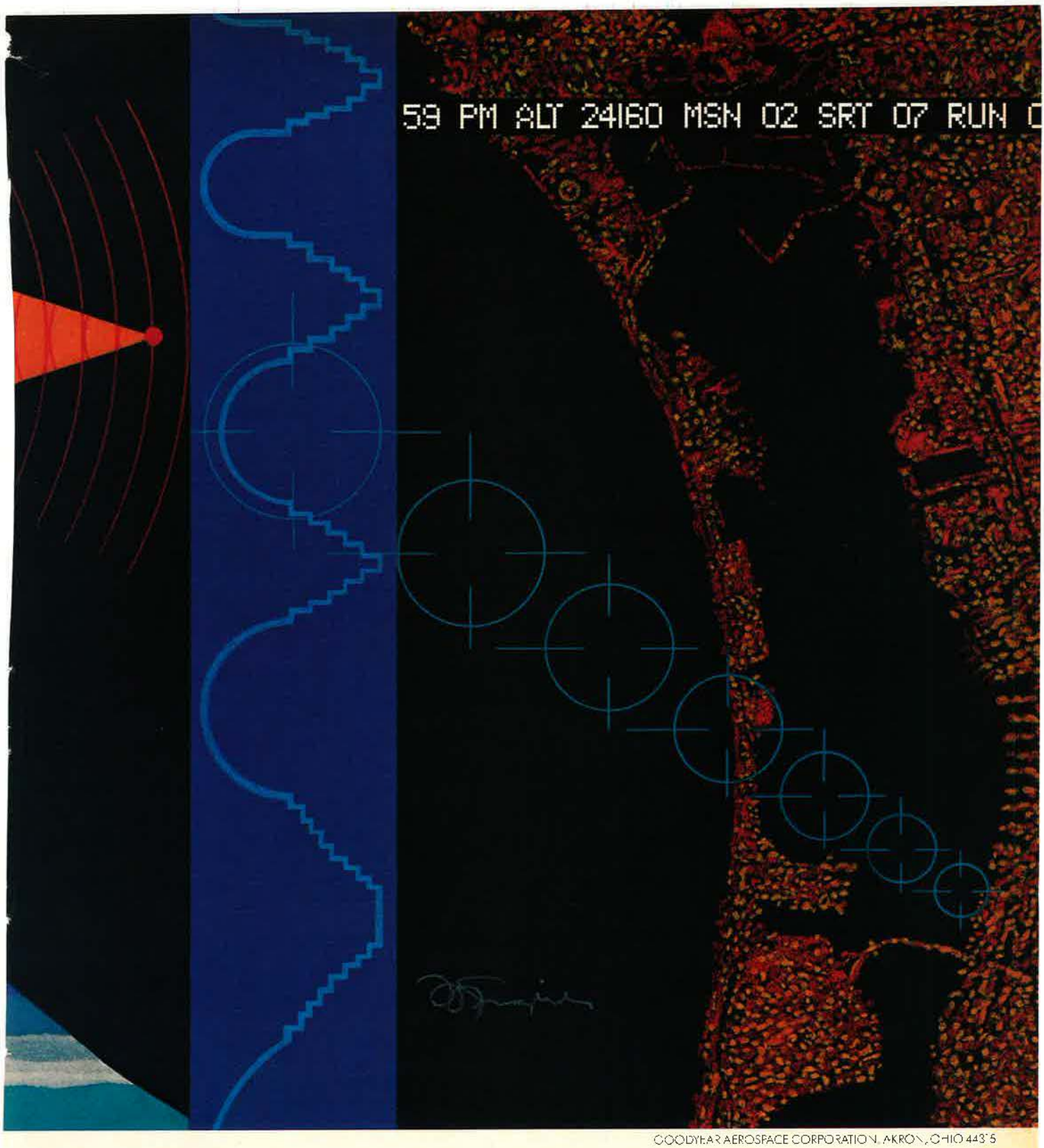


Radar technology for guidance. When radar detects a target, it must translate that information digitally through a computer where millions of computations must be done instantaneously. That was just one of the problems facing Goodyear Aerospace when it developed target-seeking systems for the Army, Air Force and Navy. It brought together the sophisticated resources of Goodyear Aerospace technology. We break down complex problems and solve them simply. Goodyear people have the expertise, experience and facilities—plus the long-term commitment—to get you where you want to go.



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AIRMAIL

the whereabouts of Capt. Lawrence Himmel, a B-26 pilot whose last known assignment was with the 90th Bomb Squadron, 3d Bomb Group, Fifth Air Force, at Kunsan, Korea, from June to December 1952. He was originally from Louisiana.

Anyone having any information about his whereabouts is asked to contact me at the address below.

Wallace Mann
11505 Oralane Dr.
El Cajon, Calif. 92020
Phone: (619) 442-7135

I would like help in locating Jerry A. Byars and his family. We were stationed together in Turkey and Texas.

Please contact me at the address below.

DeLores Malik
625 W. A St.
Lincoln, Neb. 68521

Collectors' Corner

I am an F-105 enthusiast and a River Rat who served two tours of duty in Thailand when the "Thuds" were flying. I also had the privilege of being around them at McConnell AFB, Kan., and Nellis AFB, Nev.

Currently, I am seeking to expand my collection of F-105 memorabilia (patches, books, pictures, etc.) and would welcome any assistance or information from AFA members on the availability of any such items. In particular, after one year of fruitless searching, I am especially anxious to purchase a USAF Vietnam-era jet pilot helmet, with or without oxygen mask assembly, to refinish and customize as the centerpiece of my collection.

Anyone having any knowledge about how I might obtain any of these items is asked to call or write me at the number or address below.

James Sheposh
23 Stony Run Rd.
Newburgh, N. Y. 12550
Phone: (914) 561-6137

I am ex-Air Force and a collector of World War I and World War II aviation items. I am looking for certain items and hope your readers can help me in acquiring some of the following.

I am looking for *any* Flying Tigers items, such as Chinese pilot wings, Flying Tigers patches or pins, American Volunteer Group ID cards, discharge certificates, etc. Also, any squadron patches, wings, A-2 flight jackets, or any other aviation memorabilia from WW I and WW II would be appreciated as well.

I look forward to hearing from anyone who can offer any items or help.

Tom Shane
6109 Bridlington
Austin, Tex. 78745

I am an airman assigned to Detachment 5, 39th ARRW, Tyndall AFB, Fla. I recently began a collection of squadron and other unit patches.

I would appreciate hearing from anyone who might be willing to help me in building my collection.

Please contact me at the address below.

A1C Donald B. Tyson, USAF
5808 E. Hwy. 98, Apt. 108
Panama City, Fla. 32404
Phone: (904) 871-6191

C-17

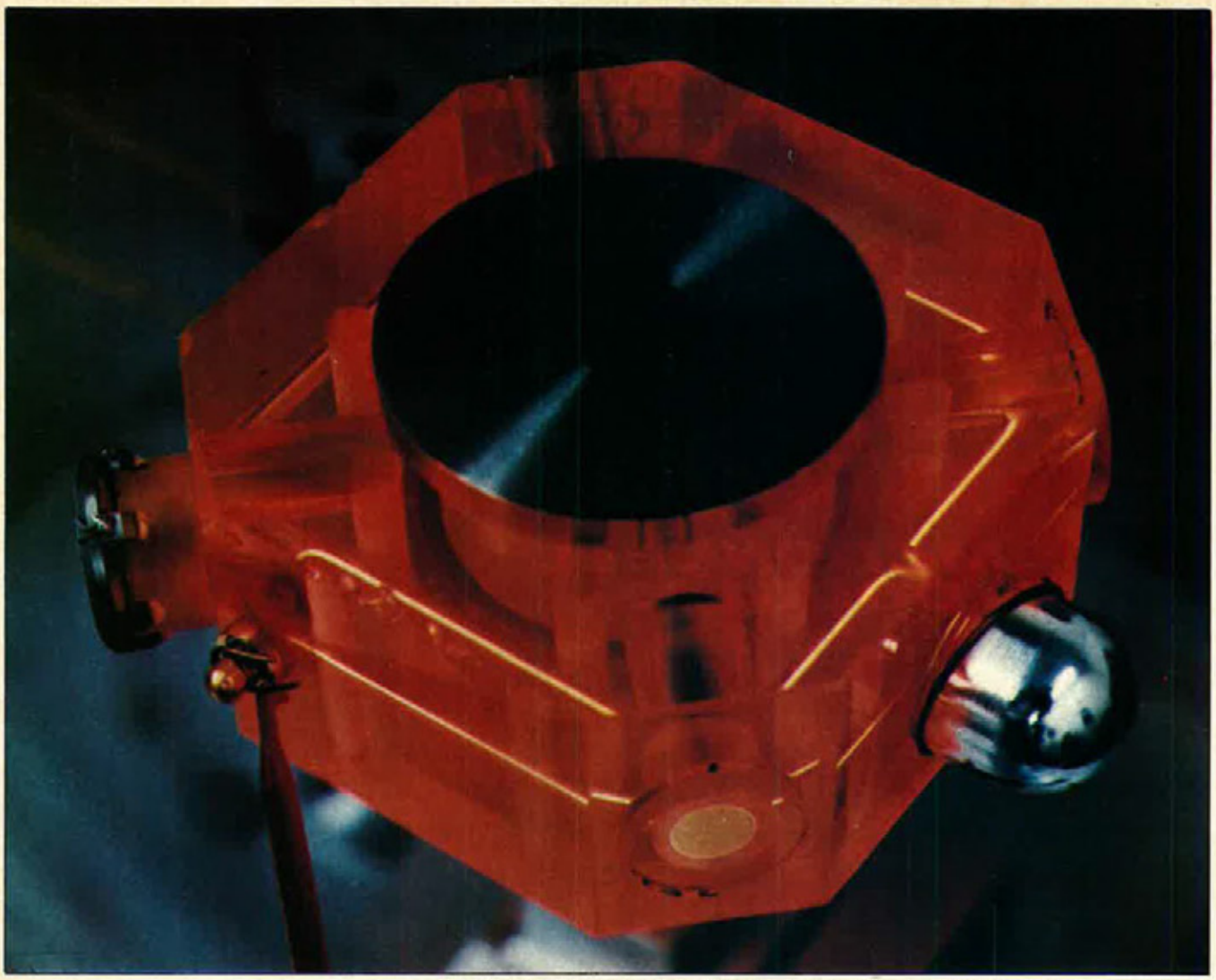
"C" as in citizen

NEW U.S. AIR FORCE AIRLIFTER TO FLY WITH AIR NATIONAL GUARD AND AIR FORCE RESERVE.

When the C-17 begins operations with the Air Force in 1991, it will also see duty with the Air Guard and Reserve. This is an example of how the needs of the Guard and Reserve are included in early acquisition and planning. Of the 210 C-17s to be built, 48 will be dedicated to Guard and Reserve units across the country.

This assignment for the C-17 is part of continuing efforts to provide our nation's citizen-soldiers with front line equipment.

MCDONNELL DOUGLAS



Compared to any triangle, Litton's square "ring" laser produces measurably less backscatter, a definite benefit.

USAF selects Litton for Standard RLG INU, world's first military RLG production program.

C-130 and RF-4C aircraft to receive first units, with HH-60A and EF/F-111 soon after.

The United States Air Force has selected Litton's Guidance and Control Systems Division, long a world leader in inertial navigation, to produce the LN-93 Standard RLG Inertial Navigation Unit. Litton's LN-93 was the first RLG system to successfully complete all tests at the Central Inertial Guidance Test Facility, Holloman Air Force Base, New Mexico, and will be the Form-Fit Function alternative to the AN/ASN-141, currently manufactured by Litton for the F-16, A-10, FB-111, and other Air Force and Army aircraft. Initially, the Standard RLG INU will be employed in the C-130 Self-Contained Navigation System and the RF-4C, and later in the HH-60A and EF/F-111. A variant of the LN-93 will be purchased for the F-15; the two configurations will share over 90% commonality.

The LN-93 Standard Ring Laser Gyro INU is Litton's most recent system to employ Ring Laser Gyros in strapdown configuration. As there are no moving parts, these gyros will have significantly better reliability than earlier-design spinning-wheel gyros. The LN-93 system employs the same 28cm pathlength Ring Laser Gyro and much of the same electronics as both the Litton commercial LTN-90 Inertial Reference System, and LN-92 RLG INS, currently under development for the U.S. Navy CAINS II. The high reliability guaranteed by Litton will allow the Air Force to employ a two-level maintenance approach, eliminating the need for test equipment at base shops.

LN-93 Standard RLG INU, a full step ahead.

Litton Guidance & Control Systems

IN FOCUS...

The Packard Report

By Edgar Ulsamer, SENIOR EDITOR (POLICY & TECHNOLOGY)

The Blue Ribbon panel proposes acquisition czars at DoD and service levels to streamline the process and shorten reporting chains for program managers.

Washington, D. C., March 5 President Reagan's Blue Ribbon Commission on Defense Management completed its interim report on February 28 and, as expected, laid the groundwork for dramatic change in how the Pentagon buys weapons and fights wars. There is evidence that the gist of the recommendations authored by the high-powered group—popularly called the Packard Commission, after its Chairman, industry tycoon and former Deputy Secretary of Defense David Packard—will be implemented by the White House in the near future.

As President Reagan warned succinctly, "Whenever the Commission's recommendations point the way to greater executive effectiveness, I will implement them, even if they run counter to the will of the entrenched bureaucracies and special interests." At the same time, the President admonished Capitol Hill "to heed the Commission's report and to remove those obstacles to good management that Congress itself has created over the years."

In an organizational sense, two specific recommendations open the door to fundamental change. On the acquisition side, the Packard Commission "strongly" urges the statutory creation of a new position, that of Under Secretary of Defense in charge of acquisition. This Under Secretary, the Commission recommends, "should have solid industrial background" and serve as the Pentagon's "full-time" acquisition executive. His mandate is to "set overall policy for procurement and research and development (R&D), supervise the performance of the entire acquisition system, and establish policy for administrative oversight and auditing of defense contractors."

The authority of the proposed new acquisition czar extends down to the service level, at which "the Army, Navy, and Air Force should each establish a comparable position filled by a top-level civilian Presidential appointee." While the Commission's initial report is not explicit on the accountability of these service acquisition executives vis-à-vis the Secretaries of their respective services, there is this telling assertion: "Establishing short, unambiguous lines of authority would streamline the acquisition process and cut through bureaucratic red tape. By this means, the Department of Defense . . . should substantially reduce the number of acquisition personnel." The roles of the acquisition executives of the services are to "mirror" that of the "defense acquisition executive."

The service's acquisition bosses, in turn, are to appoint "Program Executive Officers" (PEOs), each of whom would be responsible for a reasonable and defined number of acquisition programs. This top-down structure is to devolve to program managers "responsible directly to their respective PEO and [who] report *only* to him on program matters." The Commission recommended, however, that "each service should retain flexibility to shorten this reporting chain even further, as it sees fit." The current structure for acquisition matters seems to be left in limbo by the Commission's reorganization proposal.

On the military side, the Commission emphasizes jointness and, after a fashion, centralization by elevating the Chairman of the Joint Chiefs of Staff to the role of "principal uniformed military advisor" to the President, the National Security Council, and the Secretary of Defense, "representing his own view as well as the corporate view of the Joint Chiefs." The Joint Staff and the Organization of the Joint Chiefs are to be "under the exclusive direction of the Chairman, to perform such duties as he prescribes to support the JCS and to respond to the Secretary of Defense."

In a top-down pattern paralleling the acquisition structure, the CINCs of the unified and specified commands would have a direct command and reporting channel "through the Chairman so that the [latter] may better incorporate the views of senior combatant commanders in his advice to the Secretary."

The service chiefs would continue to serve as members of the JCS, but "the position of a four-star Vice Chairman should be established by law as a sixth member of the JCS." The Vice Chairman would back up the Chairman in representing the interests of the CINCs and would cochair the Joint Requirements Management Board in tandem with the new Under Secretary for Acquisition. The role of the JRMB would be upgraded to encompass oversight over all joint programs and appropriate service programs, including "defining weapons requirements, selecting programs for development, and providing thereby an early trade-off between cost and performance."

In contrast with congressional DoD reorganization plans, the Commission does not designate the Vice Chairman as acting Chairman in the absence of the Chairman. Instead, the Secretary of Defense is to formulate relevant procedures in a manner that "is flexible and responsive to changing circumstances." The role of the unified commanders is to be expanded by investing them with "broader authority to structure subordinate commands, joint task forces, and support activities in a way that best supports their missions and results in significant reduction in the size and numbers of military headquarters."

The Commission's emphasis on jointness is also reflected in the recommendation to "establish a single unified command to integrate global air, land, and sea transportation."

In terms of broad, overall national security objectives and priorities, the

Commission recommends that incoming Presidents select an overall military program and the associated budget level that "would be binding on all elements of the Administration. DoD would then develop a five-year defense plan and a two-year defense budget conforming to the President's determination." The President, in turn, "would submit to Congress the two-year budget and the five-year plan on which it is based."

In what might seem an optimistic notion, Congress would then approve such two-year budgets and "authorize and appropriate funding for major weapon systems at the two key milestones of full-scale engineering development and high-rate production." Linked to this approach is the ambitious stipulation that "DoD would present the budget to Congress on the basis of national strategy and operational concepts rather than [as] line items."

The Commission plans to flesh out the recommendations of the interim report with more specific implementation proposals in its final report, due early this summer.

DoE's Weapons Plan

Under the heading "Atomic Energy Defense Activities," the Department of Energy requested a total of some $8.2 billion in FY '87 budget authority, an increase of roughly $1 billion over the estimated FY '86 level. Among the noteworthy initiatives covered by the request is nuclear-driven directed-energy weapons research. The purpose of this project is to establish the feasibility of this weapons technology within the context of SDI (the Strategic Defense Initiative, or "Star Wars").

The purpose of this work is twofold. For one, DoE's Nuclear-Driven Directed-Energy Weapons research (NDEW) is to probe Soviet capabilities to design and deploy such weapons that could put US retaliatory forces or future defensive systems at risk. Such a threat analysis is deemed essential and urgent because of the potential impact of Soviet NDEWs on nonnuclear SDI research and planning.

Secondly, DoE's NDEW research is meant to provide SDI options in light of the "potentially unique" capabilities of NDEWs and as "a hedge against the failure of nonnuclear defensive weapons to meet performance requirements."

The Department of Energy, therefore, is conducting research on five NDEW concepts: X-ray lasers, hypervelocity pellets, microwaves, particle beams, and optical lasers. The basic concept underlying NDEWs is the conversion of energy generated by a nuclear explosive device. This might involve the conversion of X-rays, gamma rays, or neutrons—the "prompt" products of a nuclear detonation—to some other form of energy or a redirection of that energy. This conversion process—involving in some cases a series of steps—could lead to such end products as hypervelocity projectiles, microwaves, optical frequency photons (laser energy), atomic particles (electron and protons), or X-ray bursts.

Typically, the advantages of this emerging family of advanced weapons are their small size, low mass, and high power features. The view emerging from DoE's weapons laboratories is that NDEWs make it possible to tailor—in a precise, militarily optimized fashion—the effects of nuclear explosions.

It is equally clear, however, that this technology is still in an embryonic state. Translating the NDEW theory into military hardware will require significant advances into new regimes of basic physics, plasma (ionized gasses) processes, and atomic physics not yet fully explored. This work will require comprehensive support functions, including advanced supercomputers for weapon modeling as well as artificial intelligence and "new levels of engineering precision heretofore unattained."

Over the next several years, the research effort on NDEWs is to concentrate on basic theoretical physics, computer modeling and experimental validation, dedicated underground nuclear experiments, and engineering research on how to tailor future carriers and platforms to these weapons. Hand in glove with these analyses is investigation of the vulnerabilities, lethalities, and countermeasures aspects peculiar to different NDEW approaches. Countermeasures and countertactics, DoE reported to Congress, "will be studied in terms of hardening and shielding targets from attack, evading attack, and restricting attack as well as evaluating [the] effectiveness" of individual approaches.

In a related effort, DoE is stepping up research on systems that can detect the emissions of directed-energy weapons, whether powered by nuclear or conventional means. Also in the field of detection and verification, DoE is expanding this country's capabilities to detect and assess nuclear detonations in space, in the atmosphere, and underground. DoE will study new spaceborne sensors in this regard.

In order to broaden US capabilities to monitor nuclear tests by remote seismic means, the US is working with the People's Republic of China (PRC) on plans to install a regional seismic array on the latter's territory. This array, according to DoE, "will provide valuable data on low-level seismicity not obtainable at teleseismic distances and on seismic wave propagation in the central Eurasian continent." The actual installation of this array is to get under way in FY '87.

Project Forecast II Completed

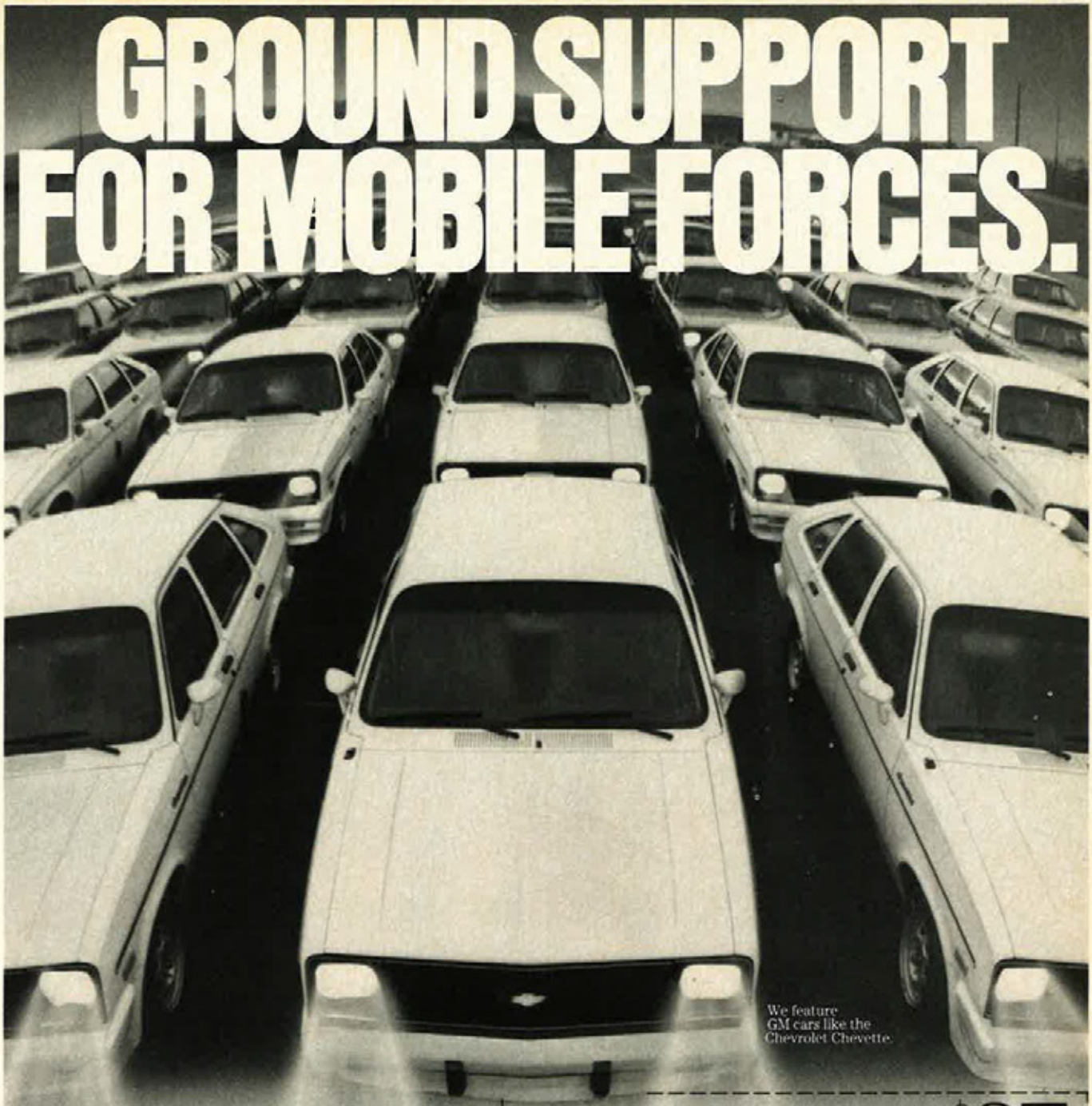
The Air Force Systems Command wrapped up its nine-month, in-depth look at emerging technologies that promise high payoffs by concluding that some seventy individual concepts deserve thorough exploration in the years ahead. The study, known as Project Forecast II, was launched last summer at the behest of the Secretary of the Air Force and USAF's Chief of Staff in order to prepare the Air Force for a "quantum leap into the twenty-first century" by means of advanced, highly leveraged technologies. According to current plans, about ten percent of the Air Force's science and technology budget will, beginning in FY '88, be allocated to Forecast II-derived projects on an annual, cumulative basis.

Several of the unclassified high-payoff technologies unearthed by Project Forecast II have been described in this space over the past three months, including the so-called National Aerospace Plane (NASP) project, which President Reagan referred to as the "Orient Express" in his recent State of the Union address. *(See also "A 'Modest Growth' Budget" on p. 100 of this issue.)*

The Air Force, AFSC Commander Gen. Lawrence A. Skantze told this writer, has been given "overall leadership" of the program. Other elements of the Defense Department and the government participating in the NASP program are the Defense Advanced Research Projects Agency (DARPA), the US Navy, and NASA. The Air Force, through AFSC, has set up a NASP program office at Wright-Patterson AFB, Ohio. Brig. Gen. (selectee) Kenneth E. Staten heads the new office.

The NASP program office reports directly to the AFSC Commander and

GROUND SUPPORT FOR MOBILE FORCES.



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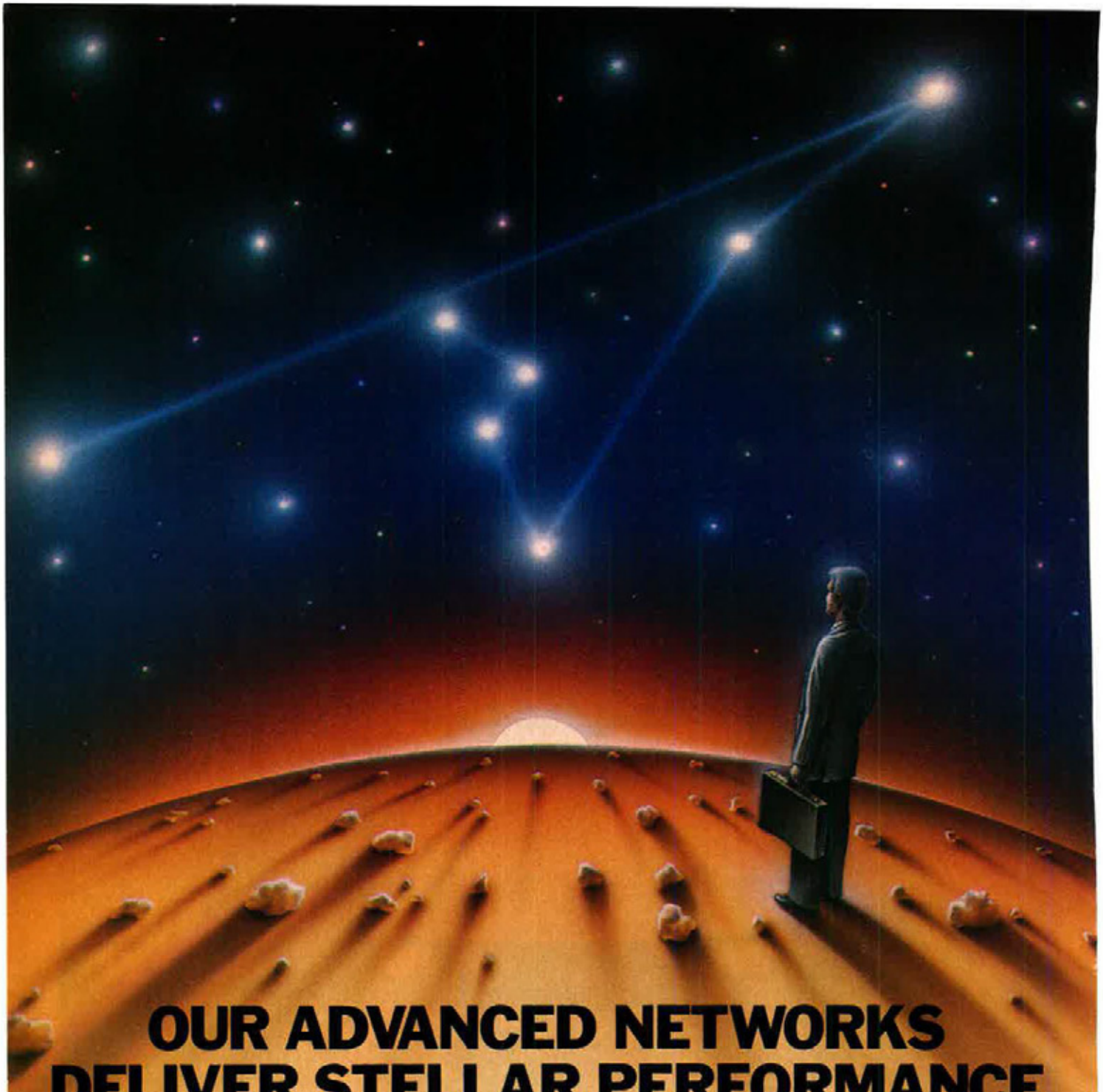

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has unfettered access to the "best talent" throughout the command, General Skantze explained. Personnel from DARPA, the Navy, and NASA will be assigned to the NASP program office at Wright-Patterson AFB, he added. Phase II of the program, the basic feasibility study, is now under way, with DARPA the lead agency. Phase II involves primarily the development of critical engine components for subsequent ground testing.

The pacing technology—and the one that has triggered renewed interest in the aerospace plane concept—is the so-called "combined cycle" engine. Propulsion systems of this type appear to be capable of operating efficiently from "zero speed" to Mach 25. Such a powerplant, probably burning exotic fuels that are being developed in parallel by related Project Forecast II projects, might scoop up and store a "reservoir" of air as the aerospace plane ascends and then use this "oxidizer" while operating at the fringe of atmosphere or in low earth orbit.

Project Forecast II, whose seventy high-payoff projects span the gamut of the Air Force's mission areas, was "scrubbed" by three separate panels. These involved a technology panel comprising subpanels patterned along the lines of major engineering disciplines; a mission panel consisting of subpanels for strategic offense and defense, theater warfare, low-intensity conflict, and battle management; and an analysis panel, which concentrated on concept trade-offs and which was assisted by threat assessment and costing subpanels.

A noteworthy finding of the threat analysis panel was that the Soviets appear to be pursuing energetically what is perhaps Project Forecast II's most ambitious and most leveraged technology project, the exploration of antimatter for military purposes. The Soviets, General Skantze emphasized, are building a large accelerator facility seemingly devoted to "antiproton" work. If the virtually unlimited theoretical energy potential embedded in proton/antiproton technology can indeed be realized, the consequences for space and missile operations would be revolutionary.

Another technology with potential application to space operations that was recommended by Project Forecast II for thorough examination is robotics. An exploration of the potential of substituting remotely controlled robots for astronauts, thereby reducing the risk of exposing humans to the vagaries of spaceflight, is especially timely in light of the recent *Challenger* tragedy. The approach proposed by Project Forecast II centers on the notion of developing actual "sensitivities in hand motions" that enable an operator on the ground to receive the finger feeling of what the robot's replicated "hands" are touching and doing in space. "Teletransporting" this type of tactile sensing could vastly increase the ability of robots to assemble or in other ways work on space platforms or to repair satellites.

The value of such a closed-loop control of robots in space by ground-based human operators could be comprehensive, especially in military applications. Such robots would not only eliminate the risks associated with exposing personnel to intrinsically dangerous space operations—especially during periods of crises or conflict—but could dispense with man-rated launch vehicles or life-support systems as well. (Work on remotely controlled devices—in fact, primitive robots—had been carried out earlier by the Air Force in connection with expendable launch vehicles, but was halted with the advent of the Shuttle.)

Project Forecast II's concept of a combination of robotics and "telepresence" would create opportunities to perform maintenance and repairs in any environment in which human life would be at risk. Among the likely military advantages might be construction or repair in a combat or nuclear-contaminated environment, including explosive ordnance disposal.

The idea of "telepresence" by means of robots gets around the problem of providing complex sensors and rudimentary machine intelligence to autonomous robots that, for the foreseeable future, could not approach the capabilities and versatility of designs under direct control of remotely located human operators. It is probably possible to develop, in a relatively rapid fashion, the technologies necessary to enable the remote operator to see and feel what he wants the robot to work on. Demonstrations of such "telepresence," General Skantze suggested, probably "would not be all that difficult or expensive. If we can do this in closed-loop fashion, we would open some very interesting vistas" on the operational utility of robots.

Project Forecast II's findings also suggest high operational payoff from "millimeter-wave weapons" that—although no larger than a conventional bomb—could focus enormous power bursts on a target area and "take out everything that's there," according to General Skantze. Weapons of this type would suggest the potential for innovative approaches to low-intensity warfare and the combating of terrorism.

Another technology of potentially high payoff in terms of special operations and low-intensity conflict is a combination of stealth and advanced fuel-efficient engines with a thrust-to-weight ratio as high as twenty to one—compared to today's eight-to-one level or lower. Engines of this type, the AFSC Commander suggested, would go a long way toward overcoming the fuel inefficiency of present vertical takeoff and landing (VTOL) aircraft. Longer range, high payload VTOLs are obviously of extreme importance to special operations forces.

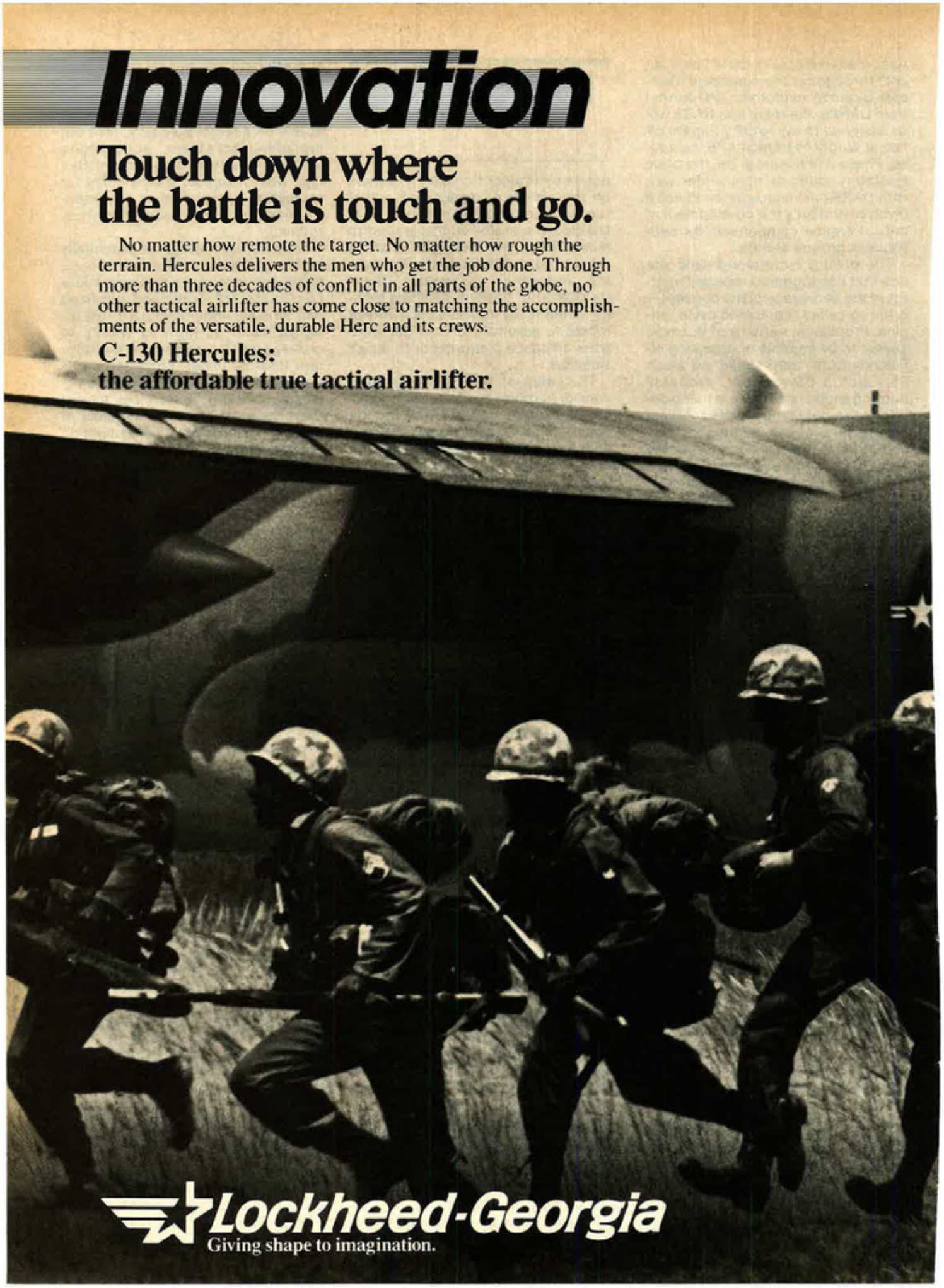
IN FOCUS...

Washington Observations

★ The Air Force has rejected draft language by the US Navy for a Memorandum of Agreement between the two services that concerns cross-service applications of the Navy's Advanced Tactical Aircraft (ATA) and the Air Force's Advanced Tactical Fighter (ATF) *(see also "Hard Calls on Tactical Technology," p. 58 of this issue).* The Navy's draft of the MOA listed the ATA as a follow-on replacement for F-111s and F-15Es.

The Air Force position is that it is too early to cite specific cross-service applications, especially in light of the as yet tentative character of the ATA. The possibility that the ATA might serve as a follow-on to the F-4G Wild Weasels has not been ruled out, however.

★ Air Force Under Secretary Edward C. Aldridge, Jr., recently testified before Congress that, in light of the loss of *Challenger,* the Defense Department "would strongly encourage the procurement of a replacement orbiter . . . to regain the [required] fleet launch capacity." The near-term impact on DoD of the loss of the *Challenger* orbiter "starts becoming severe" if—as is likely—the Space Shuttle stands down for more than one year: "There is no 'recovery' option that will mitigate this impact within the next two years." There is, he stressed, a clear need to "procure and launch additional expendable launch vehicles (ELVs) beyond our current plans and to procure a replacement orbiter." ■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CAPITOL HILL

By Brian Green, AFA DIRECTOR OF LEGISLATIVE RESEARCH

Washington, D. C., Feb. 26

The DoD Budget

Even as some members of Congress were pronouncing the budget "dead before arrival," President Reagan and Secretary of Defense Caspar Weinberger staunchly defended their $311.6 billion DoD request as the minimum necessary to meet the growing Soviet threat.

The DoD budget, consistent with a total defense package of $320.3 billion that includes Department of Energy nuclear-weapons programs, among others, is eight percent (in inflation-adjusted dollars) higher than the final FY '86 budget figure. The original FY '86 defense request of $322.2 billion was pared down by Administration compromise, congressional cuts, and, finally, by reductions mandated by the Gramm-Rudman-Hollings balanced-budget law that totaled more than $13 billion. The final defense figure for FY '86 was $286.1 billion, of which $278.4 billion was DoD's share, more than six percent lower than the FY '85 level. The FY '87 request seeks to recoup some—but not all—of those losses.

This year's budget battle, because of extraordinary pressures to reduce the deficit, is bound to be a bloody one. In increasing defense spending and avoiding a tax increase, President Reagan's budget cuts deeply into some social programs that are supported by strong congressional constituencies in order to achieve the mandated deficit target of $144 billion. The consensus on Capitol Hill is that the defense request will suffer sizable cuts. Estimates of their magnitude vary from an inflation-adjusted freeze (about a $20 billion cut) to reductions in budget authority up to $50–75 billion.

The DoD budget includes $95.8 billion for procurement (about the same as FY '86), $76.8 billion for personnel (up about nine percent), $86.4 billion for operations and maintenance (up about twelve percent), and $41.9 billion for R&D (up almost twenty percent). By mission area, general-purpose forces are slated to receive $128.6 billion; strategic forces, $25.4 billion; R&D, $32.5 billion; mobility forces, $7.5 billion; intelligence and communications, $29.5 billion; training, medical, and other personnel activities, $37 billion; central supply and maintenance, $26.4 billion; and the Guard and Reserve, $17.9 billion.

The Air Force request is $105.2 billion, compared to the Navy's request of $104.5 billion, the Army's $81.5 billion, and defense agencies' $19.5 billion. Percentage increases requested are 7.7, 6.6, 8.8, and about twenty-five, respectively.

The Air Force request features funding for 294 tactical aircraft, an increase of nearly seventy planes, despite a substantial decrease in Air Force procurement money. The request includes forty-eight F-15Es, which will provide badly needed long-range surface-attack capabilities; 216 F-16s, of which 120 will be of a new, less expensive configuration; and thirty of the winners of the air defense competition, due to be determined this summer. Twenty-one C-5B transports and eight KC-10 tanker/transports are funded to improve airlift capabilities. The first substantial purchase of the Advanced Medium-Range Air-to-Air Missile (AMRAAM)—260 missiles—is also requested, subject to Secretary Weinberger's March 1 certification to Congress that AMRAAM has met its performance and cost requirements.

Major R&D projects include the C-17 airlifter; the small ICBM, funded at $1.4 billion; alternative MX basing modes, at $390 million; the Advanced Tactical Fighter, at $294 million; and the Joint Surveillance Target Attack Radar System (JSTARS), at $356 million. JSTARS is being designed to detect mobile ground targets and provide real-time intelligence to ground commanders and tactical aircraft. The Air Force will also be responsible for about a third of the $4.8 billion requested for the Strategic Defense Initiative. USAF's research, development, test, and evaluation request is about twenty-five percent higher than last year's total.

Space activities make up about $11.4 billion of the total Air Force request. That figure includes $1.3 billion for Space Shuttle activities. The Air Force is also studying the possibility of asking for additional expendable launch vehicles (ELVs) in a supplemental budget request. The ELVs would help offset the impact of the loss of the *Challenger*.

Controversy Over Small ICBM

At a recent hearing of the Research and Development Subcommittee of the House Armed Services Committee (HASC), Under Secretary of Defense for Research and Engineering Donald A. Hicks averred his support of a three-warhead, 75,000-pound small ICBM (SICBM)—much larger and packing a much greater punch than the congressionally approved design, which envisions a one-warhead, 30,000-pound missile. The Administration and the Air Force continue to support the smaller design.

Secretary Hicks stated that he supported the concept of a small mobile missile. He argued, however, that a somewhat larger, more capable missile would not sacrifice any mobility, thus remaining survivable against Soviet attack. He also suggested that the larger missile could save the taxpayer $20 billion on a proposed deployment of 500 warheads, compared to its single-warhead counterpart.

Congressional supporters of the single-warhead SICBM maintain that making the missile much larger will limit its mobility, although some have hinted that a modest expansion to 37,000 pounds might be desirable to permit the deployment of penetration aids that are designed to defeat active Soviet ballistic missile defenses. With less mobility, the argument runs, the cost to the Soviets of attacking the total SICBM force would be lower (because the missiles could not disperse so widely), and thus strategic stability would be reduced. Rep. Les Aspin (D-Wis.), chairman of the HASC, in an extensive study of the SICBM, also argues that, in terms of the cost per warhead of those surviving a Soviet first strike, the one-warhead SICBM is much cheaper than the MX in superhardened silos. ■

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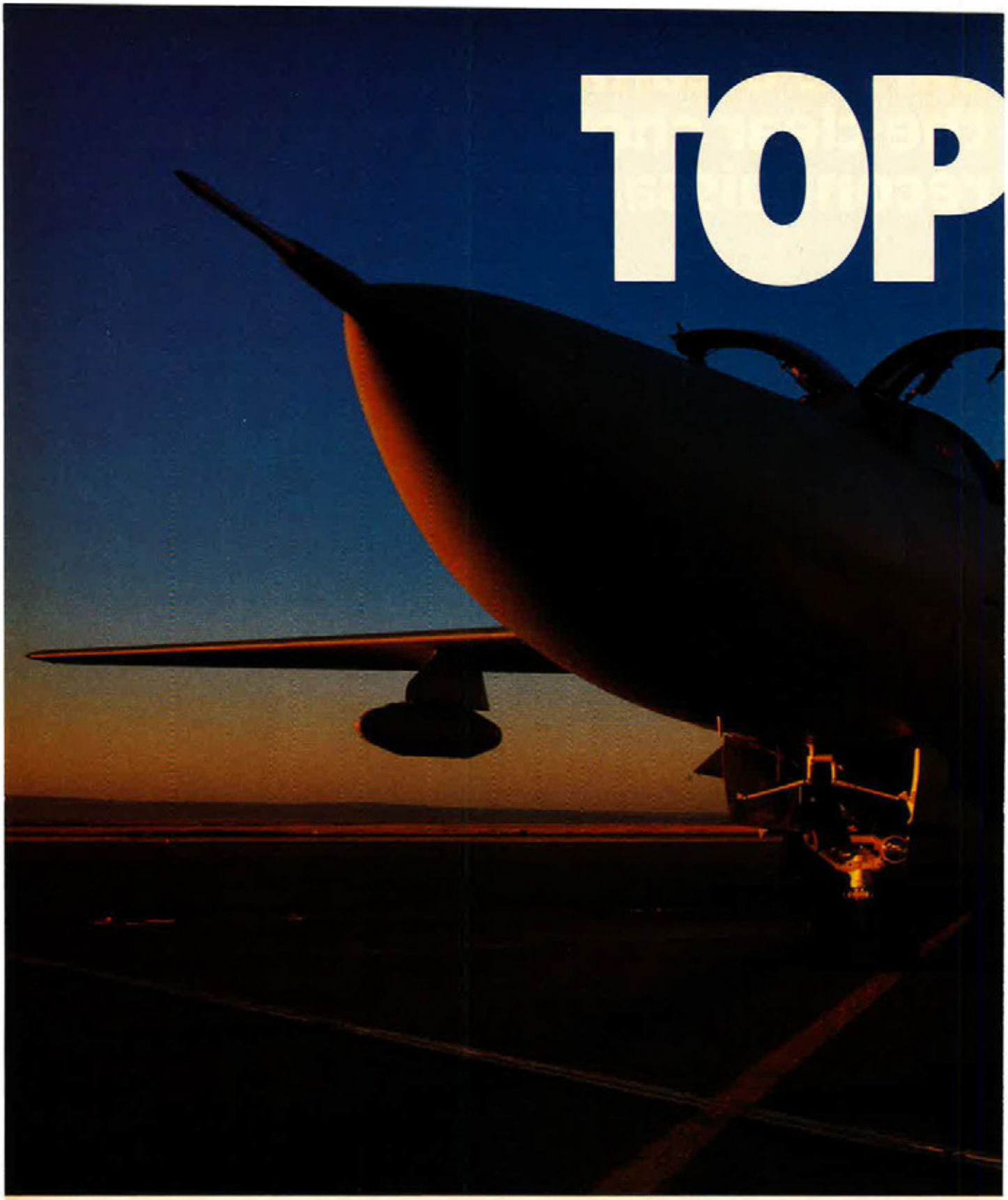

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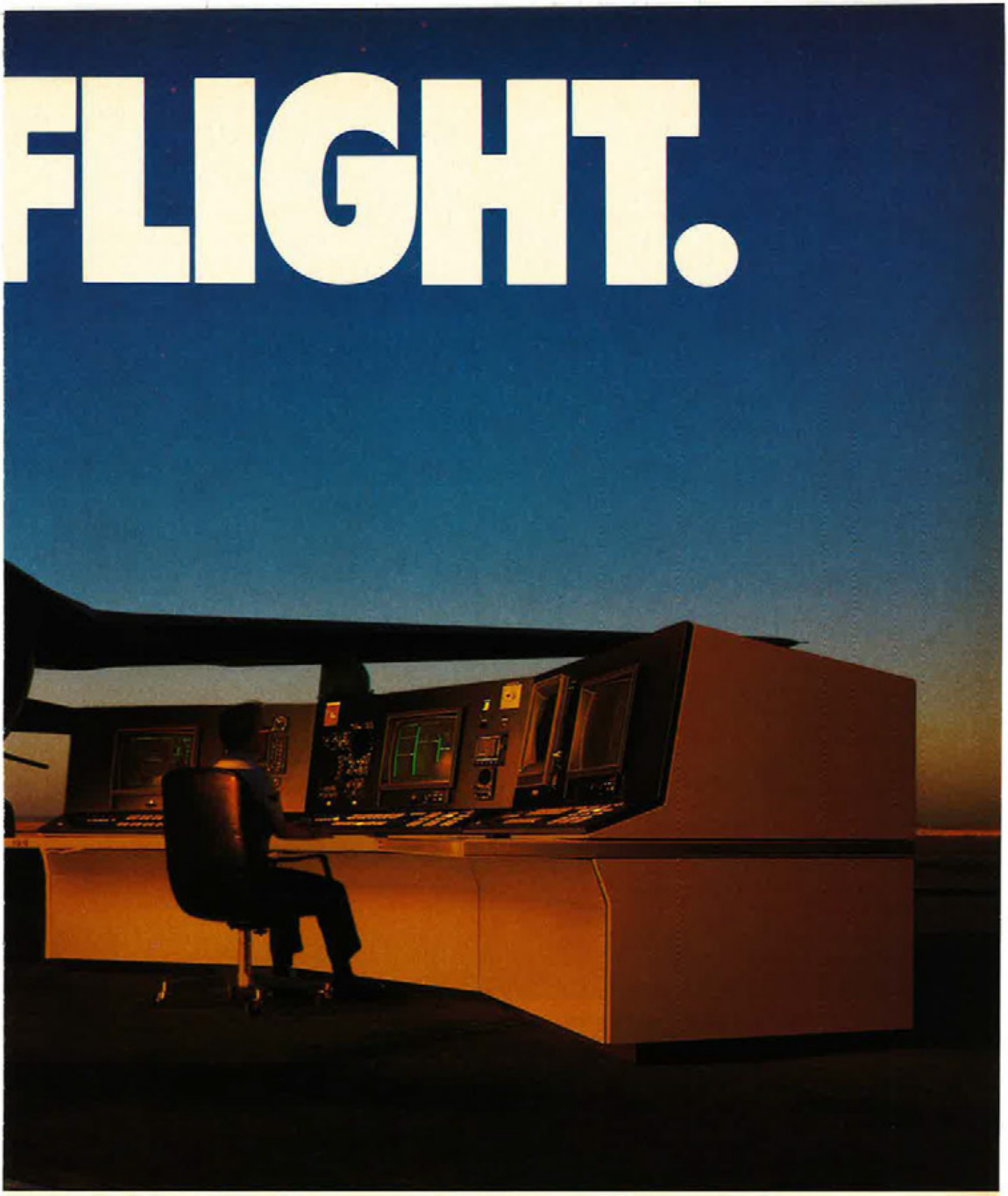

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AEROSPACE WORLD

Including Bulletin Board

Compiled by Jeffrey P. Rhodes, STAFF EDITOR

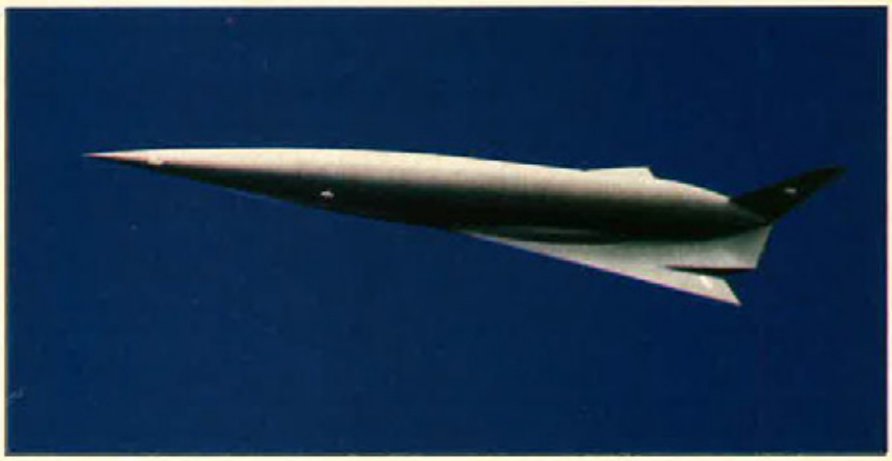
Washington, D. C., Feb. 28 ★ Beginning in FY '88, the Air Force will allot some ten percent of its science and technology base budget to further exploration of high-promise ideas identified by Project Forecast II. This effort, a direct descendant of the survey twenty years ago that eventually led to the B-1, wide-body aircraft, and the high-bypass-ratio turbofan engine, examined some 1,500 technological possibilities in search of those that USAF might profitably develop over the next two decades.

Gen. Lawrence A. Skantze, Commander of Air Force Systems Command, said that a "modest ramp-up" in S&T base money may be necessary and that the Air Force plans to have research activity under way within the next two years on about seventy of the Forecast II technological thrusts. AFSC summarized Forecast II findings at a Washington press conference on February 18 and is currently briefing Air Force major commands.

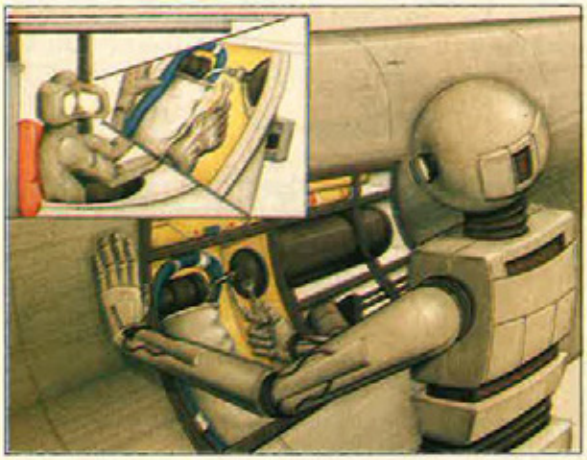
The most spectacular of the concepts is the National Aerospace Plane (NASP), a vehicle that could operate at hypersonic velocities in the upper atmosphere. It would take off from earth much as an ordinary aircraft would, accelerate to orbit, and descend for a landing on a conventional runway *(see "Bold New Missions in Space," June 1984 issue).*

Two other Forecast II ideas—antimatter propulsion, which could put Mars only a few weeks away, since spacecraft would accelerate most of the way, and the "Swarm" option, which would employ large numbers of small, relatively inexpensive satellites rather than small numbers of supercapable, expensive, ultrareliable satellites—were reported on earlier in this magazine *(see "In Focus . . ." January and February 1986).*

General Skantze also described a "super cockpit" of the future, in which the pilot relies extensively on a computer image for his view of the external world and for monitoring the systems of his aircraft. Another Forecast II idea would have robots perform maintenance and repairs in risky en-



One of the concepts explored by Project Forecast II is the National Aerospace Plane (NASP), which would be the first conventional takeoff-to-orbit vehicle.



Other promising technologies highlighted in this nine-month study included the use of robots for repairs and maintenance in risky environments. As shown here, hand movements by a technician on the ground would be telemetered to a robot in space that would then repeat the movement to effect the repair.

The "Swarm" option would involve large numbers of small, relatively inexpensive, less vulnerable satellites that would have high capability in the aggregate. The technologies highlighted by Project Forecast II are the ones the Air Force feels will be the most nearly viable as the turn of the century approaches.

vironments. For example, a human on earth might put on a specialized pair of gloves and then have his exact hand motions telemetered to and duplicated by a robot in space.

He said that the Air Force is looking ahead to smaller engines that can run hotter, with such powerplants achieving thrust-to-weight ratios of 20:1 by the end of the 1990s. Current ratios are about 8:1. Among the applications might be a vertical takeoff and landing aircraft for low-intensity conflict or special operations.

Forecast II concepts point to several possibilities in armament. These include an "autonomous weapon" that would be able to recognize and lock on to hostile targets automatically and a microwave weapon that would attack with a series of beam bursts from its antenna.

The Project Forecast II studies took nine months to complete.

★ Tactical Air Command is urging the Department of Defense to revive the requirement for a follow-on aircraft to carry out USAF's close air support/battlefield air interdiction (CAS/BAI) mission.

With TAC's backing, former Secretary of the Air Force Verne Orr initiated such a requirement last year. However, Secretary of Defense Caspar W. Weinberger ruled that the defense budget could not accommodate a "new start" CAS/BAI aircraft development program and ordered USAF to put the requirement on hold.

AEROSPACE WORLD

TAC has not given up on it. TAC Commander Gen. Robert D. Russ told AIR FORCE Magazine that USAF "must do something about replacing our A-7s in a couple of years" as "an interim move" and then "must turn to plans for replacing our A-10s in the mid-1990s."

Replacing the Air Force's A-7s is an urgent matter, says General Russ, because "in the next eighteen months to two years, all of them will reach their twenty-year service lives."

The A-7s could give way to F-16s or to Northrop F-20s, both of which USAF is now considering for the air defense mission.

It is entirely possible, however, that the A-7s will, in effect, replace themselves by virtue of an upgrading program proposed by their manufacturer, Vought Aero Products Division of LTV Aerospace and Defense.

The upgraded A-7 "Strikefighter" has clearly caught TAC's fancy.

"I think the proposal [for the modernized A-7] has considerable merit," General Russ declared, "especially if we can procure it for about half the cost of a new airplane in the F-16/F-20 class."

As conceived by LTV/Vought, the upgraded A-7s would be powered by Pratt & Whitney F100-PW-200 engines and would incorporate advanced, off-the-shelf avionics, including forward-looking infrared (FLIR) and terrain-following radar (TFR) systems.

LTV/Vought claims that it could modify 462 A-7s, including stretching their fuselages to accommodate the change from TF41 engines to F100-PW-200 engines, at a total program cost of $3 billion and at a unit flyaway cost of about $5 million.

★ The Veterans Administration unveiled its FY '87 budget request in February, and the proposal immediately drew criticism from veteran's groups and congressional supporters of improved veteran's programs.

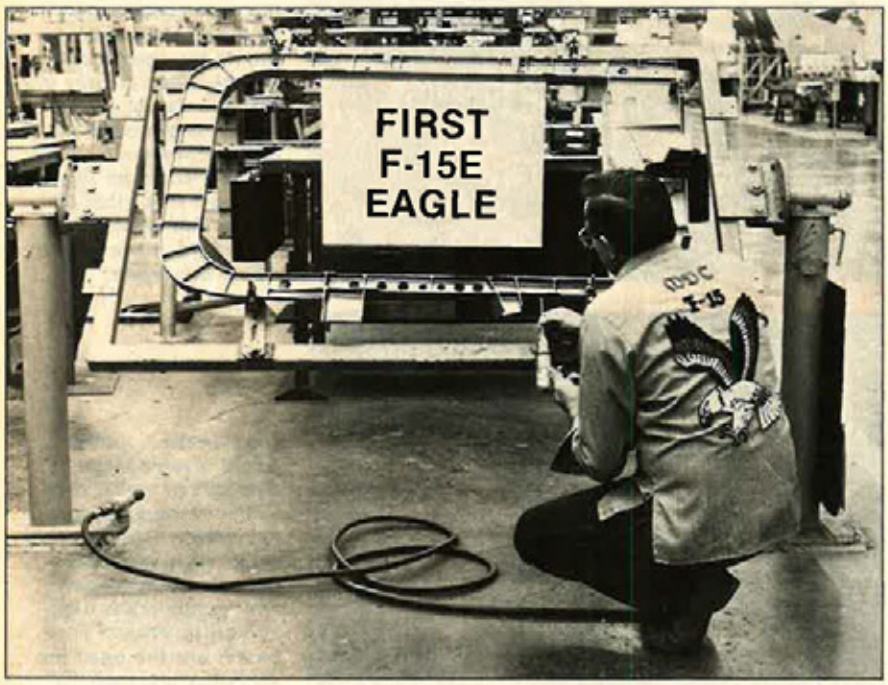
A basic analysis of the proposal reveals that the $26.6 billion requested to fund medical, compensation, and other programs for 27,800,000 veterans, eligible survivors, and family members is about $408 million less than FY '86 authorizations. The funding requested—and many say this final figure reflects a healthy paring by the White House from what the VA first said it needed—would trim VA spending to a level of several years ago. Critics charge that the request is inadequate to cope with burgeoning program demands driven by an aging veteran population.

Other budgetary recommendations in the benefits area that are coming under fire include an increase in VA home loan funding fees and a halt on October 1 to enrollments in the recently renewed GI Bill. The rationale for the latter move, says VA, is that DoD is not experiencing recruitment problems. Both of these proposals require congressional action for passage, and debate is expected to be heavy.

The one issue in the proposed budget that is raising the most hackles is the recommendation to institute a "means test" for VA care eligibility for veterans with nonservice-connected disability. VA describes this move as a "reproposal of a comprehensive reform of VA medical care eligibility for veterans both over and under sixty-five years of age."

Congress must approve such a plan and, in the past, has not been averse to making some changes. However, the proposal to set the "means" cutoff line at those veterans earning less than $15,000 per year is already stirring controversy. Congress has indicated that if such a test is adopted, an income figure of $20,000 seems more reasonable.

Also sought by VA and not likely to get too much opposition in Congress



Warren Huff, a sheet metal assembler and riveter at McDonnell Douglas's St. Louis, Mo., plant, drills holes into a forward inlet duct frame, the first part of the first F-15E dual-role fighter. The first flight of the F-15E is scheduled for December of this year.

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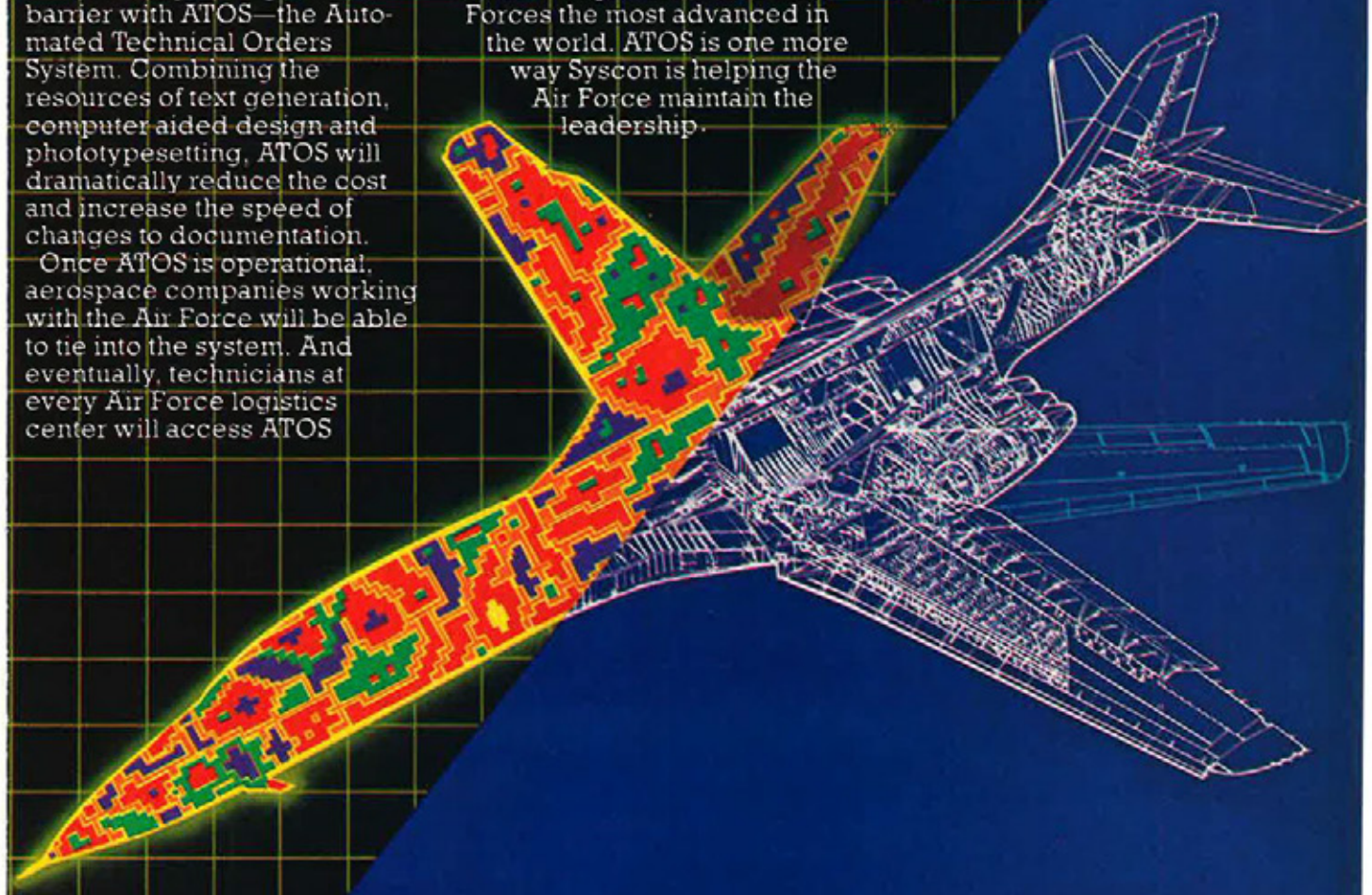

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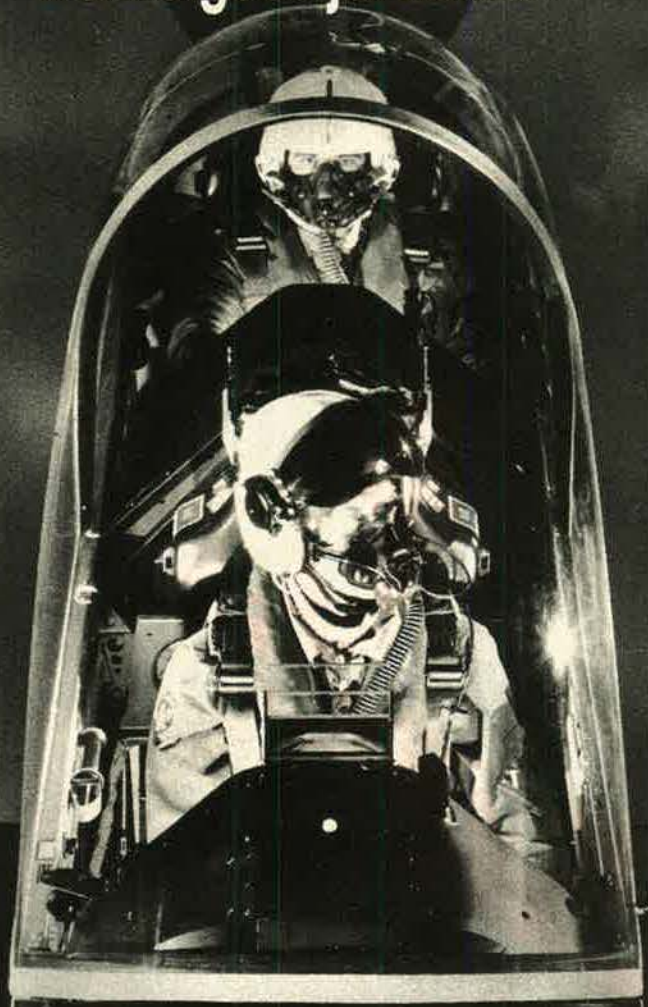

Naturally it's not the Cockpit Layout with its Single Power Control Lever, Advanced Avionics and Comprehensive Instrumentation. These features are very jet-like.

Neither is it the Performance, Maneuverability, Climb Rate or «Feel». These too are very jet-like.

Nor is it the Martin Baker Ejection System, the Hydraulics or the Sleek Aerodynamic Profile. All of these features make the PC-9 remarkably jet-like.

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is a proposal to require reimbursement from private insurance companies for veteran medical care and treatment. This approach seems to be a developing trend in all government-funded medical programs.

★ Next to Soviet defenses, the worst enemy of a ballistic missile reentry system could very well be a heavy snowstorm.

Most warheads are aimed at their target by the ballistic trajectory of the carrier missile. However, even minute shape changes in the nose cone resulting from erosion by adverse weather could affect the accuracy of the warhead and its ability to find the target.

That's why the Arnold Engineering Development Center near Manchester, Tenn., has upgraded one of its test ranges to produce a heavy snow cloud. This ultimate snowmaking machine will simulate atmospheric effects on missile nose cone models.

Testing is performed at AEDC's Range/Track G Facility. With the recent upgrade, the facility now has ninety-nine snow generators. During a test, temperatures are lowered to minus forty degrees Fahrenheit, which simulates atmospheric conditions at altitudes of 30,000 to 40,000 feet. This bitter cold causes moisture in the air to form snowmaking cirrus ice crystals on the generator plates.

The snow is made to fall by causing an electric solenoid to strike the plate. The model nose cone, meanwhile, is streaking through the "storm" after being fired from a gun. Timing is so critical in getting the nose cone to arrive in the middle of the "blizzard" that the entire process is orchestrated by a computer.

Various nose cone materials are in the process of being tested to help determine which type could best survive in a snowy environment.

★ In just seven years since the activation of the first operational F-16 unit, the Fighting Falcon fleet has surpassed 1,000,000 flight hours. The aircraft, manufactured by General Dynamics Corp., is in use with the US Air Force and eight allied nations around the world.

The 1,000,000-hour plateau was achieved in such a relatively short time because there are nearly 1,500 F-16 aircraft flying from approximately thirty bases worldwide. USAF, which has approximately 875 F-16s, is itself closing in on the 1,000,000-hour mark and should reach that milestone later this year.

There is also a growing number of

AEROSPACE WORLD

"old-hand" F-16 pilots. More than 150 aviators have passed the 1,000-hour mark, and two pilots, Lt. Col. Serge DelHoyo and Lt. Col. Larry Stellmon, each have more than 2,000 hours in the saddle of the F-16.

The US Navy has become one of the latest customers for the ubiquitous airplane. Congress has authorized twenty-six specially configured F-16Cs (designated F-16N) to complement the Navy's Israel Aircraft Industries F-21A Kfirs in adversary training. The Navy F-16s will not carry the M61 20-mm cannon, but will make use of the APG-66 radar found on the Air Force's F-16As and Bs. Deliveries are expected to begin in 1987.

★ Of the thirty-two initiatives that the Department of Defense implemented under the Defense Acquisition Improvement Program (DAIP) in the early 1980s, the most challenging—and in DoD's words, the most rewarding—has been competition.

Secretary of Defense Caspar W. Weinberger reports that the number of annual competitive contract awards has increased to more than 6,000,000 since FY '80, representing a thirty-seven percent increase in that period. The dollar value of competitive contracts has risen from $39.7 billion in FY '80 to $104.9 billion in FY '85. Nearly seventy-two percent of all DoD contract actions in FY '85 were awarded under competitive contracting.

The number of dual-sourcing contracts, or those allowing for two vendors, has also been rising. Currently, there are forty-four major systems and subsystems under dual-source contracts. These include the guidance system and motor for the air-launched cruise missile (ALCM), the alternate fighter engine (AFE), and the joint-use AIM-9 Sidewinder and the Army/Marine Corps Hellfire missiles.

In other contractor news, the $26 billion worth of DoD prime contracts awarded to small businesses in FY '85 established a new record. The FY '85 total constitutes a $2.2 billion increase over FY '84. Small businesses also set a new record of $20.1 billion worth of subcontracts from prime contractors. "Disadvantaged" small business firms increased their participation in DoD's Small Business Program by approximately $333 million, and firms owned by women increased their participation by $179 million. The Small Business Program began in 1953.

★ In what amounts to a gigantic clearance sale by the manufacturer, the Air Force has completed its buy of eight Gulfstream Aerospace Corp. C-20B VIP transports at a savings of more than $50 million.

The Air Force saved more than $50 million when it bought out the contract for the eight remaining Gulfstream Aerospace C-20B transports on order. (USAF photo)

USAF had originally planned to spend $203 million to purchase three of the Gulfstream III aircraft in 1986, three more in 1987, and the final pair of aircraft in 1988, along with the spare parts. However, Gulfstream offered the Air Force a better deal if all the transports could be bought at one time—$151 million for the lot, including the spares. The airplanes were paid for with monies appropriated for the 1986 Presidential budget.

Since Gulfstream Aerospace is tooling up for its Gulfstream IV air-

craft at its Savannah, Ga., plant, the deal proved beneficial to both parties. The Air Force got its planes, and Gulfstream could switch its production line to the new variant.

The C-20Bs will be assigned to the 89th Military Airlift Wing at Andrews AFB, Md., for airlift of Presidential, congressional, and Cabinet-level officials. The new aircraft are scheduled to start arriving next January.

★ The world's first privately financed and managed training facility specifically designed to train military fighter pilots has recently been opened in Tempe, Ariz., by General Electric's Simulation and Controls System Department.

Called the Center for Advanced Airmanship (CAA), the facility focuses on providing sound fundamental training for pilots of nations flying the Northrop F-5. The CAA uses advanced day and night simulators along with computer-based academic training to complement the user nation's existing flight-training programs. The CAA facility allows pilots to achieve greater proficiency in less time and at reduced cost. The "faculty" of the CAA is an international cadre of ex-military fighter pilots.

The academic training takes place in specially designed, individually enclosed workstations. To make the two display screens in each enclosure a little more user-friendly, there is no computer keyboard, but only a simple six-button keypad and a touch-sensitive screen. The cubicle features room for an instructor pilot for individual training.

The flight simulation training is accomplished by combining an F-5E cockpit, GE's highly sophisticated COMPU-SCENE III Image Generator, and a newly developed instructor operation station. Courses in initial training, continuation training, and advanced weapons training are currently offered.

GE feels the CAA will be able to pretrain about seventy-eight percent of the basic tasks and skills a pilot normally learns in transition training. This pretraining allows pilots to spend actual flight time concentrating on developing style and technique.

GE, which spent $42 million of its own funds to develop the CAA, is currently discussing training, research, and demonstration requirements with the Air Force, a number of foreign countries, and leading aerospace firms.

★ The first two Boeing 707 aircraft that will be upgraded and modified for the Joint Surveillance Target Attack Radar System (JSTARS) platform were delivered in late January and early February to the Boeing Military Airplane Co. in Wichita, Kan.

AEROSPACE WORLD

JSTARS is an airborne surveillance system designed to find moving and fixed ground targets and guide aircraft and missiles against them.

The two 707s, which will be designated C-18, were purchased from Korean Air Lines. Boeing will refurbish and upgrade the airframe and avionics and electrical subsystems and also add auxiliary power and in-flight equipment. Grumman, the JSTARS prime contractor, will then integrate the radar, develop associated software systems, and conduct the test program. The radar is built by United Technologies Corp.'s Norden Systems Division.

Boeing will deliver the two C-18s to Grumman in mid-1987, and the Long Island-based firm will deliver the aircraft to the Air Force and the Army for testing in a tactical environment by late 1988.

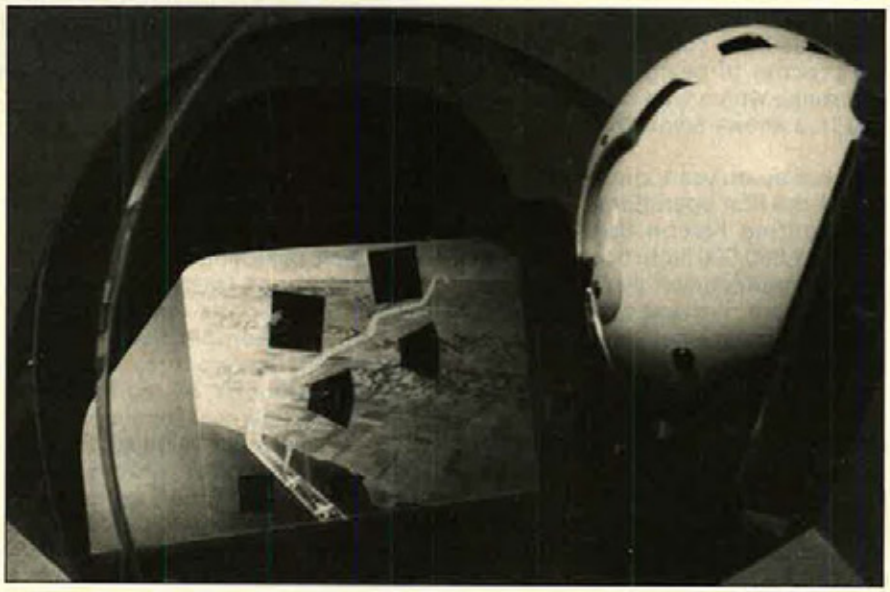
★ The changing of the guard has begun at F. E. Warren AFB, Wyo., as an LGM-30G Minuteman III ICBM was recently removed from its silo in preparation for the arrival of the first LGM-118A Peacekeeper.

Pulling the Minuteman missile was the first step in an eight-month process to modify the first group of silos to house the Peacekeeper. In addition to removal of all equipment specifically related to the Minuteman III, the silo will be physically altered to accommodate the taller and larger-diameter Peacekeeper.

Installation of new support and handling equipment will be completed prior to the turnover of the first four Peacekeeper Launch Facilities and two Launch Control Facilities to the Air Force this fall. The LGM-118A is assembled by Martin Marietta Aerospace, Denver Division.

★ In a recent speech before the Economic Club of Detroit, Secretary of Defense Caspar Weinberger reported on DoD's record in reducing the rising costs of developing new weapon systems. "We have all but eliminated the cost growth in weapon systems development, which has historically plagued cefense programs," the Secretary noted. "In fact, cost growth, which averaged fourteen percent per year in 1981 and which went as nigh as seventeen percent per year, has been forced down to *less* than one percent in each of the last two years. Our management improvement efforts, plus the President's success in controlling inflation, actually allowed us to preserve force modernization in spite of a $318 billion reduction in budget authority since 1984."

★ The pilot of the future may operate his fighter at a control panel that looks more like a living room TV set rather than with the traditional airplane dashboard. A new instrument package called Big Picture may make the control panel a reality.



Big Picture may represent the instrument panel of the future. This design eliminates traditional instruments and is activated by touch, voice, or movement.

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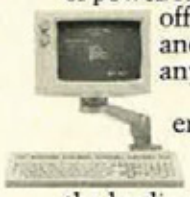

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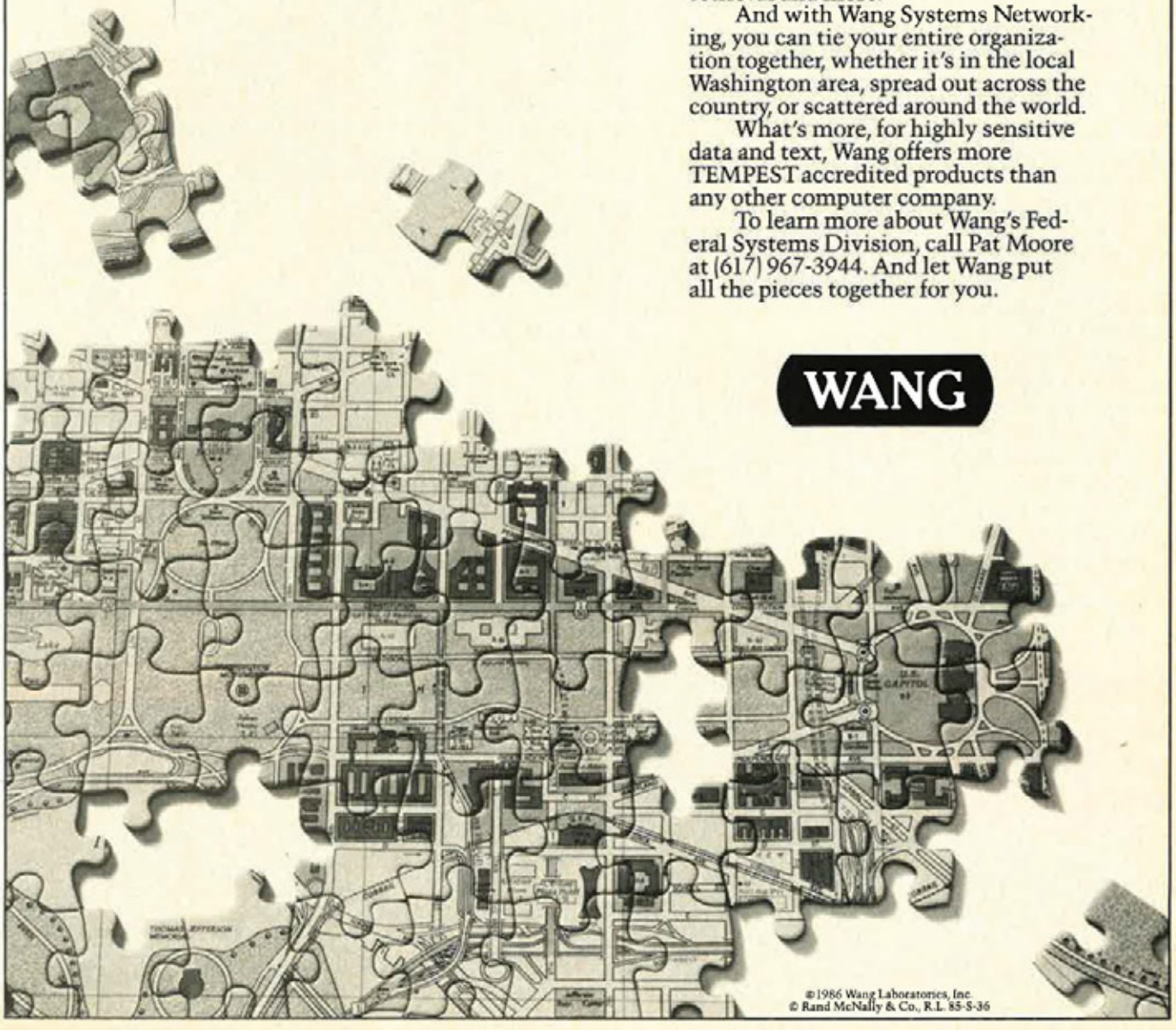
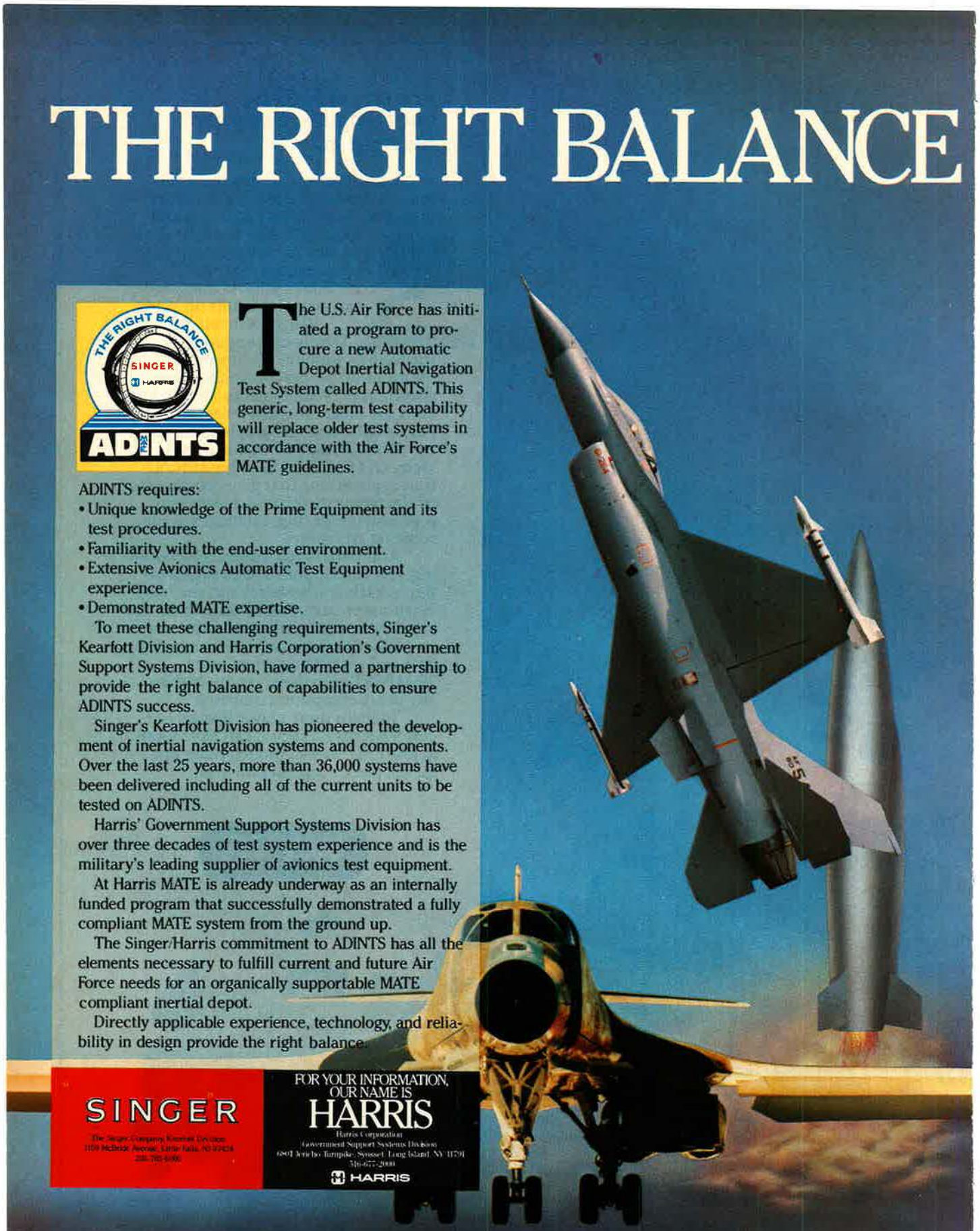


THE RIGHT BALANCE



The U.S. Air Force has initiated a program to procure a new Automatic Depot Inertial Navigation Test System called ADINTS. This generic, long-term test capability will replace older test systems in accordance with the Air Force's MATE guidelines.

ADINTS requires:

- Unique knowledge of the Prime Equipment and its test procedures.
- Familiarity with the end-user environment.
- Extensive Avionics Automatic Test Equipment experience.
- Demonstrated MATE expertise.

To meet these challenging requirements, Singer's Kearfott Division and Harris Corporation's Government Support Systems Division, have formed a partnership to provide the right balance of capabilities to ensure ADINTS success.

Singer's Kearfott Division has pioneered the development of inertial navigation systems and components. Over the last 25 years, more than 36,000 systems have been delivered including all of the current units to be tested on ADINTS.

Harris' Government Support Systems Division has over three decades of test system experience and is the military's leading supplier of avionics test equipment.

At Harris MATE is already underway as an internally funded program that successfully demonstrated a fully compliant MATE system from the ground up.

The Singer/Harris commitment to ADINTS has all the elements necessary to fulfill current and future Air Force needs for an organically supportable MATE compliant inertial depot.

Directly applicable experience, technology, and reliability in design provide the right balance.

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Big Picture will replace conventional manual controls, such as knobs and switches. It will also combine small video displays into one screen that spans the width of the instrument panel.

The large screen will display all the airplane's functional gauges and provide information on all phases of flight, including takeoff, landing, avoiding attack, and firing missiles. The panel can also perform functions automatically. Big Picture will be activated by touch, voice, or movement of the pilot's helmet.

A $1.5 million contract was awarded in early February to McDonnell Aircraft Co., a division of McDonnell Douglas, to build the Big Picture simulator and conduct pilot demonstrations. The Avionics Laboratory at Wright-Patterson AFB, Ohio, will be assisting on the Big Picture simulator program.

AEROSPACE WORLD

It looks like a restored Supermarine Spitfire Mk. IX, but it's not. Specialised Mouldings Ltd. has produced a limited number of glass-reinforced plastic model Spits for outside display. The planes are accurate down to the last detail.

★ The Army and Air Force Exchange Service (AAFES) is modernizing its approach to food service by standardizing recipes and streamlining its restaurant operations.

With an obvious bow to the success of American fast-food chains, AAFES is phasing out snackbars in favor of restaurants specializing in one type of menu and grouped together in exchange malls and other installation locations. "We want a burger or bowl of chili to look and taste the same in every AAFES restaurant," said Henry Fournier, AAFES Food Branch Chief. "Our customers are used to eating in well-managed chain restaurants. They expect consistent quality and service.

"Right now, we serve fast food plus full dinner menus in our cafeterias," Mr. Fournier explained. "Under the new concept, cafeterias will serve only full lunches and dinners."

Six types of specialty restaurants are either now operating or are planned. These restaurants feature submarine sandwiches, pizza, fried chicken, hot dogs, baked goods, and ice cream.

★ Under a two-stage modernization program, two Lockheed C-5A aircraft will be modified to carry special containers for the Space Shuttle program.

The modification will involve the removal of the upper troop compartment behind the wing for added height in the cargo hold. The two aft clamshell doors will also be enlarged.

Phase one of the contract is valued at $42 million and will cover design development and testing. The second phase, once approved, will involve additional testing and the actual modification of the C-5A aircraft.

★ Gen. Robert D. Russ, TAC Commander, is looking ahead to the day of better dressed pilots.

"I've kind of had an aversion against the current flight suit that we have had for quite some time—primarily because it looks like a bag," General Russ said at AFA's recent Tactical Air Warfare Symposium in Orlando, Fla. "Our pilots are professional, our enlisted personnel are professional, our people in their uniforms look professional, our facilities look good, our airplanes look good—and we put our pilots and enlisted aircrew members in bags."

SENIOR STAFF CHANGES

RETIREMENT: B/G Monte D. **Montgomery.**

CHANGES: B/G Loring R. Astorino, from Cmdr., 19th AD, SAC, Carswell AFB, Tex., to Cmdr., 7th AD, SAC, Ramstein AB, Germany, replacing B/G Wayne W. Lambert . . . **Col. (B/G selectee) Lester P. Brown, Jr.,** from Cmdr., 81st TFW, USAFE, RAF Bentwaters, UK, to Cmdr., 836th AD, TAC, Davis-Monthan AFB, Ariz., replacing B/G Ronald R. Fogleman . . . **B/G Donald R. Delauter,** from Cmdr., 23d AD/NORAD Region, TAC, Tyndall AFB, Fla., to Dir., NORAD Command Planning Staff, Hq. NORAD, Peterson AFB, Colo. . . . **B/G Ronald R. Fogleman,** from Cmdr., 836th AD, TAC, Davis-Monthan AFB, Ariz., to Dep. Dir., Prgms. and Eval., DCS/P&R, and Chairman, Program Review Committee, Hq. USAF, Washington, D. C., replacing B/G (M/G selectee) Robert L. Rutherford . . . **B/G Wayne W. Lambert,** from Cmdr., 7th AD, SAC, Ramstein AB, Germany, to Cmdr., Hq. ARPC, Lowry AFB, Colo. . . . **Col. (B/G selectee) John D. Logeman, Jr.,** from Cmdr., 67th TRW, TAC, Bergstrom AFB, Tex., to Vice Cmdr., 12th AF, TAC, Bergstrom AFB, Tex. . . . **B/G Charles A. May, Jr.,** from Spec. Ass't for ICBM Modernization, DCS/RD&A, Hq. USAF, Washington, D. C., to Dep. Dir., Operational Requirements, and Spec. Ass't for ICBM Modernization, DCS/RD&A, Hq. USAF, Washington, D. C.

Col. (B/G selectee) David C. Reed, from Cmdr., 485th TMW, USAFE, Florennes AB, Belgium, to Command Dir., NORAD Combat Ops. (J-31), NORAD/ADCOM/AFSPACECOM, Cheyenne Mountain Complex, Colo., replacing B/G James M. Rhodes, Jr. . . . **B/G James M. Rhodes, Jr.,** from Command Dir., NORAD Combat Ops. (J-31), NORAD/ADCOM/AFSPACECOM, Cheyenne Mountain Complex, Colo., to Cmdr., 23d AD/NORAD Region, TAC, Tyndall AFB, Fla., replacing B/G Donald R. Delauter . . . **Col. (B/G selectee) Alan V. Rogers,** from Cmdr., 96th Bombardment Wg., SAC, Dyess AFB, Tex., to Cmdr., 19th AD, SAC, Carswell AFB, Tex., replacing B/G Loring R. Astorino . . . **B/G (M/G selectee) Robert L. Rutherford,** from Dep. Dir., Prgms. and Eval., DCS/P&R, and Chairman, Program Review Committee, Hq. USAF, Washington, D. C., to Dir., Manpower and Organization, DCS/P&R, Hq. USAF, Washington, D. C., replacing retired B/G Monte D. Montgomery . . . **AFRES M/G Alan G. Sharp,** from Cmdr., 14th AF (AFRES), Dobbins AFB, Ga., to Reserve Forces Policy Board, Washington, D. C., replacing AFRES M/G Donald A. McGann. ■

It isn't just looks, though, that annoys the TAC Commander. "I have a problem with the current flight suit in that after we wash it quite a few times, it loses its fire-retardant capability, among other things," General Russ said. "So we have a test program ongoing [in which] we are going to look at some alternatives. . . . If they are worthwhile . . . maybe we'll buy some, but it's just a test program now."

General Russ made a final point about the flight suits that concerned a pilot tradition. "There's a number of things we do in the flight suits. We sew a knife pocket down here [on the thigh about halfway between the crease and the inseam] for our fighter pilots, and then we tear them all off because we wear G-suits and can't put knife pockets down there. Well, I just don't know how much it costs to put those things down there, but it doesn't appear to me to make much sense to sew them on and then have everybody tear them off as soon as they get their first flight suit. . . . Maybe we can come up with a better idea. We might as well try, and we're going to try."

AEROSPACE WORLD

★ Marriage and family counseling in itself is not a benefit under CHAMPUS. While CHAMPUS does not disapprove of such counseling, CHAMPUS will cost-share the expense of psychotherapy only if it is determined to be medically or psychologically necessary. Given this proviso, CHAMPUS will cost-share such counseling even when health-care providers fall under the general category of marriage and family counselors.

Key to reimbursement is the requirement that a physician must first refer patients for all psychotherapy involving marriage and family counselors and must supervise the treatment. This means the doctor must actually see the patient and establish a diagnosis for a CHAMPUS-covered psychiatric disorder before referral. Then the counselor must coordinate with the physician on a regular basis during the patient's therapy.

★ **MILESTONES**—Strategic Air Command (SAC) and Tactical Air Command (TAC) observed their fortieth anniversaries on March 21. Aerospace Defense Command, which was

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deactivated in 1980, would also have been forty.

SAC's EC-135 Airborne Command Post, dubbed "Looking Glass," completed its twenty-fifth year of continuous airborne alert on February 3. "Looking Glass" provides SAC with a survivable alternate means of command and control of the command's forces in the event that the SAC Underground Command Center, alternate command posts, or ground-based communications are lost during an attack.

★ **NEWS NOTES—Early outs** for Air Force personnel are **likely again in FY '86.** Those definitely not reenlisting can look for an exit up to two months early, needs of the service permitting.

The Air Force reports that, since 1980, **flying time** for the tactical air forces has increased by thirty-six percent, **peacetime spares funding** has increased by more than 200 percent, and the **mission-capable rate** for USAF aircraft is up by twelve percent across all mission areas. The F-15 and F-16 have reached eighty percent mission-capable rates. Additionally, the Air Force has realized an eighty-three percent increase in its ability to support wartime fighter sortie generation.

Veterans' **widows face no time limit** on when they can apply for a widow's pension. However, timeliness is recommended, since benefits are not retroactive.

Air Force Systems Command's Armament Division recently awarded a $57 million contract option to Avco Systems Division of Wilmington, Mass., to begin full-scale **development of the Sensor Fuzed Weapon system.** The SFW can be delivered by all US and NATO tactical aircraft, and the forty projectile warheads packaged into the tactical munitions dispenser of the SFW can provide multiple kills in a single pass.

The VA says that 1986's **GI Insurance dividend will set a new record.** Overall, about $905 million will be issued to about 3,300,000 veterans. Holders of USGLI (World War I), NSLI (World War II), and the newer VSLI and VRI programs will split the record amount. The dividend is so large because of lower death rates and high interest earnings. Payouts, in amounts based on each policyholder's age, plan, and policy duration, will be made automatically on the anniversary date.

★ **DIED**—Gen. Truman H. Landon, one of the few people ever literally to fly into the beginning of a war, died January 27 at the age of eighty. Then-Major Landon, as commander of the 38th Reconnaissance Squadron, was en route to the Philippines on December 7, 1941, when the B-17s he was leading arrived unarmed over Hickam Field, Hawaii, just after the Japanese had begun their attack. Major Landon, after being shot at and pursued by Japanese planes, was able to land safely.

Promoted to brigadier general in 1943, he commanded Seventh Bomber Command in the Gilbert and Marshall Islands in the Pacific during World War II.

General Landon later served as Deputy Commander of the National War College and held several high-ranking positions at Hq. USAF, including stints as Director of Plans and Operations, The Inspector General, and Deputy Chief of Staff for Operations. His last assignment before retirement in 1963 was as CINCUSAFE in Wiesbaden, West Germany. ■

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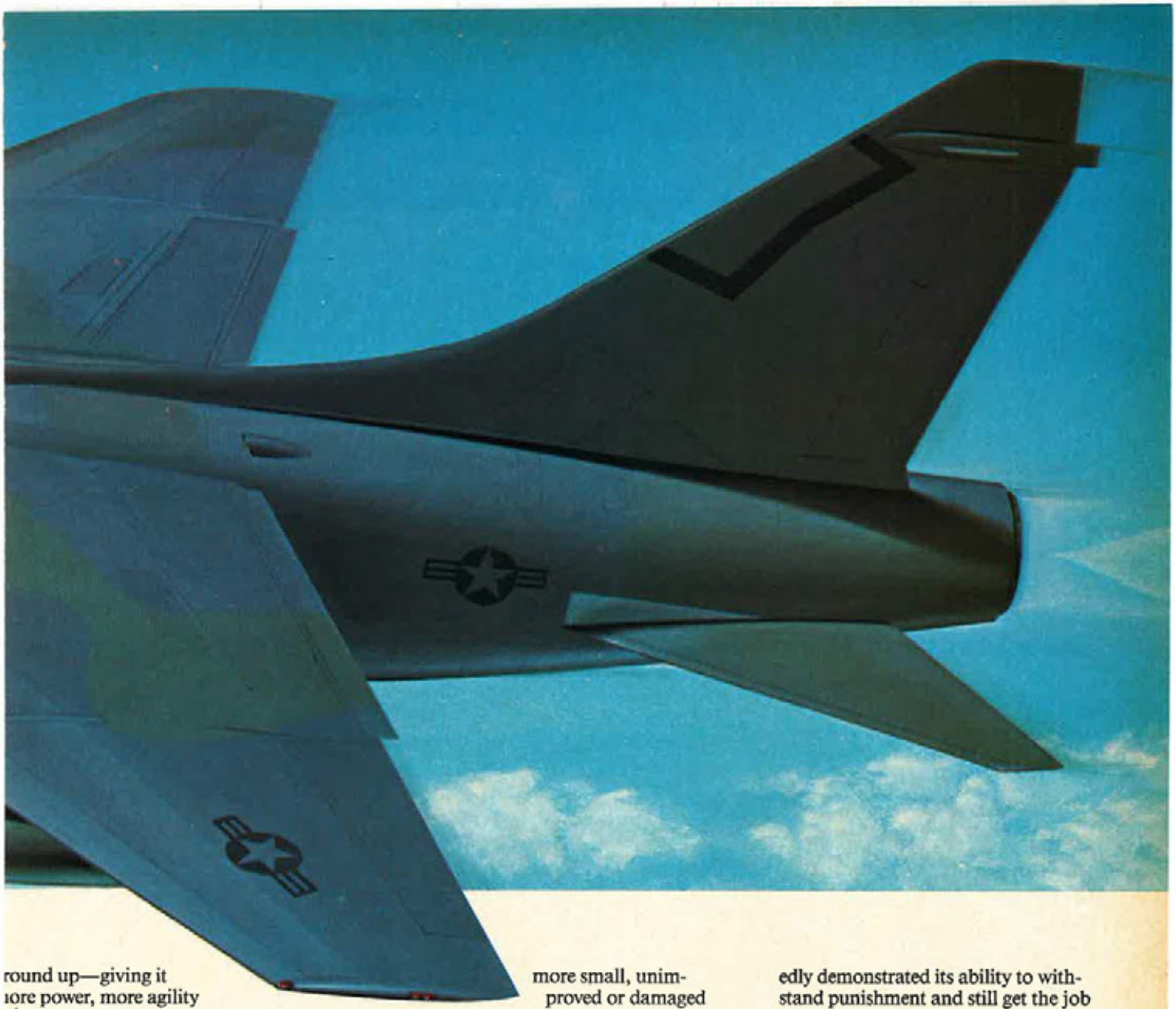

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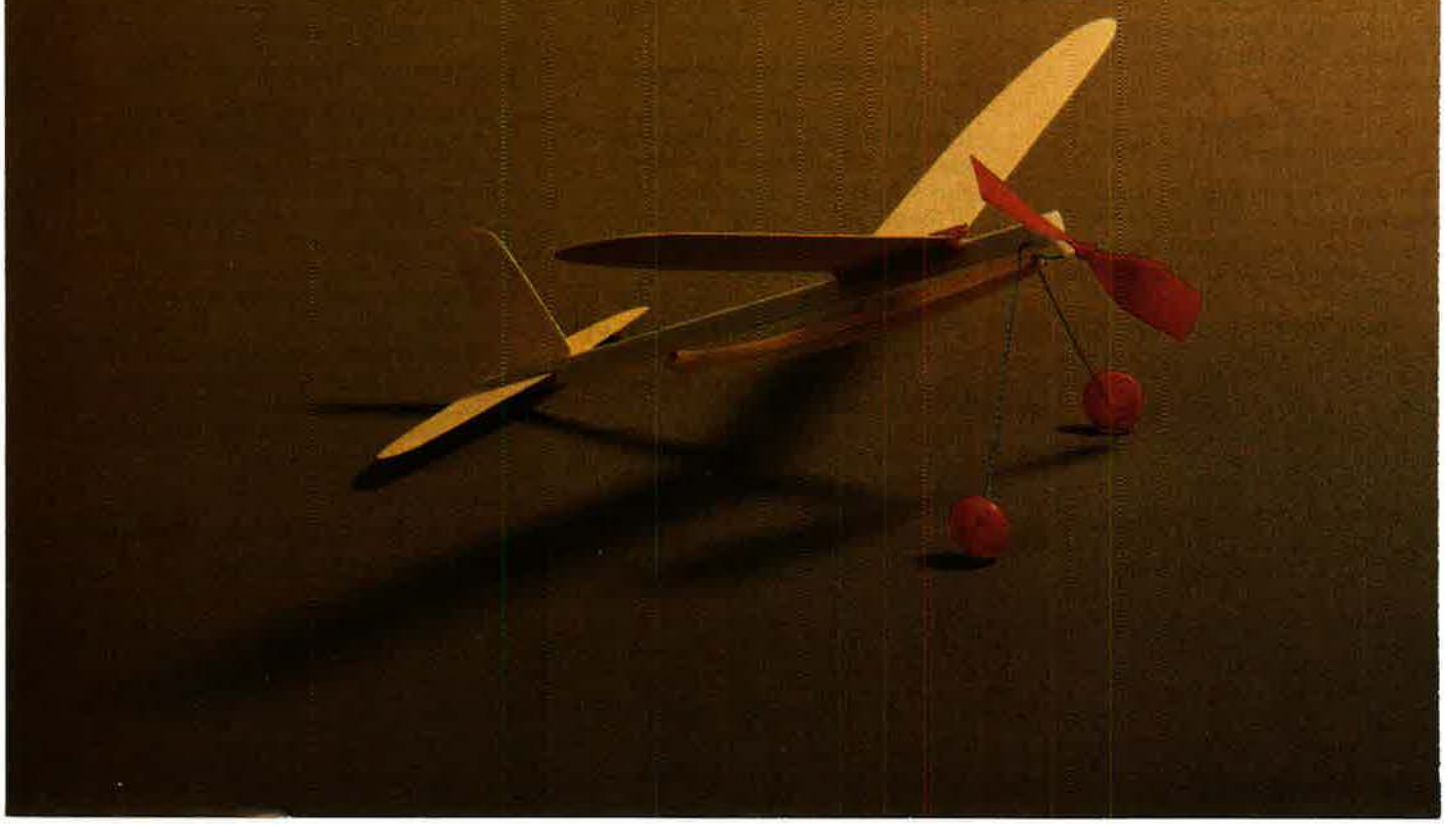

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Electronics

Tactical forces are better prepared for the air war and the ground war—but face heavy losses in the budget war.

Tactical Warfare High and Low

BY JOHN T. CORRELL
EDITOR IN CHIEF

EVEN in their present condition, stretched thin and lacking some important capabilities, US tactical forces are considerably more effective than they were five years ago. Air Force-wide, tactical squadrons are better equipped, better supplied, and more proficient.

Given the essential parts of the improvement program planned for them, they will be reasonably prepared to fight and win in theater battles abroad. That, however, depends on their surviving the budget wars at home.

The attention of official Washington is riveted on the budget and the federal deficit. Intense budget-cutters tend to regard military force planners as intransigent and warn that defense spending will be reduced, with or without their cooperation.

Against that backdrop, the commanders responsible for employment of theater combat forces explained what they must have—and why—at AFA's Tactical Airpower Symposium in Orlando, Fla., January 30–31.

• The tactical air forces have four overriding system needs: the Advanced Medium-Range Air-to-Air Missile (AMRAAM), which will allow fighters to engage several enemy aircraft at the same time; the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system for attack of ground targets in darkness and bad weather; the F-15E dual-role fighter, which doubles as an air-superiority and long-range ground attack aircraft; and the Advanced Tactical Fighter (ATF), which, assuming it comes on line as scheduled in 1995, will be USAF's first all-new fighter in twenty years.

• Nobody knows for sure how much tactical airlift it would take to supply the warfighting commands in conventional combat. What is certain, though, is that Military Airlift Command does not have enough of the right kinds of cargo-carrying aircraft to do the job. Among other things, MAC needs the C-17 airlifter, which combines intercontinental range with the capability to operate from small, austere airfields.

• Quality considerations aside, there is a serious problem of numbers. The Air Force needs at least forty combat-coded fighter and at-

tack wings to meet its tasking. It presently has 36.6.

Both the progress and the problems in tactical airpower were illustrated by the report of Gen. Charles L. Donnelly, Jr., CINCUSAFE. He told the symposium that USAFE flying hours are up twenty-two percent since 1980 and that the number of sorties flown has increased by fifty-one percent. F-4Ds and F-15A/Bs have been phased out as the command has received F-16A/Bs and F-15C/Ds. The modernization, he said, will continue for the next two years with the deployment of F-16C/Ds and new forward-looking radars for RF-4C reconnaissance aircraft.

But USAFE urgently needs new weapons and a better ability to operate at night, and congressionally-imposed troop ceilings have left the command seriously shorthanded.

—Photo by Theodore R. Jessup

RUSS: Gradual progress toward forty tactical wings.

Toward Forty Wings

The Air Force is working a problem of quantity as well as one of quality in its tactical lineup. It has been reaching toward forty tactical wings since 1976. Although the target year in which that level is to be achieved has slipped several times, Gen. Robert D. Russ, TAC Commander, said that there has been "a gradual, continual increase in the number of wings. Right now, we have 36.6. The [aircraft] buy that got us there was in 1984. With the 1986 buy [of] 288 aircraft that will come into service in 1988, we will have thirty-eight wings [flying aircraft with an] average age of ten years."

The current projection is for the Air Force to field its fortieth tactical wing sometime in the 1990s. The forty-wing goal was set rather arbitrarily as a programming-budgeting compromise. Actual requirements would suggest around forty-four wings.

In response to a question from the audience about why he had not commented more specifically about Guard and Reserve force structure, General Russ said that he does not make that much distinction between active-duty and reserve forces wings: "I give them the same support. I ask them to do the same things. I test them in the same manner with ORIs [Operational Readiness Inspections]."

The thinness of USAF force structure is felt starkly in the Pacific. Gen. Robert W. Bazley, CINCPACAF, said that, without augmentation, he has only eleven fighter squadrons and 264 fighter aircraft. Vietnam—the third-ranking threat in the Pacific, behind Soviet Far Eastern Forces and the North Koreans—has an air force that General Bazley said "is equal in size to PACAF and equipped mainly with very capable MiG-21 Fishbeds and Su-22 Fitters."

The need for force structure was also declared by Maj. Gen. Thomas S. Swalm, Commander of the USAF Tactical Air Warfare Center at Eglin AFB, Fla. His organization conducts operational tests and evaluations of new weapons as they are introduced for use by tactical squadrons. He said that US tactical airpower must exploit the value of high technology and "magic systems" and is benefiting measurably from quality improvements but (in response to a question from the audience) that the single greatest deficiency today is "the number of airplanes that we have."

Adding force structure alone, however, is insufficient to meet the needs of today, much less for battles of the future when warfare will be even more complex, difficult, and dangerous. Army Gen. Fred K. Mahaffey, CINCREDCOM, recounted an incident from the recent joint exercise Bold Eagle '86 that explains why one of the tactical airpower system priorities—LANTIRN—is by itself so urgent.

"At one point," General Mahaffey said, "the Army force commander had planned a major night attack involving an armored division in order to capitalize on the superior night-fighting capabilities of his modernized armor and mechanized infantry forces featuring the M1 Abrams tank and the M2 Bradley fighting vehicle, which are capable of moving, operating, and shooting at night. In the end, he had to cancel plans for that operation. The air forces available could not support the operation because there were no effective night systems on the aircraft performing close air support. The planned attack had to be postponed until daylight. The availability of a system like LANTIRN would have made all the difference in the world."

DONNELLY: Biggest problem is troop strength ceiling.

Requirements High and Low

General Swalm described the dense battle arena of tactical warfare today, with its netted radars, integrated command control and communications, graduated air de-

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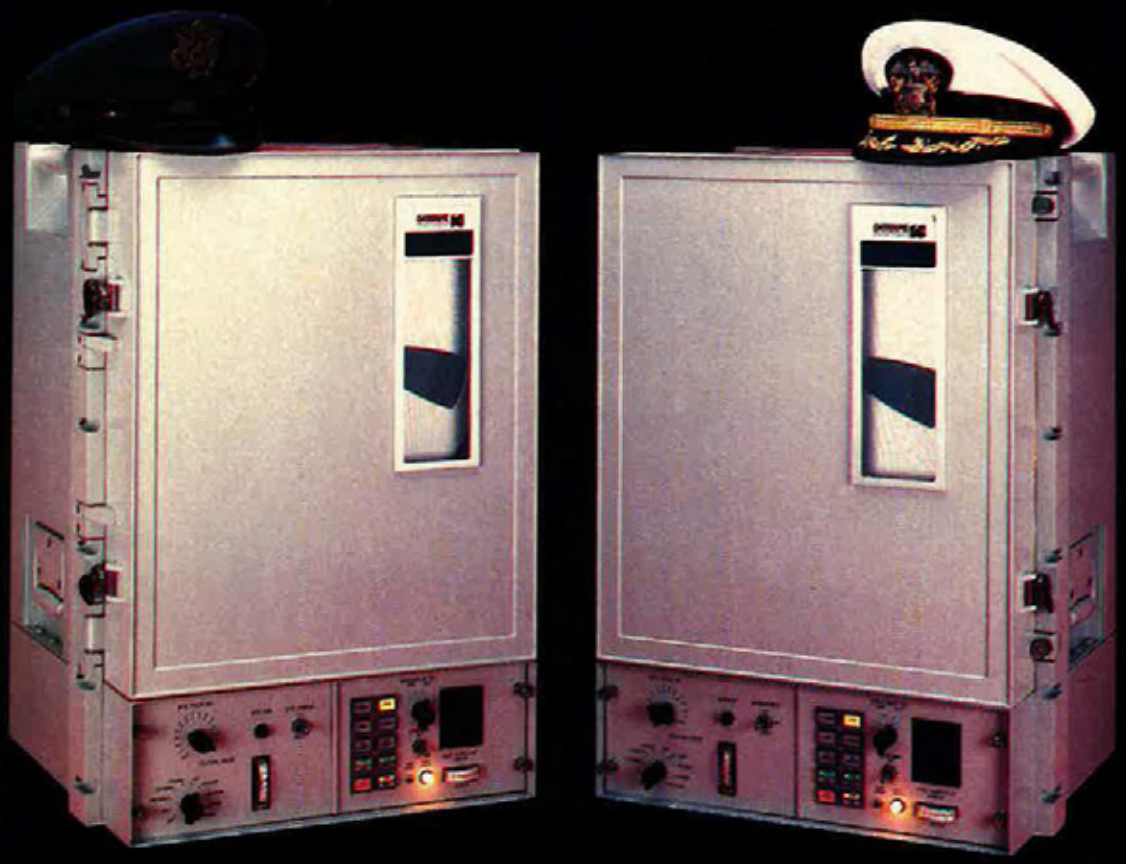

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fenses, and look-down/shoot-down fighters. "Between 1986 and the year 2000, we expect the battlefield to become more complex by a significant magnitude," he said, predicting "use of satellites, lasers, drones, advanced weapons, high-tech SAMs, and improved C^3I systems."

Faced with a rapidly expanding electronic order of battle, the Air Force has supplemented its Tactical Fighter Roadmap with "an Electronic Combat Action Plan that addresses the need, across all mission areas, to provide warning, jamming, and other disruptive and destructive techniques to ensure our effectiveness in the electronic spectrum," General Swalm said. The performance, supportability, cost, and deployment schedule of pods, internal countermeasures, and radar-warning receivers were just reviewed at top levels to make certain that C^3, warning, and countermeasures can be provided for the force as it builds toward forty tactical wings, he said.

To control the air in the 1990s, USAF must have the ATF. It needs AMRAAM even sooner than that, because, General Russ says, "It is absolutely vital that we have in the tactical forces the ability to have the first look and the first shot" in air-to-air fighting. Hot new Soviet fighters, such as the MiG-29 Fulcrum and the Su-27 Flanker, are creeping up on the dominance of the US F-15.

Meanwhile, things have been heating up on the ground, too. The Air Force will have to support the Army, which will be thrusting and maneuvering with its AirLand Battle tactics that, General Mahaffey said, "put emphasis on the spirit of the offense." The implications for close air support and battlefield air interdiction are considerable.

"Close air missions may be required on short notice," General Mahaffey said, "involving flights over dozens of kilometers of unsecured terrain to support a ground force maneuvering rapidly way beyond the forward line of troops or even in somebody else's area of responsibility. Will the air-tasking-order cycle be responsive enough to meet the needs? Can the close air support aircraft find the maneuvering force and the target? How do forward air controllers operate in such an environment? What if it's at night or in adverse weather?

"Air interdiction missions can no longer operate freely forward of some clear, straight fire-coordination line. The battlefield will be nonlinear and full of enemy and friendly pockets. Battlefield air interdiction may look a lot like close air support of a deep-attacking ground force."

In the first days of a war in Europe, Western fighters would be performing not only close air support and battlefield air interdiction in hostile territory but also flying deep-interdiction missions hundreds of miles to the rear of the enemy's first echelon. *(See also "The Opening Rounds," p. 76 of this issue.)* It is a tall order to reconcile federal budget pressures with funding for equipment and force structure to carry out these missions.

The Uncertainties of Airlift

Once engaged, forces in the well-defined theaters would rely on airlift as their lifeline for resupply and reinforcement. They would also look to the airlifters for redistribution of warfighting assets within the theater. And for operations in less predictable parts of the world, the adequacy of airlift would determine whether or not combat forces could get to the fight before it got out of hand.

It is ironic that a requirement so fundamental defies quantifying, even after forty-five years of trying. "We have *never* accurately determined how much airlift is enough in any theater," said Gen. Duane H. Cassidy, CINCMAC.

He recalled that, in 1941, the great-granddaddy of all air war plans—the legendary AWPD-1—predicted within two percent the number of heavy bombers it actually took to win the war. Airlift requirements, however, were more than four times what AWPD-1 had forecast.

Even the numbers-minded Robert S. McNamara was unable to calculate the airlift requirement when he was Secretary of Defense in the 1960s. The Congressionally Mandated Mobility Study (CMMS) done by the Pentagon in 1981 sets the goal of 66,000,000 ton-miles a day for intertheater airlift, but that's only a guess for purposes of budgeting. A Department of Defense-Joint

—Photo by Theodore R. Jessup

BAZLEY: We cannot afford strategy of attrition.

Chiefs of Staff study on worldwide intratheater mobility is two years late.

It is only the *upper* limit of the requirement, though, that forty-five years of calculating have been unable to pin down.

"Since the beginning of World War II," General Cassidy said, "airlift has become increasingly critical to battlefield success in every major conflict. The requirements for airlift have almost always been greater than were expected at the beginning of the conflict, and the variety of missions performed by airlift increased measurably as the conflict developed."

MAC is well short of the CMMS goal, which itself is generally acknowledged to be underestimated as well as artificial.

Those who think of tactical airlift in terms of C-130s and nothing more fail to understand the situation. "Sure, if you must concentrate a resupply through a container delivery system to troops in contact—or if you're moving some precision-guided munitions from Sembach to Hahn—the C-130 is the way to go," General Cassidy said. "On the other hand, if you are going to tactically insert some troops from Fort Lewis, Wash., to a target in Southwest Asia, the best airplane is going to be

the C-141. If you are going to tactically move some missile batteries, the best airplane will be the C-5. If you're going to deploy troops nonstop from Fort Bragg to Australia or Japan, you certainly wouldn't want to do it in a C-130."

The airlifter that MAC needs now, General Cassidy said, is the C-17, contrary to the opinions of those "who would have us buy additional C-5Bs and wish the problem of the airlift shortfall away." Unlike the C-130, the C-17 can carry outsize cargo. Unlike the C-5, it can use small landing fields. In Central Europe, there are 436 runways to accommodate the C-17, but only fifty-six that can handle the C-5. *(See also "MAC's Magic Number," November 1985 issue.)*

Undermanned in Europe

USAFE's General Donnelly, citing the numerical and qualitative improvements to his force since 1980, pronounced himself "positive about our ability to give the Warsaw Pact a bloody nose." He said that in the unlikely event the Warsaw Pact allowed time for Western forces to mobilize, they could throw back a strong ground attack. His biggest problem is the number of troops on hand in Europe without such a mobilization.

Photo by Theodore R. Jessup

SWALM: Future battlefields will be more complex.

"Ensuring readiness with the possibility of a severely diminished DoD budget is not an easy task when we are limited by the congressionally imposed European troop strength ceiling," General Donnelly said. "While we have outstanding people, we just do not have enough of them. In this fiscal year, the ceiling forces us to civilianize 1,700 more military positions and delay or cancel projected growth. [It] creates artificial constraints and is our greatest weakness in improving USAFE's conventional capability."

The troop ceiling has remained fixed, even though new missions have been added. For example, authorized manpower levels in Europe did not go up when the ground-launched cruise missile (GLCM) began deploying. General Donnelly said that when GLCM deployment is complete, it will take 9,000 military people to man the system and that other units will have to be drawn down or civilianized in order to fit these troops under the manpower ceiling.

"We are trading nuclear capability for conventional capability," General Donnelly said, and thus creating the perception that "we are not as committed to conventional strength as we used to be."

He pointed out that USAFE would no longer have its OV-10 forward air control aircraft on the first day of a conflict. "We had to send them home [back to the United States] to make headroom," he said.

General Donnelly expressed confidence that his fighter force would be able to operate under attack. "[The enemy's] taking out a runway slows me down, but it doesn't stop me," he said, adding that USAFE's resiliency would be even better with the ATF, which will have a takeoff roll of less than 2,000 feet.

"We can find a surface that will get [USAF's fighters] off—and back down," General Donnelly said. In West Germany alone, there are 200 strips that can be used for tactical air operations.

A questioner from the audience wondered how effective new antiarmor weapons would be in Europe, where the forested terrain could provide protective cover for tanks. "If the tanks are in the trees, they're not going very far or very fast," General Donnelly shot back. "The only reason for them to go into the trees is to hide. Tanks and APCs can't maneuver in the dense European forests."

MAHAFFEY: Emphasis on spirit of the offensive.

Looking Ahead in the Pacific

General Bazley also had progress to report from PACAF, whose fighter force has increased from 200 to 264 since 1980. Six years ago, he said, aircraft in-commission rates were commonly between sixty and seventy percent, compared to eighty-five to ninety-five percent now. These gains, however, are not commensurate with the threat posed by the combination of Soviet, North Korean, and Vietnamese military might. The greatest single threat, of course, is the Soviet Union.

"The USSR has modernized its forces in the Far Eastern theater of military operations continually over the last decade," General Bazley said. "Today, there are almost 2,000 third- and fourth-generation fighters. [This is] no longer just a defensive posture. The Soviets routinely employ their 400-plus medium- and long-range bombers—including eighty Backfires—to project power throughout the Pacific. Since 1977, the Soviets have deployed one-third

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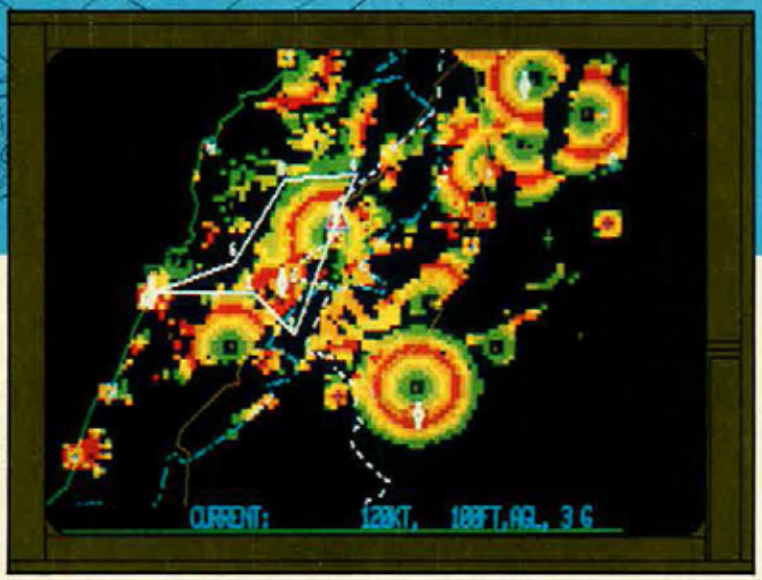

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of their SS-20 [intermediate-range nuclear missile] force to the Far East. This missile and bomber threat encompasses Alaska, Guam, the Philippines, and—with access from Cam Ranh Bay—well into the South Pacific and Indian Ocean."

World War II was won with an attrition strategy that overwhelmed the enemy with superior numbers and resources, General Bazley said. The next conflict in the Pacific, the Korean War, repeated the attrition strategy. General Bazley noted that 710,886 sorties were flown to support combat operations between January 1950 and July 1953. "Later in Vietnam," he said, "we expended enormous quantities of resources, producing sortie rates and ordnance expenditures previously unequaled."

He said that, in 1943, the Army Air Forces crashed more than 20,000 airplanes in *noncombat* losses alone. Today, the entire US Air Force inventory of aircraft of all types, including those operated by the Air National Guard and the Air Force Reserve, totals fewer than 10,000.

"We can no longer afford a strategy of attrition," General Bazley said. "We have to strike smartly to inflict wounds so severe that further prosecution of the war would be futile. We are forced to move toward a maneuver strategy—one where we strike at the time and place of our choosing. There must be a closer scrutiny of targets and a more refined prioritization. We have to be able to mass our forces against his weaknesses."

Modern systems, properly employed and supported, can produce unprecedented combat capability. General Bazley recalled the two strikes on the ball-bearing plants at Schweinfurt in World War II. The second raid put up 291 B-17 bombers, each carrying a crew of ten.

"We did get some ordnance on target and a lot around the target, but at what a price. We lost nearly 600 young Americans as sixty aircraft went down. Another five airplanes were abandoned prior to landing back in England, and seventeen others were damaged. The Germans continued to produce those war-important ball bearings, and we changed the way we did business.

"Today, we could send a handful of F-16s, [each with a] single pilot, against a similar target and take it out with nonnuclear conventional ordnance—dumb bombs plus smart airplanes. Additionally, we could do it at night or in bad weather with Pave Tack and soon with LANTIRN-equipped F-16s or F-15Es."

—Photo by Theodore R. Jessup

CASSIDY: Airlift requirement never quantified.

The first F-15E dual-role fighters come off the line in 1986, and PACAF eagerly awaits the arrival of its initial complement. The F-15E has a combat radius of 670 nautical miles on a high-low-high profile mission. Its long reach, either for air superiority or ground attack, is ideal for PACAF, where vast distances are a major fact of life.

PACAF conducts approximately fifty exercises a year. Although there is no NATO-like formal structure to pull things together in the Pacific, ninety-eight percent of the exercises are joint (involving other US services), and fifty-four percent are combined (with allied nations participating).

Since the symposium was held a week before the Philippine election, General Bazley was bombarded with questions about US basing rights in the Pacific.

"There is no really good alternative to the Philippine bases," he acknowledged. "The strategic importance of Clark is obvious." He said that "nonknowledgeable people" sometimes suggest Guam as a possible substitute. "To operate fighters between Guam and Cam Ranh Bay, we'd need every tanker in the Air Force," he said.

Other Operations

Several of the speakers fielded questions about USAF preparations for low-intensity conflict and defense against terrorism.

"It's virtually impossible to protect all our installations," General Donnelly said. "A determined terrorist can get you. Ramstein alone has fourteen miles of fence. How can you secure all that?"

General Russ said that the Air Force and the Army were that day opening a joint Low-Intensity Conflict Center to work on concepts, procedures, and doctrine. But, he said, "The answer to terrorism doesn't really lie in airpower. It lies in getting enough international pressure put on the people who are financing that sort of thing."

General Cassidy, who commands USAF's Special Operations Forces, said that proposals for a separate service for special operations "make little or no sense." And, he said, "You can't throw money at [the Special Operations Forces] and expect to turn things around overnight. They have been neglected moneywise for some time. They are not being neglected now. We've got to give it a chance to mature. And I think that should be done within the institutions that we have."

Responding to a question of a different nature, General Russ said, "We currently have no plans for buying a new airplane to replace the Aggressors. We need to put our money elsewhere."

Tactical Air Command operates two "Aggressor" squadrons of camouflaged F-5Es that simulate late-model MiGs for training exercises. Aggressor training is also conducted with F-5s in the Philippines and in Great Britain.

"We are this year putting $25 million into upgrading the F-5 to give it a better radar, that sort of thing. The real benefit of the F-5 or any aggressor airplane is the tactics that the crews use. It's not so much the aircraft itself. It doesn't have to simulate *exactly* what the Russians have." ■

The Pentagon leadership may insist on development linkage between the Air Force's ATF and the Navy's ATA.

Hard Calls on Tactical Technology

BY EDGAR ULSAMER
SENIOR EDITOR (POLICY & TECHNOLOGY)

THE Pentagon's top technologist sees an "inextricable" linkage between the Air Force's Advanced Tactical Fighter (ATF, the successor to the F-15 air-superiority fighter) and the Navy's Advanced Tactical Aircraft (ATA, a "stealthy" successor to the A-6 Intruder, a carrier-based attack plane).

Dr. Donald A. Hicks, Under Secretary of Defense for Research and Engineering, told AFA's recent Tactical Air Warfare symposium that "with these two programs, we're either going to make all the platitudes about cooperation, commonality, etc., work for real or lose the [two] aircraft [programs]."

Warning that the enormous capital investments associated with the design and procurement of these two aircraft automatically ensure intense congressional scrutiny at a time when concerns about cost and commonality run high, Secretary Hicks disclosed that the Defense Department will press the services toward firm linkage of the two programs. As a first step toward "interservice cooperation, we have established both a working-level joint-technology interface group and a flag-level review panel." As the programs become more defined this year, "we [will] start making the hard calls," he told the AFA symposium. As subsystems commonality lists undergo thorough scrubbing, "we'll be taking a hard look at cross-service applications—ATA as an F-111 replacement and ATF as an F-14 replacement, for example." He hinted that the Office of the Secretary of Defense (OSD) was also looking at other examples of ATA/ATF cross-service applications.

Despite its push for ATA/ATF commonality—which is eliciting guarded, if not gelid, service responses—OSD realizes "the political, emotional, and real difficulties of designing a multiservice airplane and the probable compromises that would result." Conversely, Dr. Hicks pointed out, "Given billions of dollars of RDT&E [research, development, test & evaluation] investment in the two programs—including the JAFE [the Joint Advanced Fighter Engine program]—we must aggressively explore amortizing that investment as efficiently as possible." One obvious way to approach this challenge is to "translate the up-front RDT&E investment into the largest possible number of aircraft in the field," he suggested.

Renewed Premium on Cooperation

Advocating multimission design approaches and inveighing against separatism—"either nationally or between our services"—Secretary Hicks called for maximized cooperation and standardization: "We can and must do better in this area than we have done in the past. I believe Congress has given us a push in the right direction with its enactment of the legislation known as the Quayle-Nunn amendments." This legislation, named for its principal sponsors, Sen. Dan Quayle (R-Ind.) and Sen. Sam Nunn (D-Ga.), consists of two separate amendments. It provides for streamlined approaches to multinational research and development projects and encourages such undertakings by "fencing," or setting aside, $200 million for that purpose.

In line with the Administration's and Congress's increasing emphasis on greater cooperation with NATO and other US allies, Secretary Hicks said a number of working arrangements are in place. These ventures include the Advanced Medium-Range Air-to-Air Missile (AMRAAM), for which the US leads the development,

The Air Force's Advanced Tactical Fighter (ATF) and the Navy's Advanced Tactical Aircraft (ATA) may have many common systems. This ATF model is based on a design by McDonnell Douglas.

and the Advanced Short-Range Air-to-Air Missile (ASRAAM), for which the NATO allies are responsible. Another major Alliance-wide effort is the NATO Emerging Technologies (ET) Initiative, oriented mainly toward providing a comprehensive automated standoff capability against the Warsaw Pact's second echelon. The key technologies involved, Dr. Hicks said, are very-high-speed integrated circuits (VHSIC), machine intelligence, supercomputers, advanced algorithms (software), and multimode sensors. As part of this initiative—and consonant with the Quayle-Nunn amendments—two new cooperative projects are about to be launched: the long-range standoff missile (LRSOM) and the complementary low-cost powered dispenser (LOCPOD) system, a short-range standoff weapon.

Underscoring in general terms the synergism that results from a prudent mix of stealth and standoff technologies, Secretary Hicks warned that "the advent of low-observable aircraft in no way obviates the requirement for standoff weapons." It would be unrealistic to believe, he said, "that technology can get us anywhere we want to go invisibly and with total immunity from the enemy's defenses." Dr. Hicks added that "I wish I had as much progress to report on the standoff side of the 'stealth/standoff mix' as I do for low observables." He emphasized his "determination to see that the standoff component of the mix is not neglected through an excessive fascination with exotic platforms." Acknowledging that the term "standoff" connotes different things to different people, Secretary Hicks suggested that, ideally, standoff "means I can shoot you, but you can't shoot me. As a minimum, however, standoff should keep my multimillion-dollar airplane and the pilot in it from getting bagged by a fifty-ruble gun." Some progress is being made on both accounts, he said.

In the air-to-air arena, the current "Lima" and "Mike" versions of the Sidewinder missile "have added head-on [tracking capability] and ECCM [electronic counter-countermeasures] that make them truly lethal." The same applies to the "Mike" version of the Sparrow missile, which is an "extremely capable design [that boasts improved] reliability, clutter discrimination, and ECCM thresholds." In the air-to-surface arena, the Harpoon antiship standoff weapon, along with Maverick, Walleye, GBU-15, Skipper, a variety of guided bombs, and Hellfire, "at least points us in the direction we want to go," Secretary Hicks told the AFA meeting.

Applauding the long-overdue fielding of the high-speed antiradiation missile (HARM), he said that this weapon "gives us a capability to take out SAM [surface-to-air missile] systems we previously couldn't touch and has the flexibility to give us a capability against others being fielded by the Soviets." By the end of this decade, a total of some 8,700 AGM-88 HARMs is to be procured at a unit flyaway cost of $260,000.

The Coming "Hot Biscuits"

Citing findings from a recent Defense Science Board analysis, Dr. Hicks said that, on the basis of careful tradeoffs between technical risks and potential utility, seventeen technologies appear capable of producing "an order of magnitude improvement" over present tactical air warfare capabilities. Not unexpectedly, many of these potential technology bonanzas are related to the microelectronic field and involve advanced software/algorithm development, soft/fault-tolerant electronics,

and very-high-speed integrated circuits (VHSIC). The latter technology, he suggested, "could well provide a thirtyfold cost improvement and a hundredfold size reduction" in processing systems. Translated into operational hardware, the envisioned quantum jump to VHSIC should make it possible to squeeze the data-handling capacity of "today's mainframe computer into a missile guidance system." Microelectronics, Dr. Hicks suggested, "is an area in which we not only enjoy an advantage over our potential adversaries but see the magnitude of that advantage increasing in the future."

—Photo by Theodore R. Jessup

HICKS: Maximum cooperation and standardization.

Other top-priority technologies singled out by Dr. Hicks that promise high payoffs in the tactical air warfare arena include high-density focal plane arrays and millimeter-wave sensors. The Commander of AFSC's Armament Division, Maj. Gen. Gordon E. Fornell, underscored the high promise of millimeter-wave technology in tactical air warfare applications, terming it "the next hot biscuit in the seeker world for night and all-weather operations." Current Air Force work on millimeter-wave seekers is oriented toward F-16 and F-15E upgrades that would allow these aircraft to search for, acquire, lock on, and destroy a variety of mobile and fixed high-value targets under adverse weather conditions.

Other high-payoff technologies in the tactical air warfare arena, according to Secretary Hicks, are ramjet technology, advanced intercept algorithms, and multimode seekers that, in concert, should open the door to follow-on air-to-air missiles that, compared to AMRAAM and ASRAAM, can operate at higher altitudes, have longer range, fly faster, and are more accurate in the terminal phase.

Tomorrow's Stealthy Air War

Among the advanced technologies that will drive the design of such future tactical air warfare assets as ATA and ATF, stealth will probably be predominant, Dr. Hicks predicted. Lt. Gen. Thomas H. McMullen, the Commander of AFSC's Aeronautical Systems Division, told the AFA symposium that the central challenge in designing ATF is to find the right tradeoffs between maneuverability and stealth. On a scale of one to ten, he predicted, ATF will probably come in as an "eight" in terms of across-the-board stealth, but still retain the "flight performance we need." The Air Force and its contractors, he explained, have found that "there is a lot of synergism between some elements of [stealth] and performance, but there also are other [elements] that [are at] opposite ends of the pole. These at the opposite ends may turn out [to be] hard to trade off."

—Photo by Theodore R. Jessup

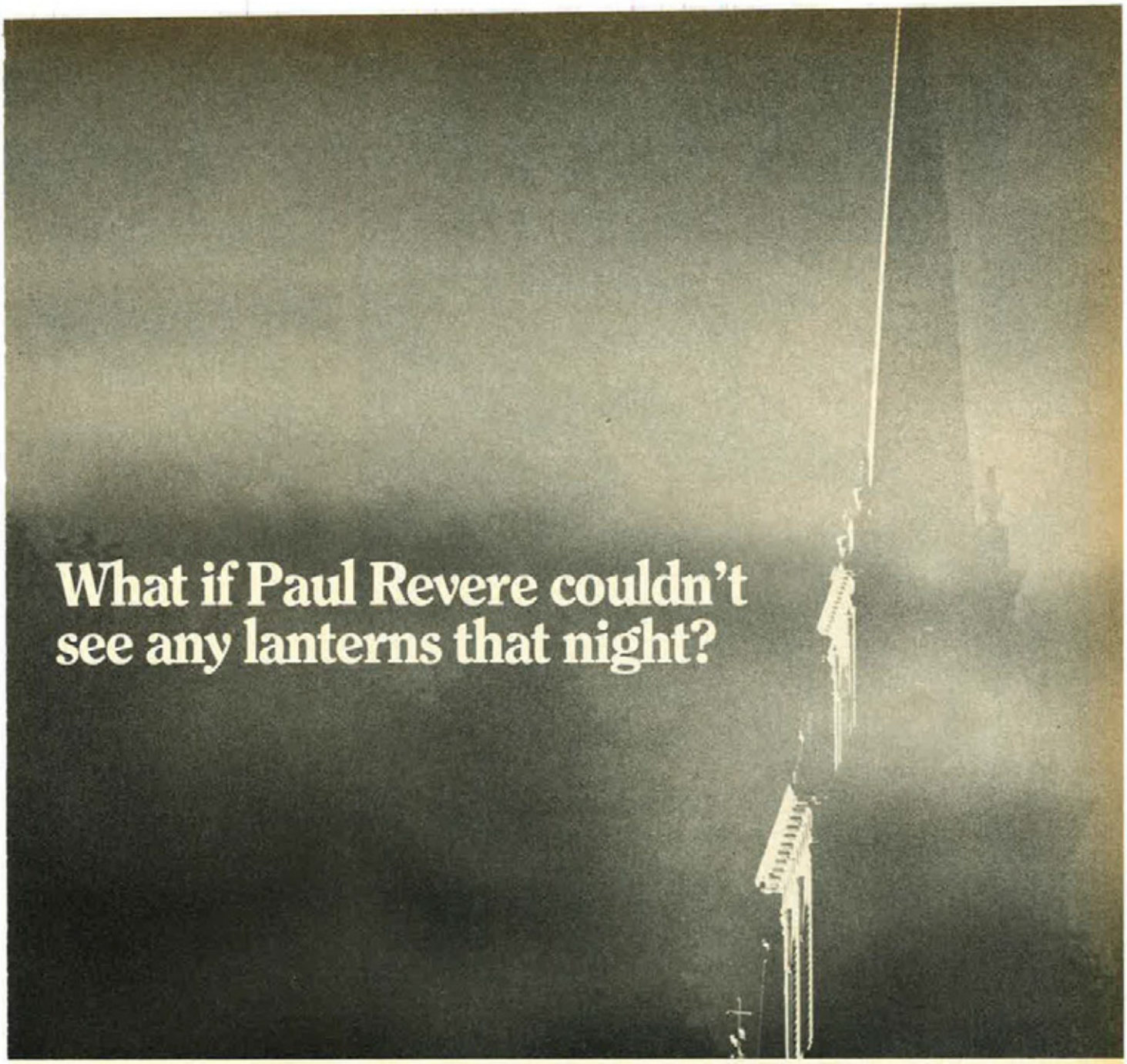
FORNELL: Millimeter wave is "next hot biscuit."

Greatly reduced observability against all advanced sensors will be a life-or-death factor in tomorrow's battlefield environment, General McMullen said. He explained that by reducing ATF's basic signature and "carefully tailoring the electronic countermeasures we give it, we can mask our presence, which gives us a real chance to effectively conduct air combat over enemy territory—an action we now take only under selected threat conditions." He said that emerging technologies applicable to ATF "promise to counter hostile systems throughout the electromagnetic spectrum—radar, visual, and infrared."

Use of composites, especially in primary load-carrying applications, "will help us lower the observability of the ATF while at the same time reducing structural weight." The ASD Commander predicted that "as much as fifty percent of the ATF's airframe" may be made of composite materials.

In describing the central requirements associated with ATF, General McMullen juxtaposed recent Soviet gains in the quality and quantity of their tactical airpower assets with USAF's need for an aircraft that, although limited in quantity, is "capable of competing and winning big in the 1990s and beyond." As a result, "we are not looking for a fighter that provides an incremental, single-dimension increase in capability; we want—we need—a multidimensional big step up." The Air Force, therefore, is tying the ATF to "emerging technologies on a broader front than we have ever undertaken in a fighter aircraft development."

But, as AFSC Commander Gen. Lawrence A. Skantze told the same AFA meeting, cost strictures are impinging on the ATF's performance requirements:



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"The directive from Congress, understandably, is 'make the plane affordable.' " This mandate caused the Air Force to shoot "for a $35 million unit cost based on the planned 750-airplane procurement at a production rate of seventy-two per year." This cap, in turn, "represents a true challenge for our contractors, who will have to respond to requirements based on enemy capabilities while avoiding the temptation to focus on coming in [at] under $35 million a copy."

The Challenge of Cost

Affordability, the AFSC Commander said, is a double-edged sword: "On one side, we [need] to look at having this fighter come in at a dollar value that is acceptable to Congress and to the Air Force. On the other side, we have to give it sufficient technical advantage over projected Soviet fighters to fight outnumbered—and win."

Explaining that the latter trait "costs money," General Skantze promised that in the make-or-break demonstration and validation (demo/val) phase of the ATF program, "we will be producing a design whose affordability is based on specific parameters. First is a unit cost that is sufficiently manageable so [that] we can buy the force structure needed at a reasonable production rate. Second is the incorporation of R&M [reliability and maintainability features] to ensure sustainability and availability for combat. Most important is providing fighter pilots based at Bitburg, Kadena, and Holloman with an ATF they can fight with and win. If we don't do all three, we are wasting tax dollars and, most importantly, risking young fighter pilots' lives."

He urged that "if we are going to build the ATF, let's build it so [that] it truly buys back the dominant air superiority that allows us to fight and win outnumbered in the enemy's backyard." General McMullen, seconding General Skantze, said the $35 million-a-copy cost goal is "a tough boundary condition for us to meet." As a consequence, the program managers will have to deal—earlier than ever before in a fighter development program—with the integration of a number of specific performance capability tradeoffs. The ATF design will involve balances in "aerodynamics, propulsion, how far our radar can see, how hard our radar is to see, [and] how hard the aircraft is to see with [the adversary's] radar." Some of these considerations, General McMullen acknowledged, are subjective at this point.

In the requirement to leverage technology both in terms of performance and affordability, propulsion plays a key role, according to the ASD Commander: "To fight effectively, we want the ATF to fly supersonic for extended periods, [necessitating in turn the ability] to maintain supersonic cruise without afterburner." The means for achieving this is the joint advanced fighter engine (JAFE) program, under which Pratt & Whitney and General Electric are each working on prototype engines that are slated to start ground testing in August of this year. Terming the JAFEs the "most advanced turbofan engines ever built," General McMullen said "we expect . . . the [demonstration engines] to offer 150 percent improvement in hot and cold part life over the current 'alternate fighter engine' and . . . sixty percent fewer specialized tools required for their maintenance." Also, the JAFEs should "give us sixty to seventy percent improvements in aborted takeoffs, unscheduled engine removal, and in-flight shutdowns over current engines."

In the avionics field, ATF will draw on the "full spectrum of technology programs under way in our laboratories—programs like Pave Pillar, which will provide an advanced architecture enabling us to integrate our total avionics suite, and INEWS, the integrated electronic warfare system that will provide us with a fully integrated electronic warfare" capability covering the range of foreseeable threats. In this context, VHSIC technology will play a major role, because it gives the ATF designers "the ability to put fifty to a hundred times more circuitry on the same chip we are now using and then [to] operate [it] ten times faster." Further, "Avionics built with VHSIC will require only about one one-hundredth as many integrated circuits; that means fewer boards and hence fewer cables, [which equates to] fewer failures at a fraction of the cost."

McMULLEN: Finding the maneuverability/stealth tradeoff.

—Photo by Theodore R. Jessup

If the operational feasibility tests under way pan out as expected, ATF will incorporate a self-repairing flight-control system that allows the aircraft to complete its mission even after sustaining heavy damage, General McMullen reported. A central design goal of the ATF program is to integrate in optimal fashion "the various systems that individually hold so much promise [and] to provide the pilot the maximum ability to use them," the ASD Commander emphasized.

Automating for Operability

Pointing out that the number of cockpit controls has proliferated since World War II to a point where there are more than 300 in the F-15, General McMullen stressed that, in the cockpit design of ATF, "we have got to take a giant step forward to help the driver, because his aircraft will be so much more capable. And we will need to exploit all of the possibilities [offered by] automation." But automation in the case of the Advanced Tactical Fighter is intended "to enhance, not diminish, the pilot's responsibilities and roles." The imperative is to work on man/machine integration prudently to keep "the airplane from outflying the pilot." Automation is

key to allowing the pilot to focus on "the critical aspects of the mission rather than being swamped by lots of information he can't handle [at a time] when he can least afford to lose concentration."

In contrast with current-generation fighters that inundate the pilot with "tremendous amounts of highly compressed information from many sources . . . the ATF pilot will be given complete situation information when and where he needs it." The goal is to "integrate man and machine to an unprecedented extent—pilot, airframe, engines, weapons, fire controls, and sensors, all working together," according to General McMullen. In the case of a system problem, for instance, "the pilot will be informed and provided recommendations and options to consider when the aircraft's sensors call for evasive action or weapons employment decisions. In short, the pilot will know exactly what's going on and what options there are to deal with the situation," with all the information provided rapidly and in easily usable fashion.

Beyond the stress on basic air combat capability, the ATF's design philosophy is anchored in the recognition that "it's the number of winning sorties that counts, and given we have lots fewer airplanes than our adversary, it's a simple deduction that we will have to use those we have more often," General McMullen told the symposium. "We simply can't afford to build a super airplane like ATF and have it become a hangar queen, [which means that we must make it] simple to fly, simple to fight [with], and simple to maintain."

During ATF's pending demonstration and validation phase, the Air Force will seek to strike a basic performance balance in terms of speed, maneuverability, range, low signatures, electronic countermeasures, and cost so that, between mid-1988 and mid-1989, the design for ATF can be nailed down and full-scale development initiated, General McMullen said. In tackling this job, ASD will "have to beware of the 'better' that is the enemy of the good," General McMullen pointed out.

While ATF is to be designed primarily as an air-superiority fighter, the aircraft is to incorporate a "good air-to-ground capability, meaning a good load-carrying capability and on-board systems that let us acquire and attack ground targets," the ASD Commander explained.

Discussing other tactical air warfare issues, the ASD Commander stressed that the Air Force, with its A-10 force, is living up to its responsibility to provide close air support for the US Army. For the future, "significant" improvements of the A-7s and upgrade efforts for the F-4s are under consideration to enhance their close air support capabilities, he added.

The Status of AMRAAM and LANTIRN

The need for AMRAAM was underscored by nearly all panelists at the AFA symposium. As Secretary Hicks put it, "AMRAAM is now well into the development test and evaluation process and performing very well, [but I won't pretend] that the program is without either substantive problems or critics." He added that "our challenges, now that the missile is working, will be to keep its cost at an affordable level and to establish some badly needed credibility with Congress, the press, and the American public." Pointing out that both present and next-generation US and allied fighter aircraft need the new missile "badly," he warned that "starting over at this point is not a viable option, either from a cost or time standpoint." Nevertheless, there "is a risk that that will happen, particularly if we don't do the job right."

General Skantze said that AMRAAM is "on track from a technical viewpoint, but perceived to be in trouble because of projected procurement costs." AMRAAM, he complained, "has become a case study in micromanagement. The FY '86 DoD authorization act states that Congress will withhold AMRAAM funds and require cancellation if [Secretary of Defense Caspar] Weinberger doesn't certify achievement of five specific elements of the program that normally are the program manager's responsibility." As a result, the program office has been forced to spend more time on "data-gathering than managing. That can't be Congress's intention, but it's the effect of the law's language." The Air Force, General Skantze pledged, "will persevere for a capable, affordable missile. As always, the cost/technical balance is critical. But the bottom line is that if the program is killed, we will have to go out the next day and reinvent it. The country needs AMRAAM for a winning fighter force into the next century."

—Photo by Theodore R. Jessup

SKANTZE: Buy back dominant air superiority.

Turning to LANTIRN, the low-altitude navigation and targeting infrared for night system that, along with ATF and AMRAAM, represents one of the pivotal requirements in the tactical air warfare arena, General Skantze said that "despite the fact that the program has nearly been killed several times, [it] has risen from the ashes. We have negotiated a firm fixed-price contract for 700 pod sets. . . . Testing on the navigation pod is complete, and we have just signed a contract for a second-year buy. The targeting pod program lags a year behind, but is progressing steadily. We completed development testing in December, successfully flying ninety-four sorties."

Predicting that a production decision on the targeting pod would occur in the first half of this year, he said that "the program has come a long way and looks good." The pilots who have flown the system "are convinced they can operate at night with the same tactics and situational awareness they have during the day." The effect of the LANTIRN system, he suggested, is that the enemy can run, but he "can't hide." ■

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The classic fighter matchup is "Two vs. Two"—a pair of friendlies against a pair of bandits—with hopes of improving the odds to Two vs. One.

Twos

BY JAMES P. COYNE
SENIOR EDITOR

Two F-15s break close formation as pilots prepare for a mock air-to-air battle. Before the engagement starts, they will extinguish their navigation lights to reduce the possibility of early enemy visual detection.

TENSION was high on the morning of August 19, 1981, as the US Sixth Fleet steamed in the southern Mediterranean off the coast of Libya. The US ships, over the objections of the Libyan dictator, Col. Muammar Qaddafi, were conducting live fire exercises in international waters. All nonparticipating ships and aircraft, under internationally accepted procedures, had been warned to keep out of the area.

But Qaddafi remained belligerent. The previous day, more than thirty flights of Libyan aircraft had flown along the exercise area, and at least five aircraft had penetrated it. They had been intercepted and escorted out of the area. US rules of engagement that day specified that US aircraft could fire weapons only after having been fired upon.

On this morning, the radar of a flight of two patrolling F-14s from the carrier *Nimitz* picked up a flight of two Libyan aircraft approaching from the south. The Tomcats left their orbit at 20,000 feet to intercept and escort the intruders out of the live fire exercise area. The Tomcats were flying a spread formation almost line abreast, a mile or two apart, with Number Two slightly back of and a little higher than his leader.

As the two flights approached at a combined speed of more than 1,000 miles per hour, the Navy pilots identified the Libyan aircraft as Su-22 Fitters. The Fitter is primarily an air-to-ground machine, but it is equipped with the Atoll, a heat-seeking air-to-air missile similar to the US AIM-9 Sidewinder. The Fitters were flying much closer together than the Americans, about 500 feet apart. Their course was almost head-on, slightly left of the Tomcat flight leader's nose and slightly low.

To get into a positive identification position and compensate for the closure speed, the US flight leader started a left turn to intercept the Fitters. As the US pilots established their turn, the lead Fitter fired a missile at them. The Atoll missed its target, and the Fitters flashed under the now hard-turning Tomcats. As they did, the lead Fitter rolled into a climbing left turn toward the area behind the Number Two Tomcat. The other Fitter performed a climbing right turn, and the lead Tomcat pursued him, moving into position to launch a Sidewinder. The Number Two Tomcat, meanwhile, continued his hard turn, fell in behind the lead Fitter, and launched a Sidewinder that flew right up the target aircraft's tailpipe and exploded. The lead Tomcat held his fire as the Fitter he was following climbed up into the sun—a difficult shot for a heat-seeking missile. As the Fitter's nose came down and he descended out of the sun, the lead Tomcat launched his missile and scored a kill. The engagement took a little over a minute.

This encounter is symbolic of all that has changed and all that is still the same in fighter aerial combat since its beginnings in 1915. The Libyans were flying in a rigid, fighting wing formation, first used in the closing days of the great air battles of World War I. This formation positions the wingman close behind and to the side of the leader. It was used extensively through World War II, but then was replaced with looser, line abreast formations similar to the one used by the US aircraft. In line abreast, or spread, formation, aircraft fly alongside each other, but far enough apart so that an attacker can bring only one of them at a time into his line of fire. Spread out, either aircraft in the formation has enough space to turn and bring his guns or missiles to bear on the attacker of the other aircraft.

The Libyans were flying too close together to do this. They had little choice of tactics, except to split their formation apart, which they did, or to carry straight through together, which might have meant one Tomcat getting them both.

The US Navy pilots, on the other hand, used the new spread formation, which is also employed by USAF. They were spaced so that they could support each other in the turn or even switch adversaries.

The sun, too, was a factor in this modern encounter, just as it has been since aerial warfare began. In the past, fighters would orbit in ambush, "upsun" and above enemy fighters entering their airspace, diving in unseen to attack. During dogfights in both world wars, a last-ditch maneuver when pursued was to climb toward the sun in an effort to lose the attacker. One of the Lib-

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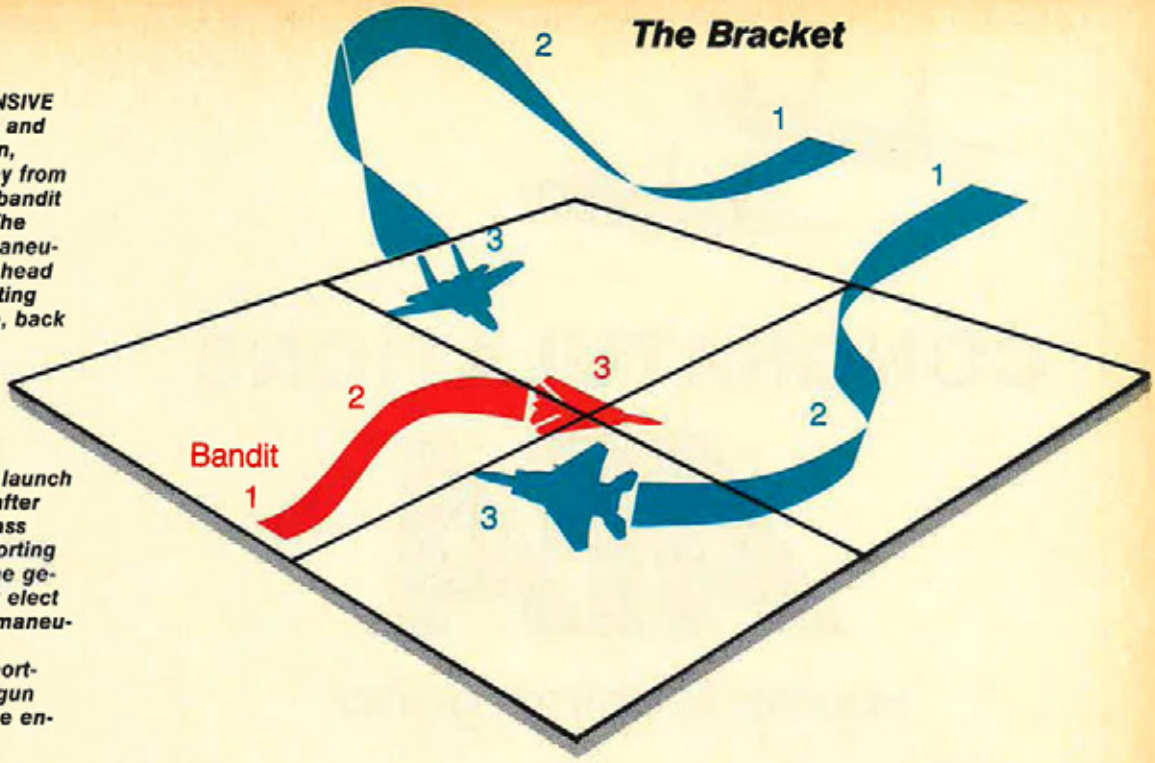


THE BRACKET, or OFFENSIVE SPLIT. (1) When fighters and the bandit meet head on, (2) the fighters turn away from each other, forcing the bandit to attack one of them. The engaged fighter then maneuvers to meet the bandit head on, (3) while the supporting fighter reverses his turn, back into the bandit.

He may launch a missile at the bandit after the other two aircraft pass each other, or the supporting fighter, depending on the geometry of the fight, may elect to hold his shot and to maneuver into the bandit's six o'clock position for a short-range missile (SRM) or gun shot. He has become the engaged fighter.

yans tried it in this encounter, and while it didn't succeed, it did cause the US pilot to delay employment of his Sidewinder.

Modern Fighters, Weapons, and Tactics

A lot of things have changed in the last decade or so to enhance USAF fighter effectiveness greatly, including avionics and munitions improvements and better training programs. "One of the most important changes since World War II and Korea is the improvement in thrust-to-weight ratio," said Col. Jeffrey G. Cliver, Chief of the Tactical Division at the Directorate of Operations, Hq. USAF. "Aircraft like the F-15 and F-16, with a ratio approaching and often greater than one to one, provide a whole new dimension to the air battle.

"In World War II or Korea, a fighter leader would, if possible, start his attack from above. This gave him the advantage of attacking from upsun, but practically speaking, he attacked from above because he simply did not have the energy available to attack from thousands of feet below the enemy force. Coming down, he could attain high speeds to reattack, reposition, or separate from the fight after the initial pass. If he chose to remain engaged, the fight would soon transition from vertical maneuvering to a series of basically horizontal but gradually descending attack or defensive maneuvers."

Attackers can now make repeated climbs or zooms, giving the air battle a true vertical dimension. Colonel Cliver pointed out that the tactical air forces (TAF) no longer view the "furball" kind of aerial combat, in which airplanes go round and round and down and down, as optimum. Rather, "straight lines and hooks"—air combat tactics in which fighters dash in for a pass and then reposition for another attack—make more sense today, "especially if we're fighting while significantly outnumbered, as we expect to in the next war."

Col. (Brig. Gen. selectee) George B. Harrison, Chief of the Joint Operations Division in the Organization of the Joint Chiefs of Staff, expanded on that concept. "The excess power now available in a modern fighter is used for takeoff, climb, and speed in getting to the engagement," he said. "Then, even under heavy G forces, which greatly increase drag and tend to slow the aircraft down, power is used to keep it near its corner velocity." Corner velocity is the speed at which the aircraft can turn and maneuver most effectively. For most fighters, it is in the transonic range.

"Today," Colonel Harrison said, "a USAF fighter pilot will plan his attack, execute it, take a [missile or gun] shot or, if the defender is effectively countering, hold the shot, then, using the power he has available, exit to an area from which he can make his next attack." Using information gleaned from USAF's Energy Maneuverability Concept studies of the 1960s and 1970s, he will also know his opponent's corner velocity, wing loading, thrust-to-weight ratio, and other performance criteria, all of which he will use in pressing his attack. Relative capabilities of aircraft determine what tactics should be used. "If you can't outturn him, make slashing attacks through his vulnerable zone," Colonel Harrison said.

Overall, Colonel Cliver pointed out, the "going in" premise has changed. From World War II prop fighters through several decades of jets—including the F-86 Sabre in Korea and F-4s and F-105s in Vietnam—the wingman had one job. That job was to "hang in there, keep your mouth shut, and Check Six" (the stern, or six o'clock position).

Lt. Col. John C. Meyer (later General Meyer and Commander in Chief of Strategic Air Command)

once wrote in a report on World War II fighter tactics: "Mainly, it's my wingman's eyes I want. One man cannot see enough. When attacked, I want first for him to warn me, then for him to think. . . . It takes a leader's full attention to destroy an enemy aircraft." This was probably the correct viewpoint for those times. Wingmen were usually new pilots, with less than a year of training. (Today's wingmen are also newer pilots, but they are much better trained.) "Welding them on the wing" was a good way for them to get experience. Flying to and from the battle area and while orbiting, waiting for the foe, the wingman's eyes were useful. But in the heat of battle, especially during violent maneuvering, most of his efforts were spent just staying with his leader.

A significant disadvantage of the World War II welded wingman system was that, except in rare cases, he carried around ordnance that he rarely got to expend. We can't afford that today, Colonel Cliver said. "In the next war, we could be outnumbered by six or more to one in any given local air battle. We can't afford to have Number Two welded to the wing, not employing his ordnance—that doubles the odds."

This is why USAF has adopted the spread formation, with two fighters line abreast or near line abreast and far enough apart that either one can turn to engage a "bandit" attacking the other. Each can check the other's six o'clock more effectively than in the fighting wing, where the wingman is in too close.

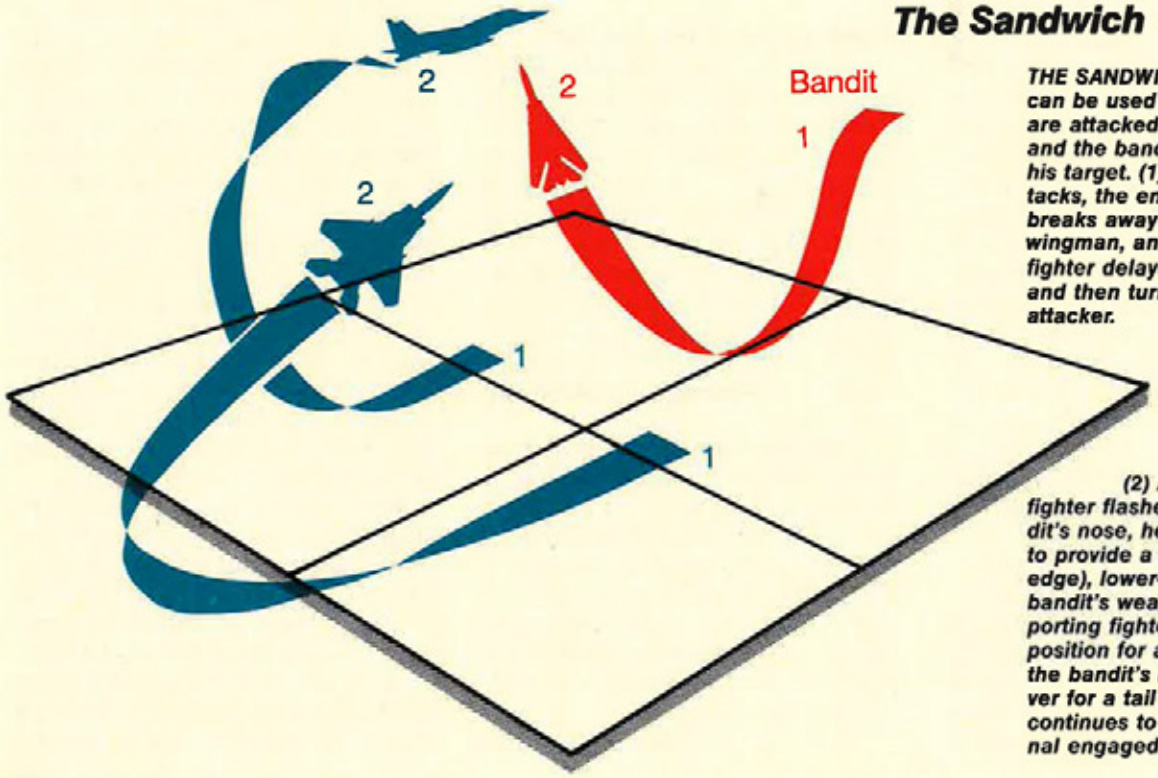
One Leader, But Two Shooters

In a spread formation, there is definitely a leader, but both fighters can be shooters. Whoever first spots a bandit turns into him and presses the attack. He becomes the engaged fighter, and the other aircraft is the supporting fighter. The supporting fighter stays on the fringes of the fight, checking not only six o'clock but nine, twelve, and three o'clock, because the other side has all-aspect missiles, just as we do. He also keeps an eye on the radar homing and warning (RHAW) system, which senses enemy radar threats and missiles. Since he is always a threat to the enemy fighter, he plays a big part in making the enemy fighter "predictable"—by closing off areas of the sky, for instance, into which he might otherwise wish to enter, making him an easier target for the engaged fighter. And if the engaged fighter calls "Winchester"—which means he's out of missiles or ammunition—the supporting fighter may take over the fight.

Weaponry is another aspect of fighter warfare that has changed dramatically. World War II pilots used the machine gun. In Korea, it was still the machine gun, with 20-mm cannon (employed like a machine gun) and some unguided air-to-air rockets. During the 1950s, the AIM-9 heat-seeking missile was developed, and by the early 1960s, USAF aircraft were equipped with both "heaters" and the AIM-7 Sparrow radar-guided missile. After a shortsighted hiatus, the gun came back into use as an aerial weapon. Today, USAF crews must know what tactics to employ to defend against all three kinds of weapons.

If the missiles of today can be fired at long ranges and from any angle, even head-on, one might wonder why we bother with the gun. The answer is that missiles, like any weapon, can be employed only within certain limits, and they can sometimes be countered. Because certain guidance criteria must be met, they sometimes cannot guide to the target aircraft because it is outside the missile's "G envelope." The envelope is broad, but sometimes evasive action by the target is violent enough to defeat the missile. A heatseeker can't be used in heavy weather. Many fighters are equipped to deceive it with decoy flares. Sometimes a radar missile

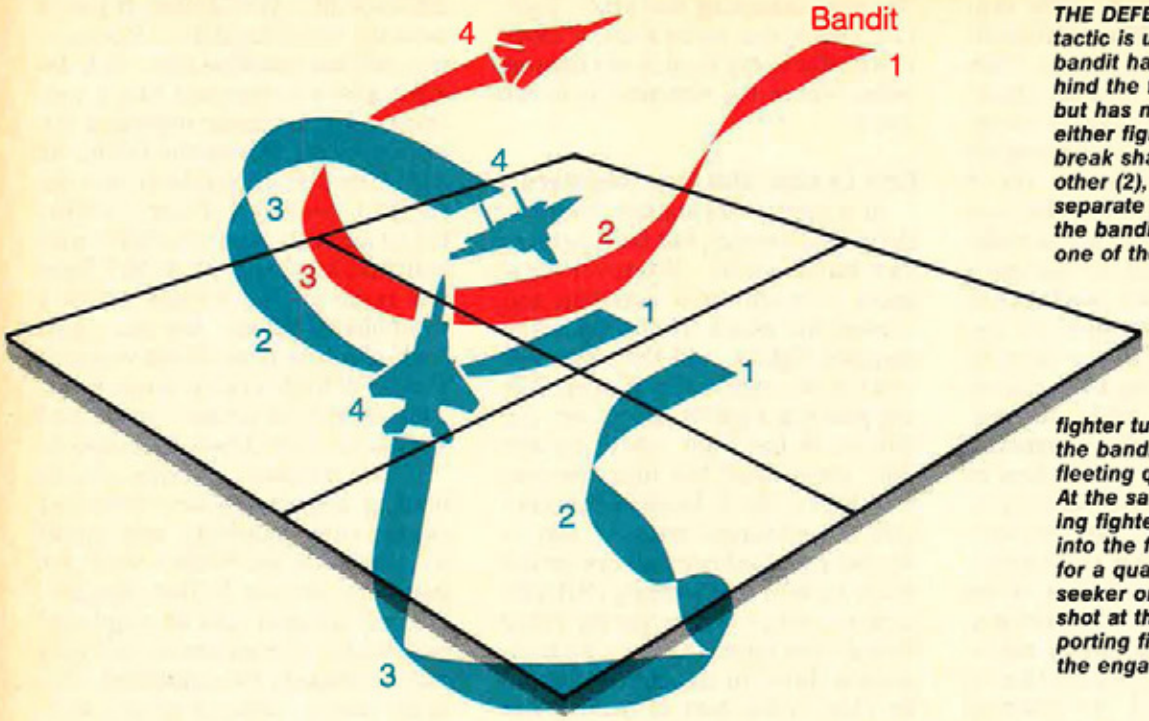
The Sandwich



***THE SANDWICH.** This tactic can be used when the fighters are attacked from the rear and the bandit has selected his target. (1) The bandit attacks, the engaged fighter breaks away hard from his wingman, and the supporting fighter delays his turn slightly and then turns toward the attacker.*

(2) As the engaged fighter flashes across the bandit's nose, he rolls wings level to provide a side profile (knife-edge), lower-risk target for the bandit's weapons. The supporting fighter has come into position for a missile shot at the bandit's belly or to maneuver for a tail shot if the bandit continues to pursue the original engaged fighter.

The Defensive Split



***THE DEFENSIVE SPLIT.** This tactic is used (1) when the bandit has been spotted behind the flight at long range, but has not committed against either fighter. The fighters break sharply away from each other (2), as if to split and fly separate circles. This causes the bandit to commit against one of them.*

The engaged fighter turns sharply (3) into the bandit, giving him only a fleeting quartering nose shot. At the same time, the supporting fighter breaks back hard into the fight, maneuvering (4) for a quartering rear heat-seeker or radar-guided missile shot at the attacker. The supporting fighter has become the engaged fighter.

does not track correctly—a malfunction, or perhaps the result of enemy jamming—and it misses the target. Sometimes—this happened in Southeast Asia on occasion—it launches and tracks, but the fuze malfunctions and does not detonate the warhead.

On the other hand, the radar on the launch aircraft might fail, or the launch aircraft may be forced to turn away from the target before the missile gets there. Since current radar missiles need both the launching aircraft radar and the missile's own seeker to track the target, this "break lock" destroys the missile's intercept geometry. There is a minimum launch range—about a half mile—so that the missile has time to come off the launching rails, orient and arm itself, and start tracking the target. It is possible to evade a radar-guided missile. Sometimes, because a fighter can carry only so many missiles (the AIM-7 is twelve feet long and weighs 500 pounds), there will be enough targets to use them all up.

Since missiles can be defeated by electronic countermeasures or maneuvering by the target aircraft, it is essential to have a gun on board. To date, it is the most widely employed air-to-air weapon—and the most flexible. It enhances the kill capability of the fighter. The F-15 and F-16 employ the M61 Gatling gun, which can spit out 6,000 high-explosive incendiary rounds a minute. Together, the missiles and the gun provide an all-aspect, all-range attack capability. The radar missile is for medium range, the heatseeker is for short range, and the gun is for close-in fighting.

Fighting Out of the Spread

The primary commandment of air-to-air warfare, which has been stated many different ways, is: *If at all possible, engage only if you have the advantage*. This means that a flight of two always attempts to engage a single bogey. If it is a two vs. two engagement, the attacking pilots try to turn it into two separate two vs. one engagements. In other words, if you don't have the upper hand, it is probably better to wait and fight another day.

This doesn't mean turning away from a fight with a larger formation, Colonel Cliver said. "Like most everyone, what a fighter leader does depends on his job that day. If he's defending his country, an ally, an army, a navy, or an air base (especially one he needs for landing and replenishment), he engages no matter what the odds.

"However, if he has options, as during a fighter sweep over enemy territory, he may just want to avoid a few vs. many 'grovel' to the end. He may decide to pick off a few adversaries using high-speed hit-and-run tactics en route to home base, keeping his force relatively intact for use again after a quick turnaround."

In training, USAF pilots are taught to "start small" in two vs. two engagements. To learn the teamwork they will need to operate within the framework of any air battle, large or small, they practice fighting in pairs. While there are infinite variations on tactics, limited only by the imagination, there are three basic close-in tactics that are often used by fighters operating out of the spread formation. For each, the fighters in the spread formation fly line abreast and a mile or two apart. The three tactics are the Bracket (also known as the Offensive Split), the Sandwich, and the Defensive Split *(see diagrams)*.

- *The Bracket*. Initially, when the flight in spread formation spots the attacking bandit, the two fighters turn away from each other. As soon as the bandit commits himself against one of the fighters, the fighter under attack (the engaged fighter) attempts to meet him in a head-on pass while the other (the supporting

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fighter) turns back hard into the fight for a missile and/or gun shot. At this point, the supporting fighter becomes an engaged fighter (he is now attacking). While he is pressing this attack, the fighter that was originally under attack repositions. If the bandit is smart and decides to heed the adage that he should not engage unless he has the advantage, he may try to disengage. Then both attackers can go after him.

- *The Sandwich.* In this situation, with the flight being attacked from the rear, they wait until the bandit commits himself against one of them. The attacked fighter turns right, away from the supporting fighter, to spoil the attacker's attack geometry and draw him away from the supporting fighter. As the bandit comes into position for a beam (ninety degree angle) shot at the engaged fighter, the supporting fighter will be in position for a good shot at the bandit. If the bandit breaks left to avoid giving his assailant a better angle for a shot, the original engaged fighter can break left and threaten him.
- *The Defensive Split.* This tactic is used when the bandit, spotted making a long-range rear attack, is not committed against either fighter. On a signal or radio command, the defenders break away from each other. The objective is to get the target aircraft to turn and pursue one of the attackers, who, in a sense, acts as a decoy. As the bandit goes after the decoy, the other attacker is able to move into position for a kill. The aircraft under attack risks getting shot at by the bandit while the supporting fighter attempts to kill the bandit.

A disadvantage of this tactic is that by initially turning away from each other, the defenders may lose visual contact because the radius of turn at jet speeds is so large. The end result, though, could be to throw the attacker out of the fight and make him go home. A similar split was attempted by the two Libyan fighters in the engagement described at the beginning of this article, except that they were attacking, and the F-14s were coming head-on. It was not well executed, and the results were disastrous.

An effective variation of the Defensive Split is the vertical split, with one defender zooming to an altitude several thousand feet above the other. Another is the half-split, in which one fighter continues on course while the other turns away from him. In all cases, when the attacker commits, the supporting fighter turns into him.

Two vs. Two

Two vs. two attacks use many of the same tactics used in two vs. one.

When attacking a flight of two, whether they are line abreast, in echelon, or in trail, bracketing by the attacking flight can be a good opener. The objective remains the same: maintain mutual support and try to turn the fight into two vs. one.

For the attacking flight, bracketing has the advantage that each of the attackers must look in only one direction (into the enemy formation) to see both defenders. This is so because one flight member is on each side of the formation being attacked. Defenders, on the other hand, have to look both left and right to see their attackers (giving them acquisition and tracking problems and causing their "anxiety factor" to increase dramatically).

After the attack is initiated, if the bandits split and each turns toward the attacker on his side of the formation, each will present his tail to the attacker from the opposite side of the formation, providing the possibility of quick missile shots. If the bandits don't split, but turn as a formation in the same direction toward one attacker, then the attacker they turn away from will have the best chance of pressing the attack.

From there, the fight depends on which attacker (if any) got a kill on the initial pass. If both got kills, the fight is over. If one bandit remains, both go after him. If both bandits survive, the fight does not degenerate into one vs. one—mutual support would be lost, and the longer the fight continued, the bigger the chance would be of additional enemy fighters entering the battle. Instead, the attacker in the best offensive position presses his attack, and the other attacker becomes the supporting fighter.

They then dispatch the target cooperatively in a two vs. one fight, a task greatly complicated by the presence of the second bandit. In this case, it is the job of the supporting fighter to fend off the supporting bandit, engaging only for short periods measured in seconds, while the attacker destroys the target. At this point, if the second bandit is prudent, he will break off and head for home.

It may be a good idea, especially if the mission was only to disrupt the enemy formation (perhaps to enable a friendly strike force to enter enemy territory in an area below the aerial battle), for the attackers to disengage. After disengaging, the attackers can rejoin in line abreast formation and get ready for the next encounter.

Changed, But Still the Same

The lessons learned in World War II and Vietnam, which, in many ways, were lessons relearned from earlier wars, are still valid. General Meyer, in an Air University historical interview, said, "I never turned with them, except for maybe one turn, to see what they would do." He thought dogfighting, in a sky filled with planes, was not smart.

Today's air battles are fought with modern machines operated by highly trained people. The weapons employed are far more sophisticated and effective. The battle is bigger because of the speeds. In World War I, a fighter pilot flying a Spad could reverse course in about five seconds. In a supersonic F-15, it could take as long as fifteen seconds. Today's pilot must worry more about fuel. In full afterburner, an F-4 can gulp more than 150 gallons per minute.

But, basically, the primary tasks of fighters haven't changed since 1915. These are still to defend airspace, protect ground targets from attacking aircraft, protect another airborne asset or force, and attack enemy aircraft in their own airspace. The Air Force currently labels these missions Air Defense, Point Defense, Force Protection, and Fighter Sweep.

In carrying out these missions, the fighter pilot uses tactics that are new, because they reflect new capabilities in the equipment. But basically, they are still the same. Use the sun. Don't fight alone. Engage, if at all possible, only when you have the advantage. Don't get into a prolonged turning fight. And always, Check Six. And Three, and Nine, and Twelve. ■

The US, Britain, Germany, and France intend to cooperate on standoff weapons that would make a big difference in the first days of a European conflict.

The Opening Rounds

BY JAMES W. CANAN, SENIOR EDITOR

THE United States and three of its most militarily prominent European allies are forging a landmark agreement to cooperate in developing new air-to-surface standoff missiles.

All four nations—the US, Britain, West Germany, and France—covet such weapons. Supreme Allied Commander Europe (SACEUR) Gen. Bernard W. Rogers, USA, has prodded NATO's industrial nations to get together in coming up with them.

NATO doctrine calls for the interdiction of second-echelon and third-echelon Warsaw Pact forces with nonnuclear weapons to prevent those forces from reinforcing front-line assault units. That mission falls to NATO attack aircraft.

To pull it off, those aircraft would have to destroy or badly mangle the increasingly intimidating Pact surface-to-air and air-to-air defenses right at the start of a war in Europe. This means attacking airfields and defensive radars so that attack aircraft can pass through to interdict Pact chokepoints, command and control centers, and other high-priority targets beyond the Forward Edge of the Battle Area (FEBA).

USAF and allied air forces are looking ahead to new and improved fighters, perhaps to new tactics, and to enhancements of their ground-attack "force packages" to help get the tough job done if it ever comes to that.

Meanwhile, however, there is a pressing need for precision-guided

USAF F-111 armed with Rockwell Missile Systems Division GBU-15 glide bombs. These weapons give USAF's interdiction aircraft short-range standoff capability. The US and three European allies are jointly planning long-range standoff weapons.

weapons that would enable NATO attack aircraft to hit targets from afar without flying into the teeth of the SAMs and guns defending them.

The emerging multinational program is aimed at producing such weapons at costs that all the participating nations can afford in concert, but probably could not afford in going it alone.

Need Is Acute

On the verge of being clinched at this writing, the program would help to refute the allegation that the US Air Force, for one, is so caught up in building glamorous new fighters that it has neglected development of the long-range standoff weapons that ground-attack variants of those fighters would need to launch in order to survive a war in Europe.

USAF denies the allegation and believes that it can cite evidence to the contrary. It has developed some close-in standoff weapons and has laid the groundwork for US participation in the transnational program.

Prime players in this include Gen. Robert D. Russ, Commander of Tactical Air Command (TAC), and Lt. Gen. Bernard P. Randolph, who succeeded General Russ last year as USAF's Deputy Chief of Staff for Research, Development, and Acquisition.

Transatlantic cooperation in weapons development projects has always been hard to come by. Conflicting national or continental economic, industrial, and technological priorities have usually stood in the way.

In the case of standoff weapons, however, the common need now seems to have transcended nationalistic considerations.

"We are optimistic about pulling this off, because the time is ripe, and the need is there," General Randolph told AIR FORCE Magazine.

General Randolph's optimism was shared by Dr. Donald A. Hicks, Under Secretary of Defense for Research and Engineering, who was planning to go to Europe last February to put the finishing touches on a formal agreement for new families of modular, all-purpose standoff weapons.

Dr. Hicks has pressed USAF to

place greater emphasis on developing and deploying such weapons to keep attack-aircraft losses under control, particularly in the first day or two of a war in Europe, when those aircraft would have a harshly demanding job. Whether their present tactics, short-range armaments, and electronic-combat and target-acquisition support elements would enable them to do that job without suffering disastrous losses is a highly controversial question in some defense circles.

USAF believes they could do it. "I am confident that we have and will maintain the capability to penetrate, destroy targets, and survive," General Russ asserts.

Dr. Hicks worries about that, though, declaring, "It would be impossible to keep Air Force attrition low without using standoff weapons, especially in the early part of a war, to knock out their radars and airfields. Nobody is saying that everything would have to be done with standoff weapons, but they would be very important during the early days [of war]."

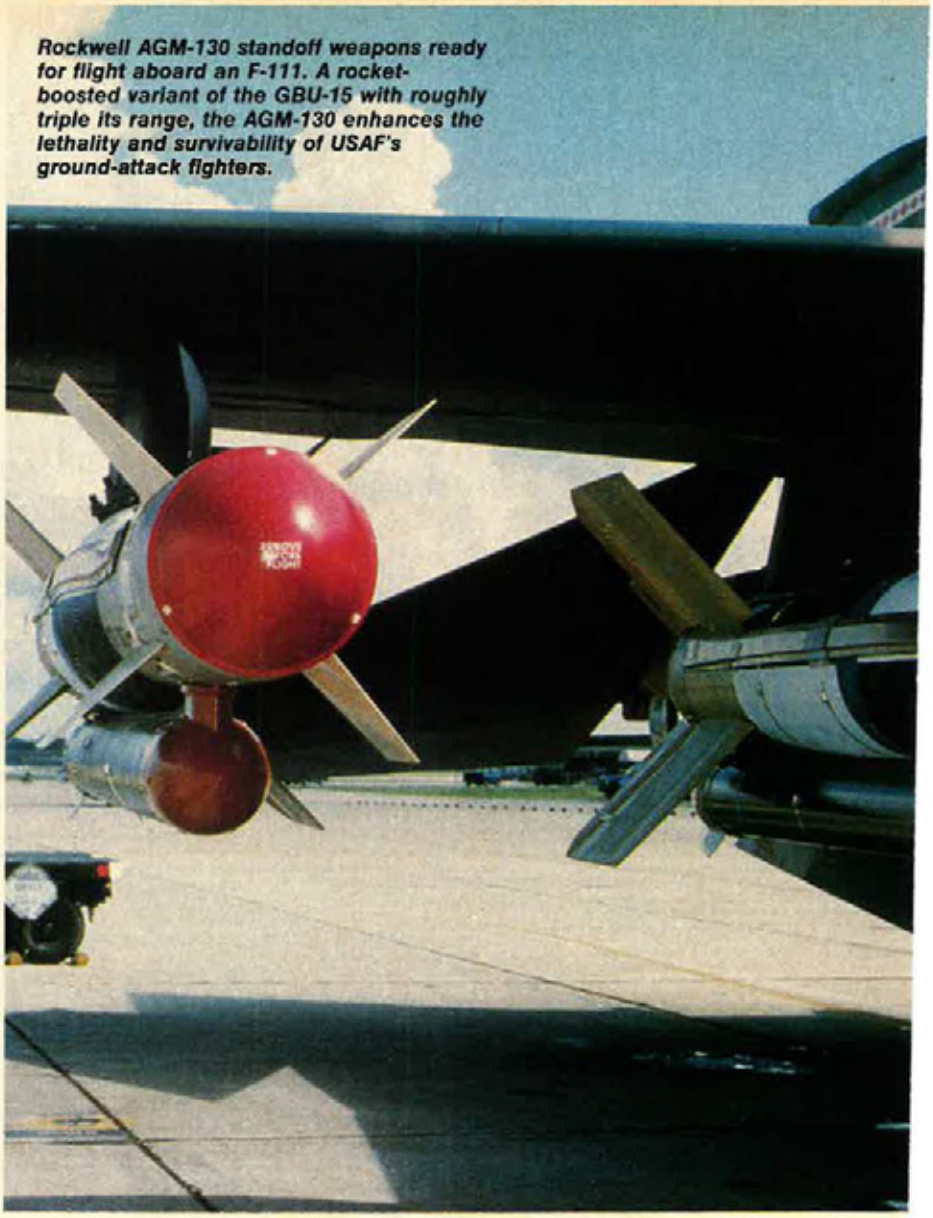
The First Few Days

If the balloon goes up, NATO attack aircraft—mainly F-111s, Tornados, F-16s, and F-4s—would be called upon right off the bat to penetrate Pact territory, in many instances far beyond the Forward Edge of the Battle Area, again and again.

Deep interdiction would be the job of the F-111s and, to some extent, of the Tornados. Prominent among their targets would be Pact air bases, most of which are from 300 to 800 kilometers east of the border between West Germany and East Germany.

"Sortie generation" is a dead-serious requirement for those deep-interdiction aircraft. They are outnumbered by their assigned targets. This is why the production of long-range F-15E dual-role fighters, scheduled to begin this year, ranks very high among US tactical air forces (TAF) priorities.

Quickly, US and allied attack aircraft would also have to rip into the radars that direct the flights and fire of the Pact's increasingly capable fighter/interceptor forces and the fire of its ever-denser belts of SAMs and antiaircraft guns.



Rockwell AGM-130 standoff weapons ready for flight aboard an F-111. A rocket-boosted variant of the GBU-15 with roughly triple its range, the AGM-130 enhances the lethality and survivability of USAF's ground-attack fighters.

Many of those defensive radars would be near the FEBA. The SAMs and guns under their control would menace the NATO attack aircraft attempting to fly eastward beyond it and the NATO close-support aircraft operating near or above it.

Spearheading those missions against those radars would be F-4G Wild Weasel aircraft armed with high-speed, radar-homing missiles.

After enough radars are knocked out, US and allied attack aircraft—and presumably French Mirages as well—could slip through the resulting radar gaps to interdict bridges, tunnels, defiles, railway offloading sites, and other such chokepoints. This would block the enemy's second-echelon and third-echelon armored and mechanized infantry units from moving forward to reinforce assault units at the FEBA. The attack aircraft would then go after those stopped-up rear units, having also struck Pact command and control centers, ammunition dumps, and the like.

These days, NATO attack aircraft would come up against something new—Soviet fighters and air-to-air missiles equipped with look-down/shoot-down radars and teamed with Il-76 Mainstay airborne early warning and control (SUAWACS) aircraft with look-down capability.

Soviet look-down/shoot-down radars are still fairly primitive by US operational standards, but will almost certainly improve. Eventually, they will be as effective as such radars now in NATO fighters and air-

to-air missiles. When that happens, they will be a grave threat, unless jammed, to NATO ground-attack aircraft, no matter how low, how fast, and with how much high-energy maneuvering those aircraft would be flying in order to elude any defensive radars on the ground.

General Russ does not see this happening until about the year 1995. By then, if all goes as planned, USAF will have deployed the next generations of air-combat fighters and air-to-air missiles that it will need to be capable of escorting attack aircraft beyond the FEBA and of defending them against enemy interceptors.

The Next Generations

USAF's F-15 fighters are the best in the world. Over friendly territory in Europe, they would more than hold their own against the best fighters that the Soviets can fly against them, even though the newest of those fighters are now quite good.

Beyond the FEBA, however, it would be a different story. In the escort mode, the F-15s would come up against droves of Pact interceptors and, at fighting altitudes, heavy ground fire. Their air-to-air missiles are good, but maybe not good enough in that sort of environment. There are not enough F-15s to maintain air superiority beyond the FEBA, except in some possible circumstances, and their crews are not trained to do so. While they have great range, they can go supersonic only on afterburners, and that means heavy fuel consumption and detraction from fighting time.

This is why USAF badly needs the Advanced Medium-Range Air-to-Air Missile (AMRAAM) and the Advanced Tactical Fighter (ATF). With AMRAAMs, its air-superiority fighters will be able to engage multiple targets in quick succession and maneuver out of enemy range immediately on launching their missiles.

But the ATF will be the main key to USAF's future ability to fly cover for NATO ground-attack aircraft beyond the FEBA. It will be much better, not just a little bit better, than the F-15 in, among other things, its maneuverability, its fully integrated flight-control and fire-control avionics, its ability to cruise supersonically without using its afterburner, its turnaround time, and its much smaller radar signature.

"The ATF will be able to go on the other side of the FEBA and survive," General Russ declares. "That's why we cannot afford to slip the 1995 IOC for the ATF. Naturally, we'd like it to be sooner.

"The ATF is our crucial element. It will enable us to maintain air superiority when and where we choose—on our side of the FEBA and on his. I'm not talking air supremacy, which means air superiority everywhere. We couldn't maintain that. I'm talking air superiority on top of the [vertical] cones that the attack aircraft are flying through—keeping everything off their backs while they get in and out."

In preparing for the very good Soviet look-down/shoot-down radars that it anticipates in the mid-1990s, USAF's fighter community is already thinking about changing the tactics of its attack aircraft in order to take maximum advantage of their ATF cover and to finesse defensive radars on land. Warsaw Pact forces have been orienting such radars ever more heavily to intercepting NATO attack aircraft coming through on the deck, a tactic that those aircraft adopted years ago, when defensive radars were oriented instead to intercepting them coming in high.

USAF may someday decide to erase or to ease the threat from such radars by attacking at medium altitude (about 15,000 feet). This would do nothing to ameliorate the air-to-air threat and may even make it worse. But the thinking at TAC is that the ATF would be able to handle it.

"Don't count on us flying in forever at 200 feet or at 100 feet," General Russ declares. "There's too much regime that's available to us above that that we're not using, and we may decide to use it all."

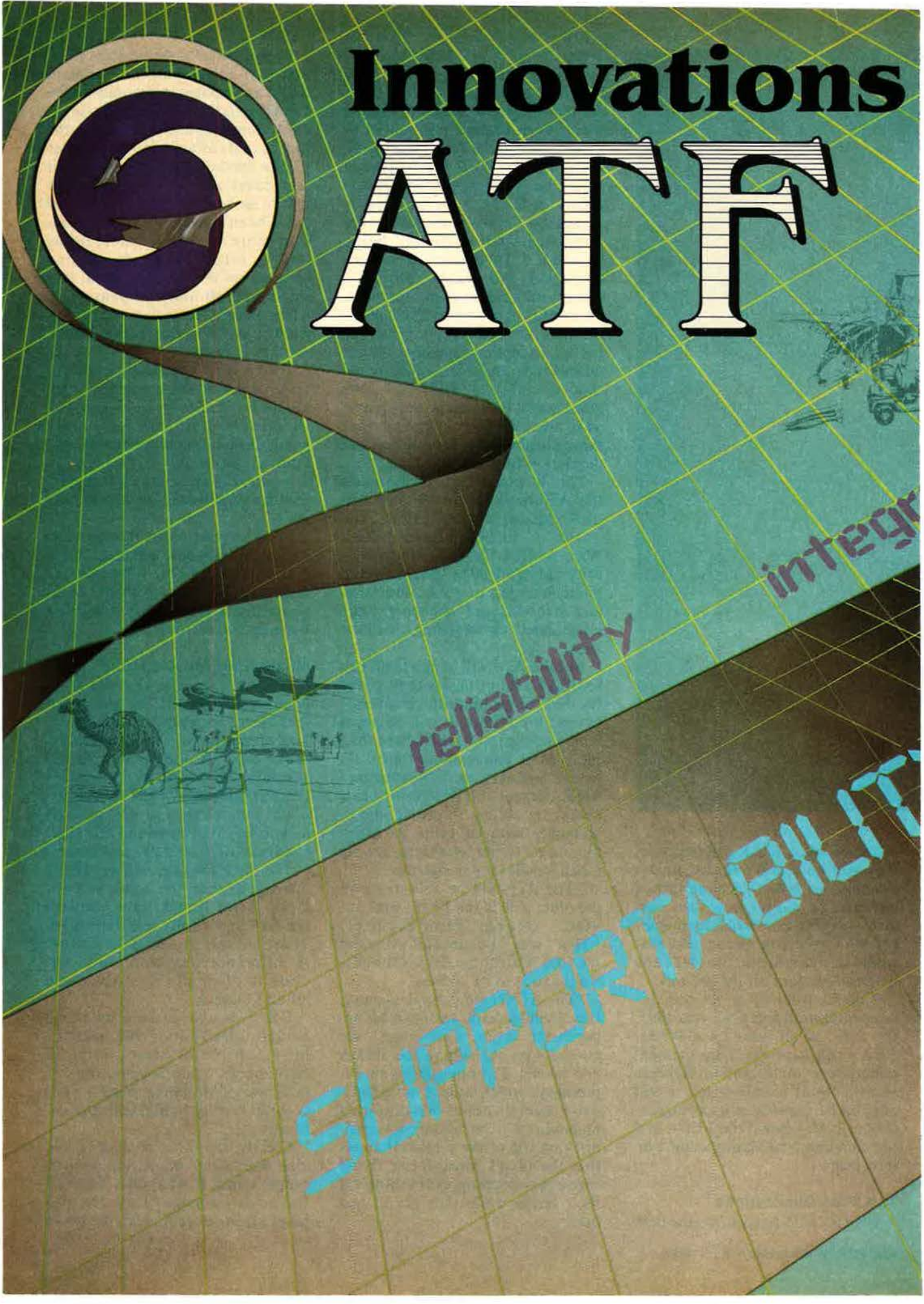
Maximizing Air-to-Ground

Meanwhile, USAF will keep working to upgrade its ground-attack "force package" of such tightly knit elements as TR-1 reconnaissance aircraft equipped with the Precision Location Strike System (PLSS) radars, Wild Weasel aircraft, jammers on attack aircraft and on EF-111 Raven and EC-130H Compass Call aircraft, and others.

The force package will be greatly upgraded when the Joint Surveillance Target Attack Radar System (JSTARS) aircraft are deployed. These aircraft should make a world of difference for interdiction aircraft in their ability to acquire ground targets.

USAF is also making its attack aircraft, chiefly its F-16s, increasingly capable of maneuvering at high speeds while hugging the terrain and of dropping bombs very accurately prior to hightailing out of trouble.

Clearly, the force package could also use many more and longer-range standoff weapons. General Russ acknowledges this. He also takes strong exception to the accu-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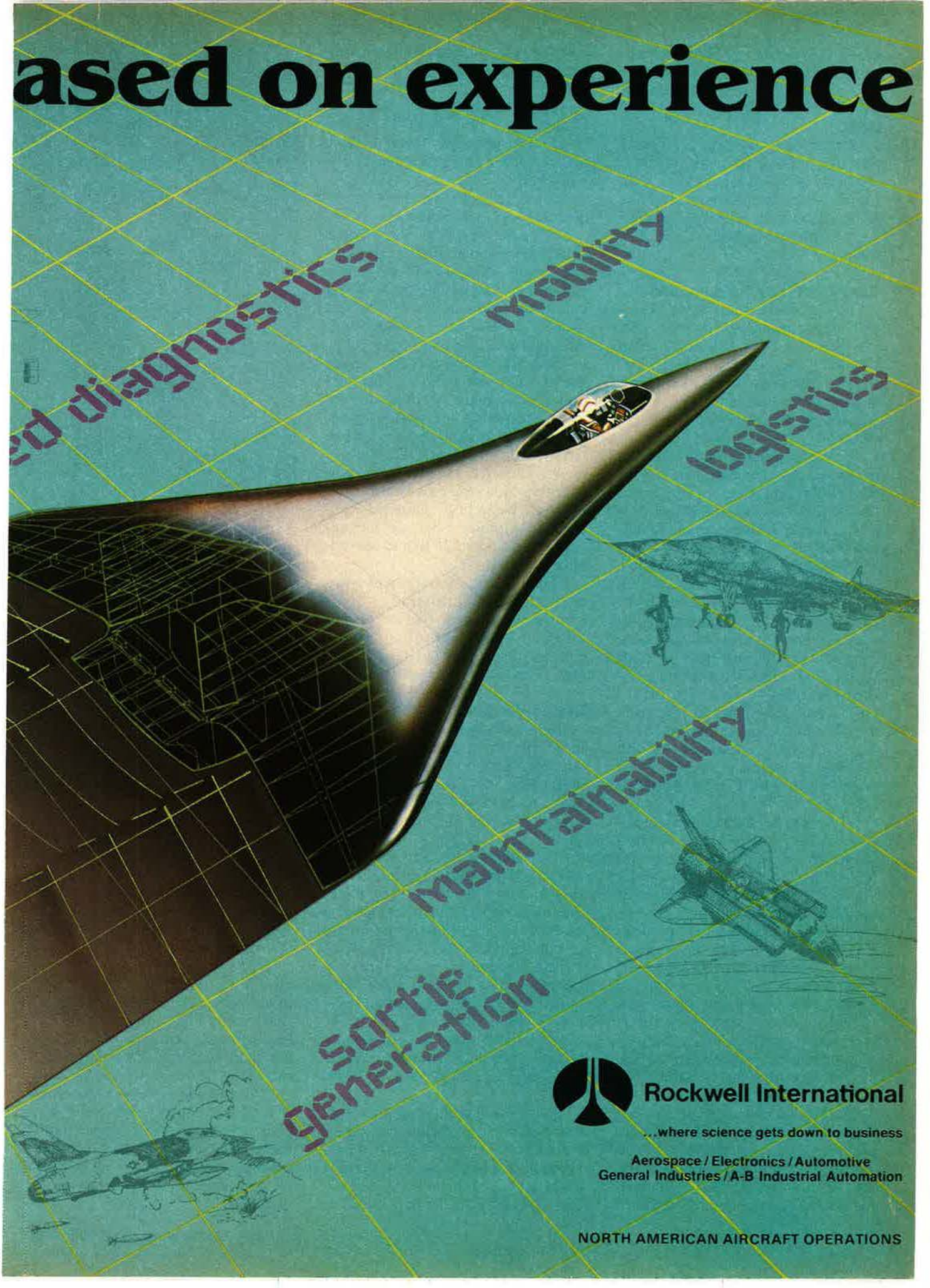

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sation that USAF—TAC in particular—is disinterested in developing such weapons and underrates the risks of overflying targets to bomb them.

"It's crazy to fly over a target if you don't have to," he asserts. "Nobody is trying to get killed. TAC supports standoff weapons and has given them high priority. I myself am a strong proponent of standoff weapons."

Cost-Efficiency Calculations

"The problem with them," General Russ continues, "is their cost. We have not been able to develop standoff weapons of sufficiently low cost to allow us to buy sufficient numbers of them. If we're going to have them, we're going to need lots of them.

"Cost is as much a requirement as range, payload, or anything else. We must design weapons that are in the hundreds of thousands of dollars' category rather than in the millions of dollars' category."

The longer a standoff weapon's range, the greater is its cost, which is mostly a factor of the sophisticated midcourse and terminal guidance systems that make it accurate. This is why the only real standoff weapons in USAF's inventory are the "close-in" (five miles or so) GBU-15 glide bomb and Maverick missile and the longer-range (fifteen miles or so, depending on the altitude at which it is launched) AGM-130, which is a boosted GBU-15.

USAF has begun work on a medium- to long-range air-launched standoff weapon called Tactical Missile System (TACMS), but is not all that confident about it ever seeing production.

Acknowledging that "cost has always been an issue" in standoff weapons, OSD's Dr. Hicks claims nevertheless that "you can buy an awful lot more of them at hundreds of thousands of dollars apiece than you can airplanes at many millions of dollars apiece. When you lose an aircraft, you have lost an awful lot of money."

Dr. Hicks claims that today's guidance and propulsion technologies now make it possible to build air-launched missiles capable of flying "twenty to fifty miles" with inertial guidance systems and terminal guidance systems that would enable them to "come around again if they overfly the target."

They would indeed be costly, Dr. Hicks says, but "would still be much less expensive" than aircraft equipped for the offensive-counterair and defense-suppression missions that he sees as the most urgent ones for such standoff missiles.

USAF's General Randolph comes at it from another angle, saying, "An F-16 costs $10 million to $15 million, depending on how you count, but you can use it over and over again. But once I launch that missile, that's the end of it.

"So what we have to do is to get the unit cost [of standoff weapons] down to where we could deliver many at one time, many times over, and not run ourselves right out of missiles and money.

"We know from the technical perspective that we can build good standoff weapons," General Randolph continues, "but we haven't yet solved how to do that at reasonably low cost.

"Their accuracy is critically important. Getting accuracy—and I mean down to one to two meters—is tough and very expensive. If you can't do that, you've lost the advantage of having a standoff weapon."

Cooperating to Cut Costs

Joining forces with NATO nations in developing "a family of modular standoff weapons," General Randolph says, "is the only way we're going to be able to get their costs down to where we can all afford them.

"By modular, we mean the airframe and the control system could be the same. But the propulsion modules could be varied, depending on how far you wanted it to go, the terminal guidance systems could be varied, depending on the kinds of targets you're after, and the same [goes] for unitary warheads or dispenser pods. You'd simply tailor the weapon to the mission you're about to do—antiarmor, runway busting, fixed targets, mobile targets, whatever."

The transatlantic standoff-weapons program now being worked up would not have to start from scratch. Each of the four nations involved in it at this writing has special strengths in certain kinds of standoff technologies and has developed them, in many cases, into basic hardware.

Slung on an F-15, Durandal runway-cratering weapons await a workout. Made by France's Matra, Durandal would be used on offensive counterair missions aboard such aircraft as the F-15E. Durandal is not a standoff weapon.

Pooling such resources should save each nation lots of money in developing the weapons to the point of production.

"I'm encouraged and excited by this," General Randolph asserts. "I think we're onto a very good thing. With tight budgets and the Gramm-Rudman cuts, our only salvation, in the final analysis, is to figure out new ways to make things happen.

"If we're worried about the security of our country, we can't just give up because the money isn't there. We just have to do things smarter, and I think that's what we're doing with this [transatlantic] program." ■

The C-20A Gulfstream III: It's doing everything they asked it to do.

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When the U.S. Air Force set out to select replacement aircraft for the C-140s, it established some very demanding criteria. And rightfully so. The transports operated by the 89th Military Airlift Wing play a vital role in the conduct of our nation's affairs at home and abroad.

The Air Force program standards called for specific levels of performance, mission readiness, supply and maintenance efficiency —not to mention tight schedules for outfitting, crew training and delivery of the first three aircraft to Andrews Air Force Base. What's more, two mission requirements—one long range, the other medium range—suggested that two aircraft types were needed to do all the work that has to be done.

In the end, the Air Force decided it could get everything it needed in *one* airplane: the Gulfstream III.

The first C-20A Gulfstream III went into service in September 1983, only three months after contract signing, on schedule, within budget. Now that three C-20A Gulfstream IIIs are on duty, they're living up to the long heritage of superior performance, dispatch reliability, systems dependability, low maintenance requirements and cost-effectiveness of Gulfstream executive jets in transporting key executive teams anywhere in the world.

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The rate of non-mission capable supply—a measure of the inability to dispatch the aircraft because of a parts shortage—could be no more than 1.0%. With the C-20A Gulfstream IIIs, the rate is only 0.50%.

The Gulfstream III's performance not only meets the mission requirements of the C-140 program, it also fills many overseas travel demands for the Special Airlift Mission Fleet. This capability increases the flexibility and efficiency of the Air Force to meet high priority travel requests, yet the C-20As require only 7.5 maintenance man-hours per flight hour compared to 27 for the C-140s they replaced.

Finally, an example of the mission versatility and cost-effectiveness of the C-20A Gulfstream III in meeting the needs of the Special Airlift Mission Fleet:

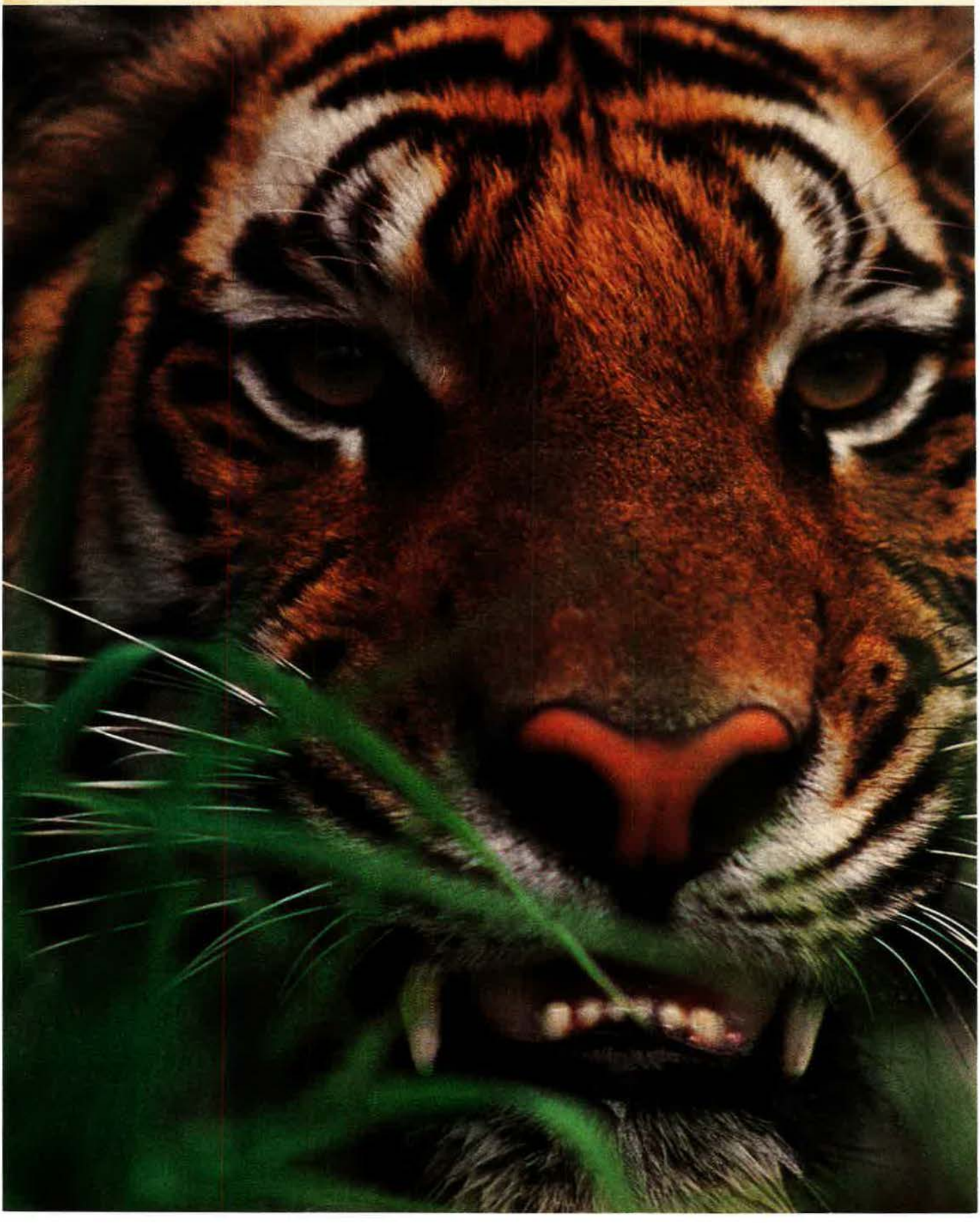
One C-20A Gulfstream III departed Andrews AFB on a 13 day trip, logging 43 flight hours and traveling to locations in the Pacific. Upon its return to Andrews AFB, it was cleaned, refueled and put to work the next day flying missions in the United States. It required no maintenance for the entire period.

The U.S. Air Force demanded a lot in its new jet transports. By any measure, the C-20A Gulfstream IIIs are delivering everything it asked for.

And more.

Gulfstream Aerospace

For more information about the C-20A Gulfstream III or other mission capabilities of the Gulfstream III, contact Larry O. Oliver, Regional Vice President, Military Marketing, Gulfstream Aerospace Corporation, P.O. Box 2206, Savannah, Georgia 31402. Telephone: (912) 964-3246.



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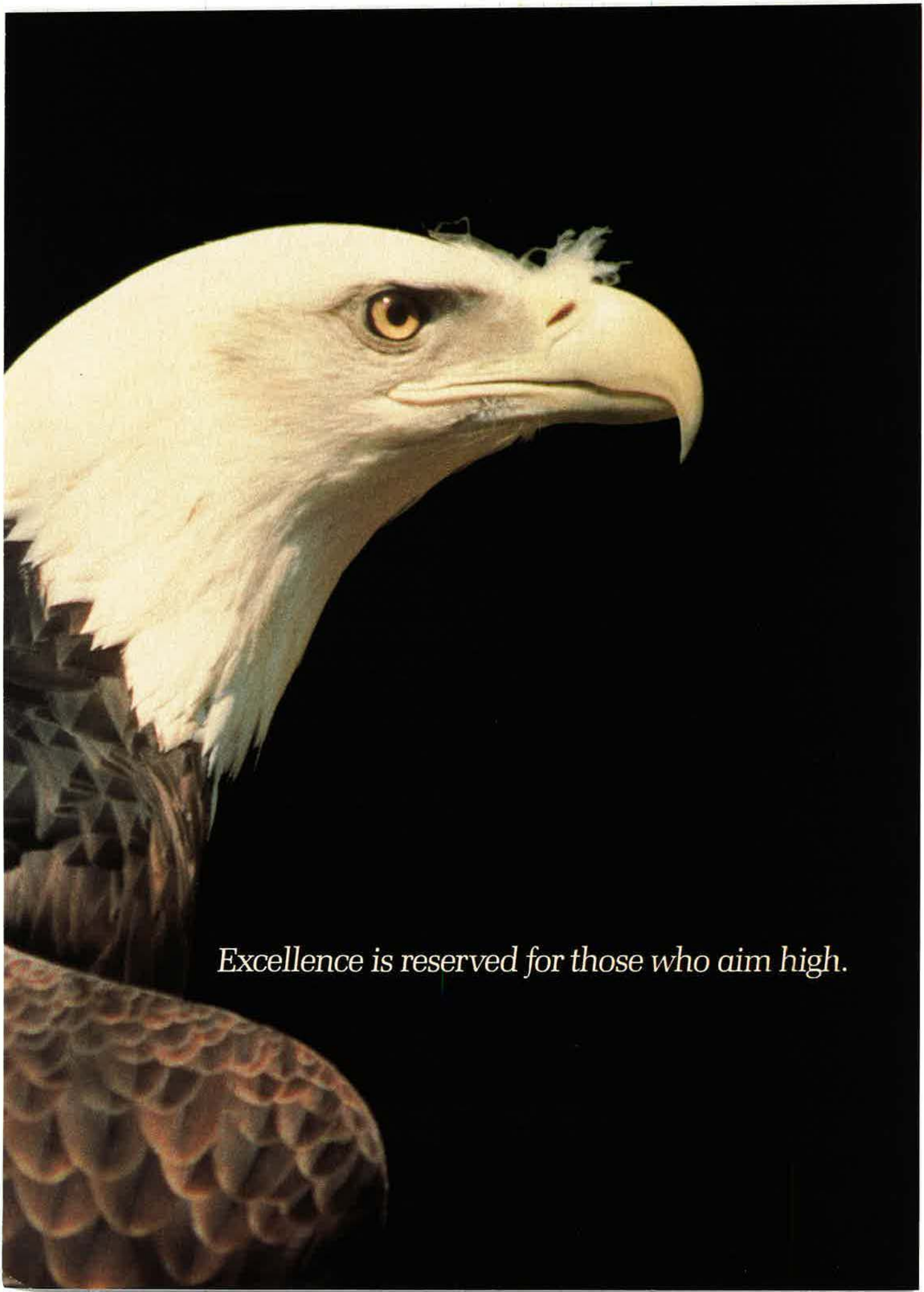
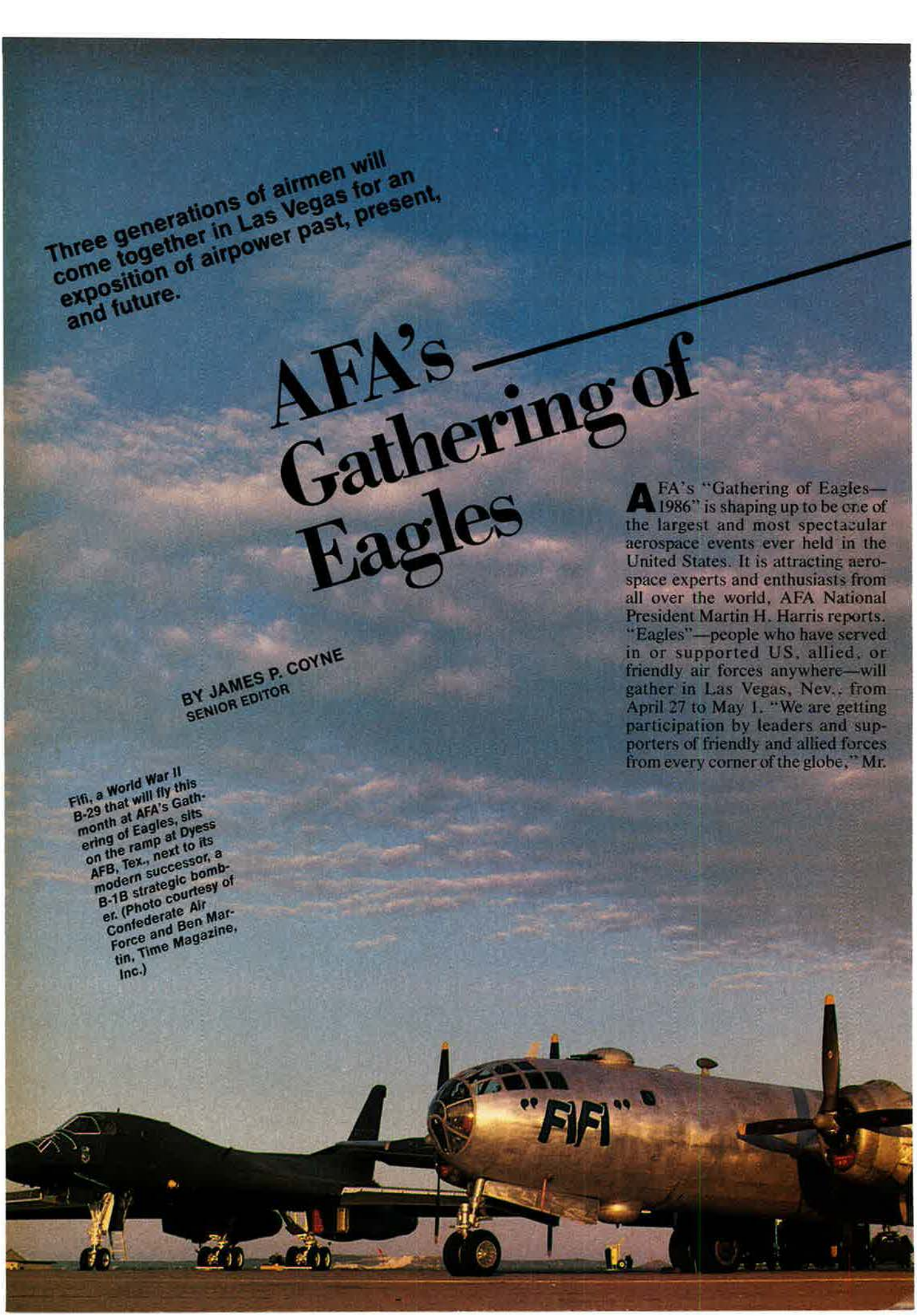

Excellence is reserved for those who aim high.

Three generations of airmen will come together in Las Vegas for an exposition of airpower past, present, and future.

AFA's Gathering of Eagles

BY JAMES P. COYNE
SENIOR EDITOR

AFA's "Gathering of Eagles—1986" is shaping up to be one of the largest and most spectacular aerospace events ever held in the United States. It is attracting aerospace experts and enthusiasts from all over the world, AFA National President Martin H. Harris reports. "Eagles"—people who have served in or supported US, allied, or friendly air forces anywhere—will gather in Las Vegas, Nev., from April 27 to May 1. "We are getting participation by leaders and supporters of friendly and allied forces from every corner of the globe," Mr.



Fifi, a World War II B-29 that will fly this month at AFA's Gathering of Eagles, sits on the ramp at Dyess AFB, Tex., next to its modern successor, a B-1B strategic bomber. (Photo courtesy of Confederate Air Force and Ben Martin, Time Magazine, Inc.)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Harris said. "People and exhibitors from all over the United States continue to sign up."

The Gathering of Eagles salutes military aviation progress and accomplishments over the years. "We are commemorating free world aerospace achievements over three generations," Mr. Harris said. American participants include heroes of three wars. Among them are Air Force and Army Air Forces Medal of Honor recipients, Gen. Jimmy Doolittle and his Tokyo Raiders, Gen. Curtis E. LeMay, former Commander in Chief of Strategic Air Command and later USAF Chief of Staff, and noted test pilot Brig. Gen. Chuck Yeager. The Gathering celebrates the establishment of Strategic Air Command, Tactical Air Command, Aerospace Defense Command and the founding of the Air Force Association forty years ago.

In the air, scores of vintage warplanes will recreate the major air engagements of World War II. US Air Force live flying demonstrations and a tactical capabilities exercise will show the Eagles the potential of today's airpower as modern fighters and fighter-bombers employ live ordnance.

The Gathering includes two symposia and a major panel discussion on timely military aerospace topics. Participants are US Air Force and Navy top leaders and the heads of foreign air forces from every major global region. There is even a workshop on educating young people for careers in space, with participants from NASA, the Air Force, and the American educational community.

Except for the flying demonstrations, most events will take place in the large Las Vegas Conference and Convention Center. AFA has reserved more than 200,000 square feet of floor space for displays, meetings, symposia, and social activities. More than 150 international aerospace firms and the US Air Force Orientation Group will provide the displays. Interspersed among the commercial displays will be vintage World War II aircraft from the Confederate Air Force (CAF), an organization dedicated to preserving operational aircraft from the World War II era. The display will include a Messerschmitt, a British Spitfire, a Japanese Zero, and three US warplanes—a P-51 Mustang, a P-47 Thunderbolt, and a Navy F4U Corsair.

There will be an honors dinner in the MGM Grand Hotel to recognize distinguished guests. A Gala Stage Show featuring nationally known performers and honoring distinguished military aviation personalities will take place in the Aladdin Hotel's Theatre for the Performing Arts.

Throughout the Gathering of Eagles, the Confederate Air Force will display some 100 World War II-era aircraft at McCarran Field International Airport. Many of these aircraft will be flown over Las Vegas the week of the Gathering. The CAF will also perform the large-scale recreations of key World War II air battles.

Between 5,000 and 7,000 people are expected to attend the Gathering of Eagles. Both Secretary of the Air Force Russell A. Rourke and Chief of Staff Gen. Charles A. Gabriel will participate in symposia and ceremonies. Foreign air force leaders from eighteen countries will attend. Among them are Air Chiefs who will travel from Belgium, France, and West Germany in Europe; from Korea and Japan in the Far East; and from Somalia and Sudan in Africa. Australia and New Zealand will send representatives from the South Pacific. Air Chiefs from Canada and the United Kingdom, as well as other nations, will also attend. Fifty-three air attachés will represent nations all over the globe. The air services of many countries sending official representatives will be honored during ceremonial events.

More than twenty organizations with ties to military aviation will be in Las Vegas for the Gathering of Eagles. Among these are the 8th Air

The F-15 Eagle will participate in a mock US-Soviet air-to-air battle during a tactical capabilities exercise, just one of the features to be seen at the Gathering of Eagles.

Las Vegas showpeople will join with distinguished entertainers who have made significant aerospace contributions during the past four decades in a Gala Stage Show to be held in the Theatre for the Performing Arts in the Aladdin Hotel.

Force Historical Society, P-51 Mustang Pilots Association, 82d Troop Carrier Squadron, 86th Fighter Bomber Group, Reserve Officers Association, 1st Air Commandos, Western P-47 Thunderbolt Pilots Association, 459th Bomb Group Association, F-86 Sabre Pilots Association, 1st Troop Carrier Squadron, and 18th Tactical Fighter Wing Association.

On Tuesday, April 29, Eagles will see the aerial demonstrations and a tactical capabilities exercise. They will first witness the recreation of World War II by the Confederate Air Force. In "Airshos" throughout the United States, CAF flyers perform aerial battle maneuvers in real World War II warbirds. Bombing is realistically simulated by pyrotechnics set off on the ground as planes pass overhead. At the Gathering of Eagles, spectators will see such original or restored vintage aircraft as the Japanese Zero and the renowned British Spitfire. American warbirds to be seen include the P-40 Warhawk, P-51 Mustang, P-38 Lightning, T-6 Texan, B-17 Flying Fortress, B-24 Liberator, B-29 Superfortress, B-25 Mitchell, B-26 Marauder, and such Navy fighters as the Wildcat, Hellcat, and Corsair.

The recreation begins with P-40s fighting Japanese Zeros over China and progresses through the Battle of Britain, the attack on Pearl Harbor, Jimmy Doolittle's Tokyo Raid, the Battles of Coral Sea and Midway, the daylight bombing raids over Europe, low-level attacks on Ploesti, the Normandy invasion, the Tokyo raids, and, finally, the flight of the *Enola Gay,* the B-29 that dropped the atomic bomb on Hiroshima and accelerated the Japanese surrender and end of World War II.

USAF pilots from Nellis AFB, in the Air Force's most modern aircraft, will take over and carry out some of their modern air warfare weapons employment training requirements in a dynamic tactical capabilities exercise. Both air-to-air and air-to-ground tactics will be exercised. Other demonstrations will follow.

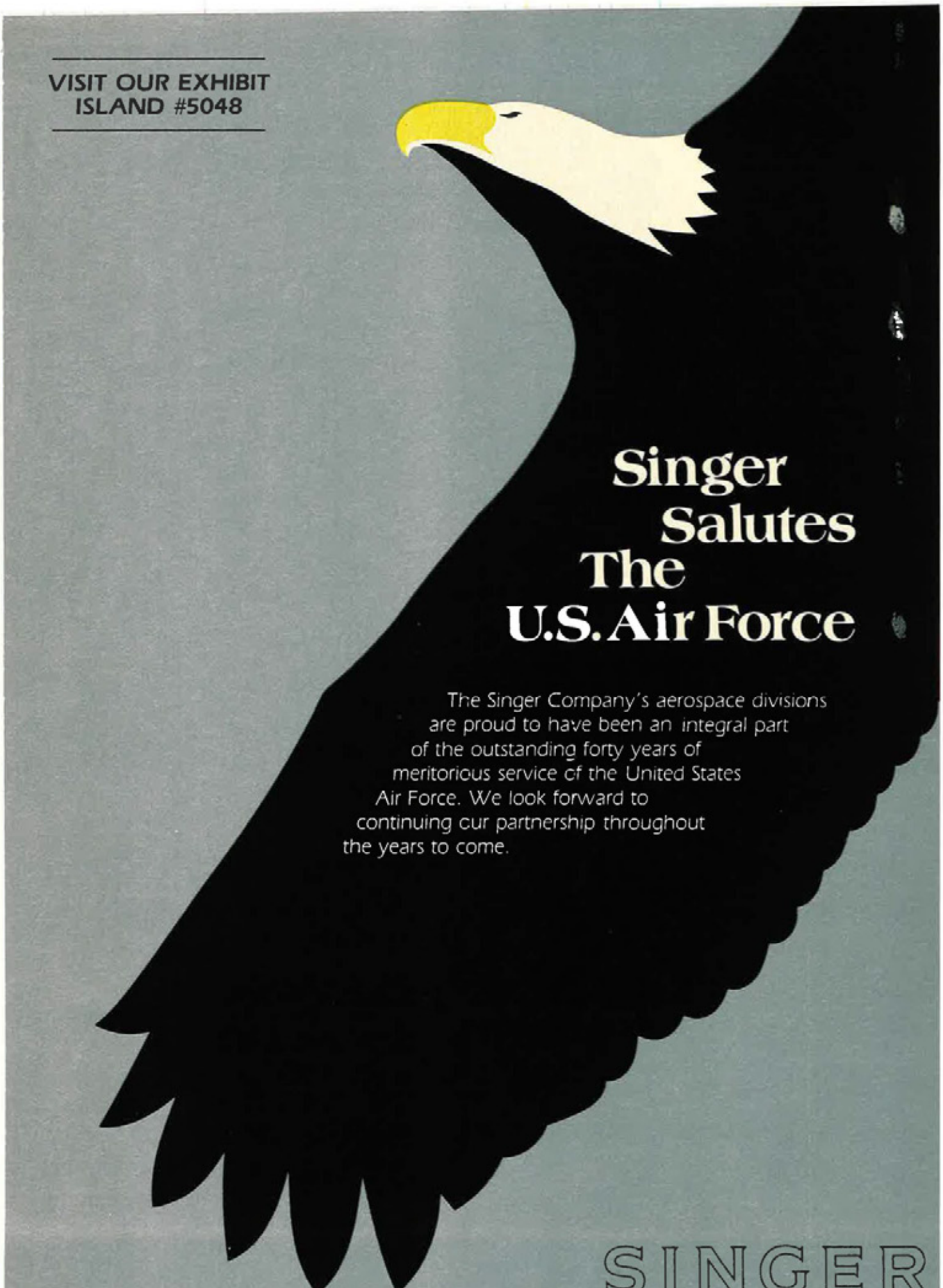
In the Las Vegas Convention and Conference Center, a "Global Aerospace" symposium will allow GOE participants to sit in on panel discussions by some of the most distinguished individuals in military aerospace today. Among symposium panelists will be General Gabriel; Adm. Wesley L. McDonald, former CINCLANT; General Kim, In Ki, Chief of Staff, Korean Air Force; General Lieutenant Eberhard Eimler, West German Air Force; and Sir David Craig, Air Chief Marshal of the United Kingdom. These allied air chiefs will provide an authoritative perspective on the interacting responsibilities of the free world's air forces.

Secretary Rourke will be the keynoter for the symposium on "Your Air Force Today." Participants will include major Air Force commanders presenting up-to-date information on all aspects of command capability.

Dr. Eleanor Wynne, Vice President of the Air Force Association's affiliated Aerospace Education Foundation (AEF), will moderate an educator's workshop on "Educating for Leadership in Space." The nation's leading primary and secondary educators have been invited to attend. Participants will include Henry E. Clements, Director of Astronaut Selection for NASA, and Gen. Robert T. Herres, Commander in Chief, US Space Command.

An AEF televised Roundtable discussion, "Designing Tomorrow's Air Force," will wrap up the series of symposia. Gen. Lawrence A. Skantze, Commander of Air Force Systems Command, will keynote the Roundtable. AFSC's product division commanders will take part in the discussions.

A Reception and Honors Banquet will be held the evening of Wednesday, April 30, in the Main Ballroom of the MGM Grand Hotel. Attendance is limited to the first 3,500 registrants and is now fully subscribed. Honored during the evening will be military aviation leaders, past and present. The USAF Aerial Demonstration Team, the Thunderbirds, will be introduced, as well as the Doolittle Raiders, who carried out the daring raid on Tokyo in the early days of World War II. Medal of Honor winners and Air Chiefs of foreign nations will be recognized, as will the Secretary of the Air Force and former Secretary Verne Orr. A special film recalling many of the most significant events and personalities in USAF history will be shown. Highlighting this eve



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USAF's Airmen of Note, appropriately dressed in World War II Army Air Forces "pinks and greens," will recall the Glenn Miller era in performances for nostalgic attendees at the Gathering of Eagles.

ning will be the presentation of an original painting by noted aviation artist Keith Ferris, commissioned to commemorate the fortieth anniversary of the Air Force Association. AFA President Harris will present the painting to General Gabriel for the USAF Art Collection.

Chuck Yeager will be the General Chairman of the Gala Stage Show, which climaxes the Gathering of Eagles on Thursday, May 1, in the Theatre for the Performing Arts in the Aladdin Hotel. The show features Master of Ceremonies Tennessee Ernie Ford and two hours of live entertainment, including guest appearances by stage and screen stars who have made noted contributions to aerospace progress. Distinguished actor and retired brigadier general Jimmy Stewart, a member of AFA's first Board of Directors, will play a leading role. The presentations at the Gala will recognize significant events in Air Force history from World War I up to the present. USAF's Airmen of Note, dressed in Army Air Forces "pinks and greens" of World War II, will recall the Glenn Miller era in a nostalgic big-band performance.

The Gathering of Eagles promises to open a door to the past and to showcase the historic military aerospace accomplishments of four decades. In many cases, Eagles will be in the company of the actual people (and their machines) who made history. But the event will be far more than an airmen's reunion. It will be remembered also as a major exposition of the free world's military and civilian aerospace achievements, expectations, and challenges—an unparalleled view of aerospace yesterday, today, and tomorrow. ■

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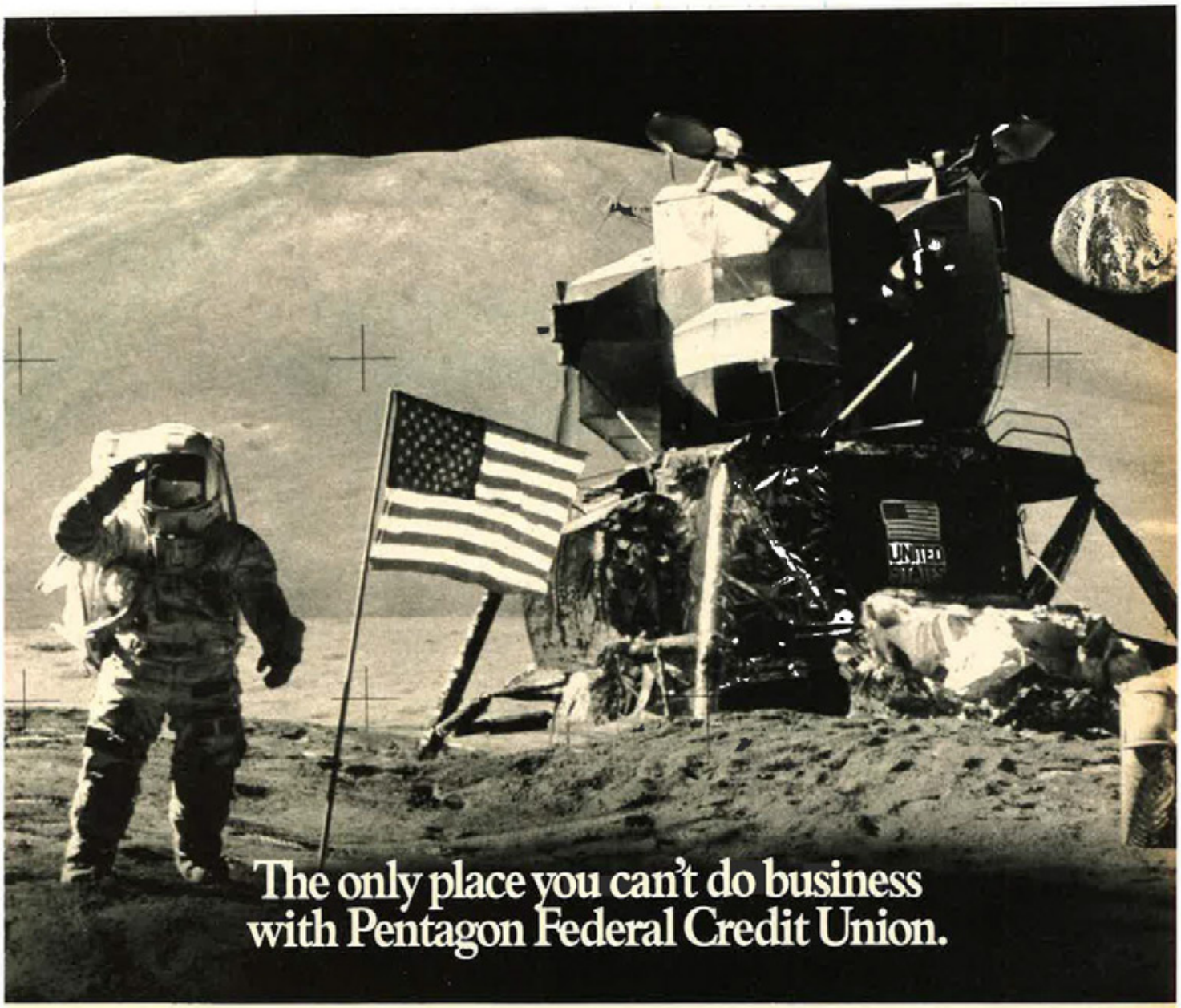

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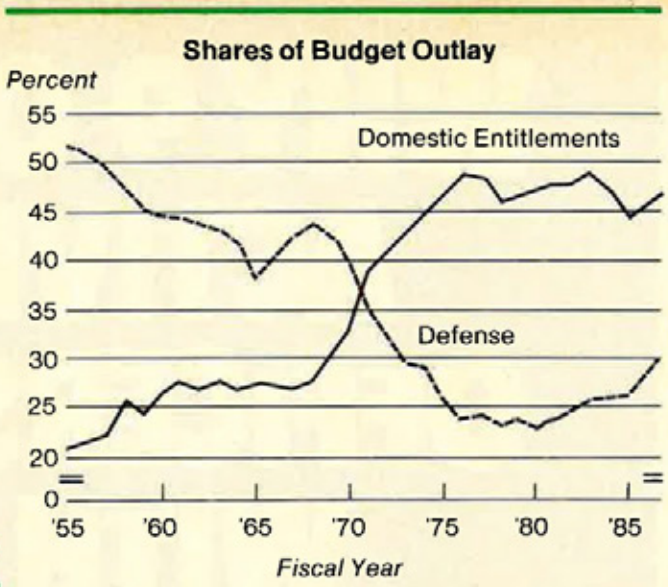
The Pentagon has asked for $311.6 billion in FY '87, but major cuts—if not wholesale revamping of the proposed budget—seem likely.



A 'Modest Growth' Budget

BY EDGAR ULSAMER
SENIOR EDITOR (POLICY & TECHNOLOGY)

THE Administration's proposed FY '87 defense budget totals $311.6 billion in budget authority (funds authorized to be spent over a number of years) and $274.3 billion in outlays (monies expected to be spent in the current fiscal year). In terms of net budget authority, the funds requested by the Administration for FY '87 top defense appropriations for FY '86 by $22.2 billion. At first blush, the magnitude of this jump might seem excessive at a time when primal congressional concerns are riveted on the vast federal deficit. But such a reaction—already obvious on Capitol Hill—overlooks the fact that the FY '86 defense budget was down by about 6.2 percent compared to FY '85 because Congress—and in particular its 1985 Gramm-Rudman-Hollings deficit-reduction legislation—had excised some $35 billion from the Administration's defense funding request for that fiscal year.

The Administration, therefore, justifies the boost over FY '86 as an attempt to restore defense spending to an even, modest growth pattern. That growth, in turn, is necessitated by the scope and nature of the military threats facing this country. Nevertheless, the largely negative reaction by Congress to the Administration's proposed defense budget suggests that major cuts, if not a wholesale revamping of the request, are in the offing, especially if Public Law 99-177, the Gramm-Rudman-Hollings 1985 deficit-reduction bill, is triggered by October 1 of this year.

The consequences of actuating the currently in-force provision of the Gramm-Rudman-Hollings bill for "sequestration"—meaning automatic cuts of the defense budget—are not completely clear, but probably would vitiate the US defense posture. Initial findings by the Congressional Budget Office conflict with the Administration's assertion that the FY '87 budget request meets the Gramm-Rudman-Hollings bill's mandate that the federal deficit in FY '87 not exceed $144 billion. If that is so—and if the courts uphold the basic constitutionality of the deficit-reduction bill—sequestration and all that it entails would seem to be foreordained.

In his initial testimony on the new budget, Secretary of Defense Caspar W. Weinberger appealed to Congress to "return to a solid and consistent budget plan for national security resources." The alternative, he suggested, is "to squander past gains and return to the practice of regarding defense spending as the balance wheel of fiscal policy—a practice which gave us the hollow forces of the 1970s."

Terming Soviet military capabilities the dominant consideration in sizing the new budget request, Secretary Weinberger said that "several military power balances long favorable to the US have begun tilting in favor of the Soviet Union." Acknowledging that Mikhail Gorbachev's ascension to the post of General Secretary yielded "cosmetic improvements" in Moscow's public relations, Secretary Weinberger warned, however, that "Soviet military growth continues with new strategic and conventional systems being fielded and even more advanced systems under development or in various stages of research." There is, he added, "not the slightest indication that a reduction in our commitment to invest in our military forces will result in a corre-

Air Force Modernization

	On Hand FY 1980	FY 1985	FY 1986 & Prior Auth/Approp & soon to be delivered	FY 1987
Tactical Fighters				
F-15	507	728	105	48
F-16	157	838	398	216
Strategic Aircraft				
B-1B	—	2	100	—
Mobility Aircraft				
KC-10	—	35	57	8
C-5B	—	—	29	21
Strategic Missiles				
Peacekeeper	—	—	54	21
ALCM-B	12	1,472	267	—
Nuclear/Tactical Missiles				
GLCM	—	196	288	76
Sparrow	8,192	10,302	1,965	379
Sidewinder	11,617	16,753	3,581	1,710

sponding reduction" by the Soviets and their allies or an abandonment of their strategic objectives. "If the US were to devote the same percentage of its GNP [gross national product] to its military as the Soviets do, we would not be submitting an FY '87 defense budget for $311.6 billion, but for some $700 billion," Secretary Weinberger told Congress.

Ominous Threats

The Chairman of the Joint Chiefs of Staff, Adm. William J. Crowe, Jr., testifying in tandem with Secretary Weinberger, sketched a concise panorama of Soviet military gains. Pointing to a "dramatic" shift in the strategic nuclear balance, Admiral Crowe reported that "the Soviets now enjoy superiority in ICBMs, medium-range nuclear forces, and mobile ballistic missiles." The Soviets, he added, "are a burgeoning nuclear power intent on achieving dominance over the US strategic deterrent." In the realm of conventional arms, Moscow "leads the world," according to the JCS Chairman: "The Soviet inventory includes about a four-to-one advantage over the US in tanks, two-to-one in aircraft, and five-to-one in artillery." Moreover, he warned Congress, "These gaps will likely continue to grow, since the Soviets have historically produced more weapons than the combined efforts of the US and NATO."

The personnel picture is equally dark, Admiral Crowe suggested: "Active Soviet military forces outnumber US active forces by about two to one." In the maritime arena, the Soviet Navy's transmutation from a short-legged regional force to a blue-water fleet with global reach ranks as Moscow's top military achievement, he told Congress. In the aggregate, Admiral Crowe stressed, the Soviet buildup "is unprecedented in world history and on sheer momentum will continue well into the 1990s, if not longer."

The nation's top military leader underscored for Congress several paramount aspects of Moscow's military power.

- Soviet military doctrine consistently stresses the offense and a "war-winning" philosophy.
- Soviet forces vastly exceed levels necessary to defend their territory.
- Soviet forces are now capable of waging war on two fronts, both in the east and in the west.
- Given their modern navy and political connections with satellite countries, they now have a "global military reach."
- The Soviets possess an overwhelming superiority in the area of offensive chemical weapons.
- Most disturbing, the qualitative edge that the West has long enjoyed is being eroded. This has been achieved through large R&D investments, emphasis on technological education, piracy of Western technology, and willingness to accept inefficiencies in the process.

Ancillary factors that boost Soviet geopolitical leverage are Moscow's cultivation of surrogate forces and her unprecedented arms sales. "The USSR is the world's largest arms salesman, delivering some $95 billion in weapons over the last decade. Approximately $80 billion worth of equipment—some new and some outdated by Soviet standards—has been funneled into the Third World during the same period," Admiral Crowe testified. Exacerbating the problem is the fact that "Soviet customers are emerging as the military powerhouses of Southeast Asia, the Middle East, Africa, the Caribbean, and Latin America. Moreover, Moscow continues to be successful in having its clients act against Western governments and peoples." The corollary is "a burgeoning terrorist threat, more small but fierce regional conflicts, and an increasing willingness of small anti-American regimes to challenge Washington."

Admiral Crowe importuned Congress to deal with the FY '87 defense budget "based on a full and unemotional appreciation of the peril we face. These threats cannot be assumed away, nor is it necessary to overstate them. They are impressive and ominous in their own right."

The Basis for the Budget Request

The fundamental objective that shaped the FY '87 defense budget request is completion of the third phase of the policy of "containment" that this country has

pursued since 1946 in an effort to thwart Soviet imperialism. With the first two phases of the US containment policy deemed essentially complete—one, the ideological appeal of international communism curbed, and two, the geopolitical expansion drive stalled—US policy now is to deny to Moscow exploitable military advantages derived from its status as a "one-dimensional superpower." This form of "containment," the Pentagon argues in its annual report that undergirds the new budget request, boils down to the ability to deny "the Soviet Union the ability to establish military superiority it can use for territorial or political advantage."

The US containment formula is anchored in a firm military deterrence posture, with deterrence defined as "the sets of beliefs in the minds of the Soviet leaders, given their own values and attitudes about capabilities and will. It requires us to determine, as best we can, what would deter them from considering aggression, even in a crisis." In concrete terms, effective deterrence, as defined by the Pentagon's FY '87 posture statement, hinges on four criteria.

- **Survivability.** US forces must be able to survive a preemptive attack with sufficient strength to threaten losses that outweigh gains.
- **Credibility.** The threatened US response to an attack must be credible; that is, it must be of a form that the potential aggressor believes that this country could and would carry out.
- **Clarity.** The actions to be deterred must be sufficiently clear to our adversaries so that they know what is prohibited.
- **Safety.** The risk of failure through accident, unauthorized use, or miscalculation must be minimized.

Mated to these four deterrence criteria are four operating policies that constitute the cornerstones of US military strategy: "A balance of forces adequate for each mission, alliances for collective defense, forward-deployed forces, and flexibility." Extending this quadripartite philosophy further, the Pentagon's new posture statement erects "four pillars in the defense policy by which we seek to achieve a more stable deterrence for the 1990s and beyond." These four pillars, Secretary Weinberger told Congress, are "SDI [the Strategic Defense Initiative] and secure nuclear deterrence, use of force and secure conventional deterrence, a strategy for reducing and controlling arms, and competitive strategies for deterrence."

Strategic Missile Requirements

In the pivotal field of strategic nuclear forces, the Pentagon paints a relatively dark picture, with the trends "favoring the Soviet Union until the late 1980s, at which time the benefits of US modernization programs begin to offset some Soviet advantages."

The current, slight US lead in the number of warheads—as opposed to such criteria as equivalent megatonnage and prompt hard-target kill capability, in which the Soviets are widening their already substantial advantage—"will continue to decline until the Soviets begin to achieve an advantage in the early 1990s." The new Pentagon report finds that the Soviets have more than thirty new strategic offensive systems in various stages of development. Projections for the next decade include new solid-propellant ICBMs, both silo-based and mobile, a liquid-propellant follow-on to the giant SS-18, and improvements to the currently deployed ICBMs.

Where the Money Goes
(in current $ billions)

	FY 1985	FY 1986	FY 1986 G-R-H	FY 1987
Military Personnel	67.8	67.9	−0.2	76.8
O & M	77.8	78.7	−3.8	86.4
Procurement	96.8	97.3	−4.7	95.8
RDT&E	31.3	35.5	−1.7	42.0
Military Construction	5.5	5.6	−0.3	6.8
Family Housing	2.9	2.9	−0.1	3.4
Other	4.7	1.6	−0.1	0.5
Totals	**286.8**	**289.4**	**−11.0**	**311.6**

How the Services Fare
(in current $ billions)

	FY 1985	FY 1986	FY 1986 G-R-H	FY 1987
Army	74.3	74.9	−2.5	81.5
Navy/Marine Corps	99.0	98.5	−3.7	104.5
Air Force	99.4	98.3	−3.9	105.2
Defense Agencies	13.1	15.9	−0.8	19.5
Defense-wide	1.0	1.9	*	0.9
Totals	**286.8**	**289.4**	**−11.0**	**311.6**

*Less than 0.1

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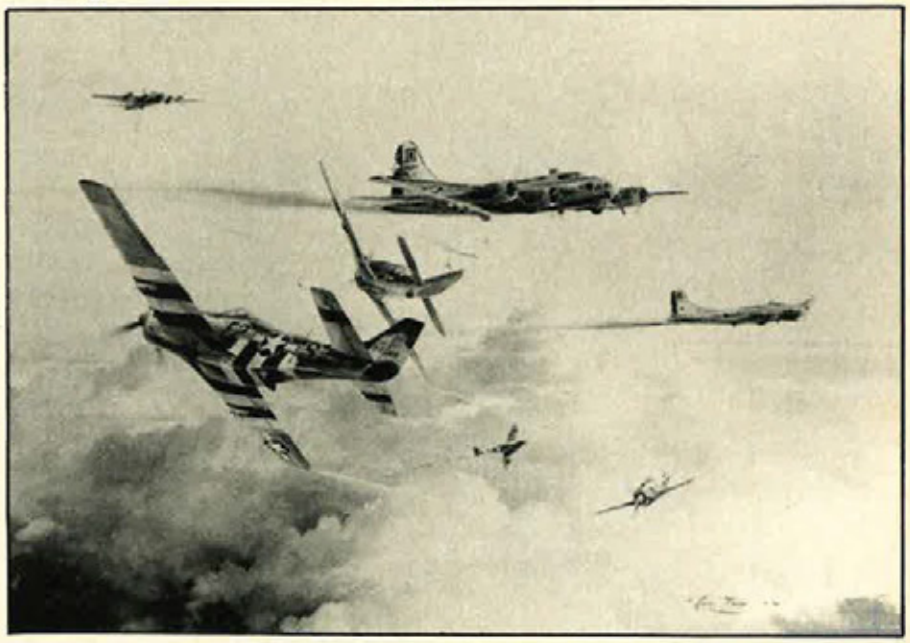

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This popular fighter pilot commanded No 85 Hurricane Squadron throughout the Battle of Britain; shot down and wounded twice (he was flying whilst unable to walk). Became an Ace before being appointed as Equerry to His Majesty King George VI.

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A Battle of Britain Ace who flew Hurricanes with No 56 Squadron until he was shot down and badly burned. After 2 years hospitalization and 25 operations he was back flying Spitfires. Ended the war a Wing Commander with 17 air victories.

James Goodson

Volunteered for the R.A.F. in 1940, one of the few American Eagle Squadron pilots to survive. Transferred to the 4th Fighter Group in 1942 to command 336 Squadron. Flew almost throughout the war, this highly decorated Ace had 32 victories (15 air).

Adolf Galland

Regarded as the Luftwaffe's greatest fighter leader, he led the famous Abbeville JG-26 Me 109's throughout the Battle of Britain, until in 1941 he became Germany's youngest General, co-ordinating all day and night fighters. Flew the jet Me 262 in combat in 1945.

Gunther Rall

One of the Luftwaffe's outstanding aces who saw combat during the invasion of France, the Battle of Britain, the Balkan and Crete campaigns. Rall flew 621 missions, the majority of which were on the Russian Front, scored 275 victories, yet was downed 5 times himself.

Johannes Steinhoff

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Basic traits of the new systems are greater accuracy and increased targeting flexibility. As the Joint Chiefs point out in their Military Posture Statement, the Soviet lead in ICBM capability is staggering and growing: "The current force of 308 SS-18s has more throw-weight potential than the combined force of all current US ICBMs and SLBMs. If the Soviets increase the number of warheads carried on each SS-18—which is within their capability—the corresponding equivalent megatons and hard-target kill capability of the SS-18 [force] could approach the capabilities of the entire modernized US ICBM and SLBM force." Air Force Secretary Russell A. Rourke told Congress that the Soviet ICBM force numbers approximately 1,400 launchers that carry 6,500 warheads and accommodates an aggregate throw-weight "about three times that of the US ICBM force."

The Air Force's response to these adverse trends, he testified, consists of efforts to ensure the prompt deployment of 100 MX Peacekeeper ICBMs, development of a small, single-warhead ICBM, and a basing technology development program. MX, he reported, is in full-scale development, with ten out of a planned twenty R&D flight tests completed and demonstrating "outstanding accuracy and functional performance." Delivery of the first MX is scheduled for May of this year, and initial operational capability (IOC)—meaning ten missiles deployed in Minuteman silos at F. E. Warren AFB, Wyo.—is planned for December 1986. Total acquisition cost for fifty MX ICBMs—in line with the congressional stipulation that the second fifty missiles not be acquired and deployed until a more survivable basing mode is found—is $14.5 billion (expressed in FY '82 dollars). The new budget request seeks about $1.4 billion to procure twenty-one test missiles, some $331 million for testing and evaluation, about $27.5 million for support facilities, and $390 million to examine alternate basing modes.

Secretary Rourke told Congress that eight basing options are under study, including "shallow tunnel [hardened trench], hardened Minuteman silos, superhard silos, superhard silos with mobile transport, mobile encapsulated ['carry hard'], rail-mobile, ground-mobile, and deep underground basing." The Air Force, he reiterated, remains convinced that deployment of 100 Peacekeeper missiles "is the most prudent option to ensure continued effective deterrence and stability." Assuming that Congress accedes to the FY '87 Peacekeeper funding request, the Administration plans to buy forty-eight MX ICBMs in FY '88 at a cost of about $2.143 billion.

The new budget seeks about $1.4 billion—along with a tentative $2.6 billion in FY '88—for the development of the small ICBM (SICBM), identified as being in the fifteen-ton class and "compatible with a broader range of basing modes, including mobile." (There is evidence, however, of mounting interest within Congress and among Defense Department weapons experts in scaled-up versions of the SICBM that—while still fully mobile and hence survivable—could accommodate perhaps as many as three MIRV warheads along with penetration aids.) Depending on how small-missile technologies and basing modes evolve, "the SICBM should enter full-scale development in late 1986, with its first flight occurring in 1989, leading to an initial operational capability by December 1992," according to Secretary Rourke.

Strategic Offensive Forces

	US		USSR
ICBMs			
Titan	17	SS-11	450
Minuteman II	450	SS-13	60
Minuteman III	550	SS-17	150
	—	SS-18	308
	—	SS-19	360
	—	SS-25	45
	1,017		1,373
SLBMs			
Poseidon (C-3)	288	SS-N-5	39
Trident I (C-4)*	360	SS-N-6	304
	—	SS-N-8	292
	—	SS-N-17	12
	—	SS-N-18	224
	—	SS-N-20*	80
	—	SS-N-X-23	32
	648		983
Bombers			
B-52G	167	Bear	130
B-52H	96	Bison	30
FB-111	61	Backfire	270
B-1B	3		—
	327		430
Approximate Totals Delivery Vehicles	US	USSR	
Missiles	1,665		2,356
Bombers	327		430

*Includes SLBMs potentially carried on Trident and Typhoon on sea trials.

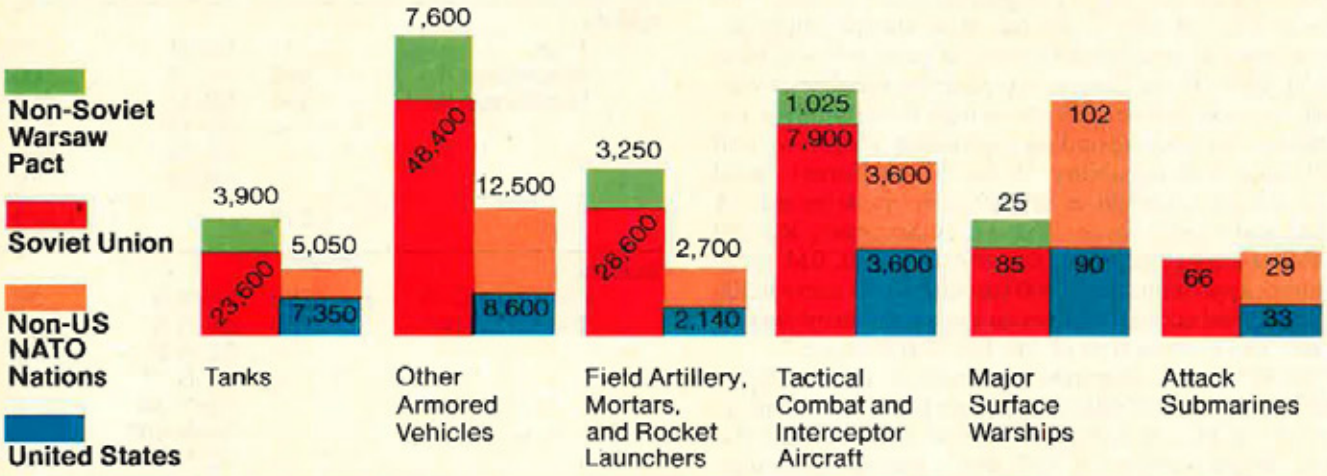
Basing modes under examination by the Air Force for the SICBM include hard mobile launchers (HMLs), superhard silos, and deep underground sites. Two full-size preprototype HMLs are undergoing mobility testing under "near actual operational conditions." The challenge is to "provide sufficient hardness without severely restricting mobility," he pointed out.

Essentially as a hedge against possible Soviet abrogation of the 1972 ABM Treaty, the Air Force seeks about $177 million in FY '87 toward the development and deployment of penetration aids to "ensure that our reentry vehicles [warheads] can penetrate the upgraded Soviet ABM defenses." Included here is work on a maneuvering reentry vehicle (MaRV) to "give us an effective retaliatory capability in the face of potential Soviet ballistic missile defenses . . . and to help the US maintain a strong ICBM deterrent into the foreseeable future."

Upgrading the Air-breathing Forces

The air-breathing leg of the strategic triad will experience a major upgrade with the introduction of the first B-1Bs into the operational inventory. The B-1B program has chalked up a "major acquisition success story by remaining ahead of schedule and within the certified $20.5 billion—expressed in FY '81 dollars—cost ceiling," according to the Air Force's report to Congress. The service pointed out, however, that "during enact-

System Production 1975–87



ment of the FY '86 budget, the B-1B suffered a reduction of more than $700 million. The B-1B is currently funded $1 billion below the certified cost ceiling. . . . These large reductions, considered premature and risky by the Air Force, could result in future requests for supplemental funding."

Because of national security considerations, the new budget request provides no public cost information concerning the Advanced Technology Bomber (ATB, or "Stealth"), other than that this R&D program is "proceeding on schedule at a fast, yet prudent, pace" toward IOC in the early 1990s. The new budget language is similarly tight-lipped with regard to another "stealth" weapon, the advanced cruise missile (ACM), described as a "Presidentially approved, Secretary of Defense-directed, second-generation cruise missile [whose] signature level, range, accuracy, and targeting flexibility will enhance the long-term effectiveness of our air-breathing force." The Air Force told Congress that a "competitive source selection was concluded in April 1983, and the full-scale development contract for the ACM was awarded. The ACM will join the current generation of ALCMs as a deployed system on current as well as future aircraft."

The proposed FY '87 budget also seeks R&D funding to the tune of about $165 million for the new short-range attack missile (SRAM II) that is to be carried by both B-1B and ATB aircraft. This follow-on to the aging SRAM I betters both the range and accuracy of the latter to "provide increased capabilities against mobile and hard targets." The new SRAM incorporates advances in stealth technology, navigation systems, propulsion efficiency, and system accuracy and, as a result, "makes the penetrating bomber more flexible by giving it a weapon system that can strike many targets from standoff."

Supporting the modernization effort of the air-breathing component of the triad in FY '87 is continued modernization of the KC-135 tanker fleet. About $1.077 billion is sought for the reengining and modification of fifty of these tankers.

In terms of strategic defenses, the new budget request seeks about $4.8 billion for SDI, some $244 million for air defense, and some $311 million for space defense, mainly the ASAT antisatellite weapon. Modernization of USAF's air interceptor force in FY '87 includes a congressionally mandated air defense fighter competition that, according to Air Force testimony, is "open to all interested firms." Final contractor selection is planned for October 1986, with the winner supplying "as many as 270 aircraft."

The Pentagon plans to continue modernization of the sea-based leg of the strategic triad with the acquisition of another Trident SSBN—at a cost of about $1.5 billion—and the development and acquisition of D-5 (also called the Trident II) SLBMs to the tune of $3.25 billion. The first operational missiles—twenty-one this year—are to be procured under the FY '87 budget request.

Tactical Air Modernization

The tactical air modernization program envisioned by the Five-Year Defense Plan (FYDP) kicked off by the FY '87 budget request stresses increased readiness and sustainability, the acquisition of more capable aircraft for both the active-duty and reserve forces, improved force survivability through boosts in electronic warfare and command and control capabilities, and modernization of both surveillance and targeting systems. Over the five-year period, the Air Force is slated to receive a total of 1,590 and the Navy/Marine Corps a total of 1,117 fighters.

Included in USAF's total are 294 aircraft to be procured in FY '87, consisting of forty-eight F-15Es, ninety-six F-16C/Ds, 120 F-16CMs, and thirty air defense interceptor competition aircraft. The same acquisition formula applies to the "outyears," except that the number of air defense interceptors is to be stepped up from thirty per year to sixty per year. The C and D versions of the F-16 Fighting Falcon to be procured this year will be able to employ such advanced combat and support systems as AMRAAM, LANTIRN, the ALR-74/56M radar-warning receiver, and Global Positioning System (GPS) receivers. The F-16CM, a modified, less expensive version of the C/D series, is to be launched by the new budget request. The CM aircraft

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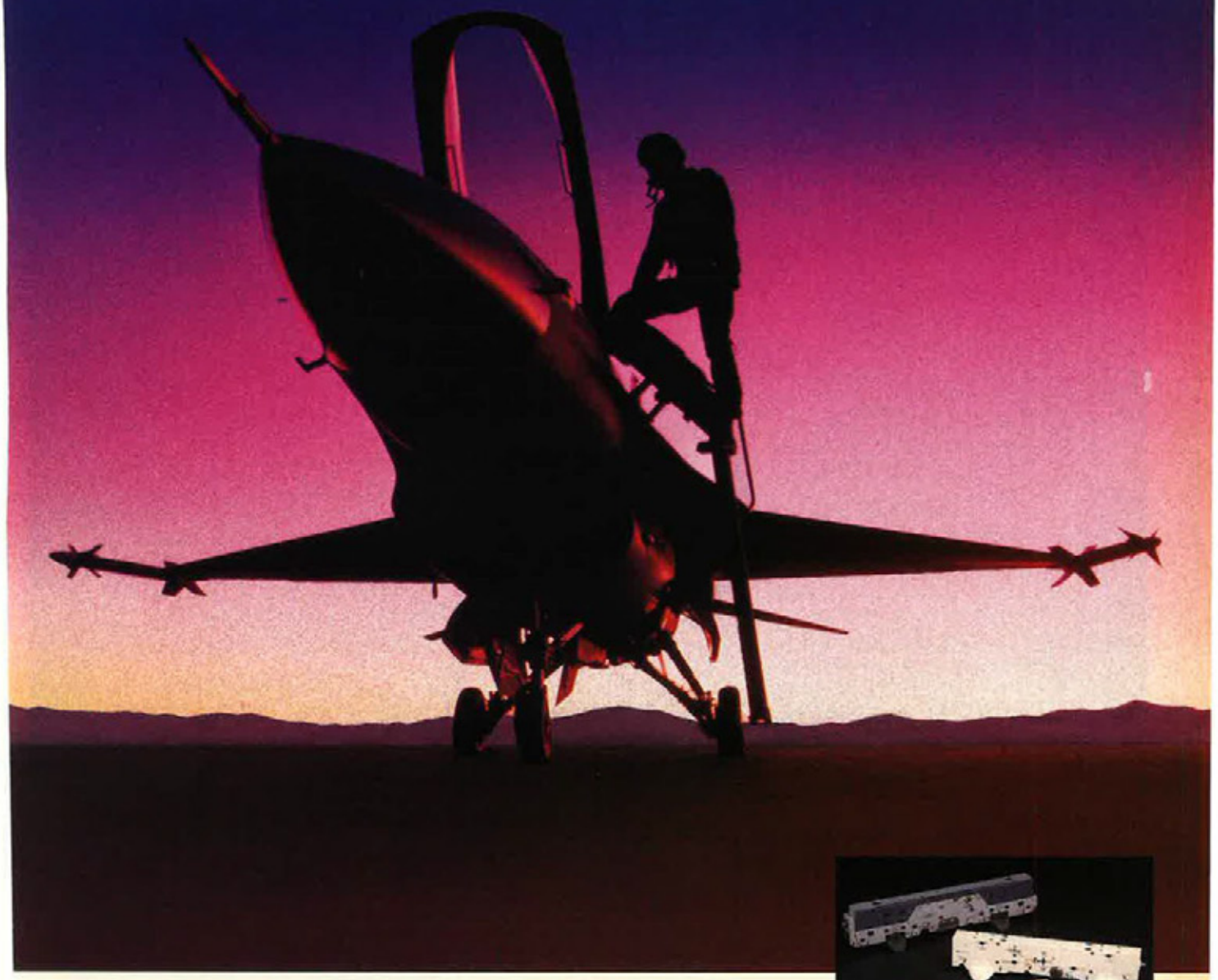

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will be assigned a "less comprehensive multirole mission, [but will still remain] highly capable in both air-to-air and air-to-surface missions."

Other funding requests in the tactical air arena are in line with USAF's Tactical Fighter Roadmap and include some $294 million for the Advanced Tactical Fighter (ATF) as well as funds for the Alternate Fighter Engine and Increased Performance Engines programs.

Overall, the Air Force's new budget request devotes about thirty percent of all available funds to the tactical mission area, compared to twenty-two percent for the strategic sector. About seven percent of USAF's proposed total budget authority is allocated to mobility forces. Included here is the acquisition of twenty-one C-5Bs at a cost of about $1.9 billion and provision of about $830 million for continued full-scale development and initial long-lead procurement of the C-17 airlifter. The total number of aircraft to be procured by the Air Force in the new budget year is 359 and includes, in addition to the acquisitions enumerated previously, three TR-1/U-2 and five MC-130H aircraft.

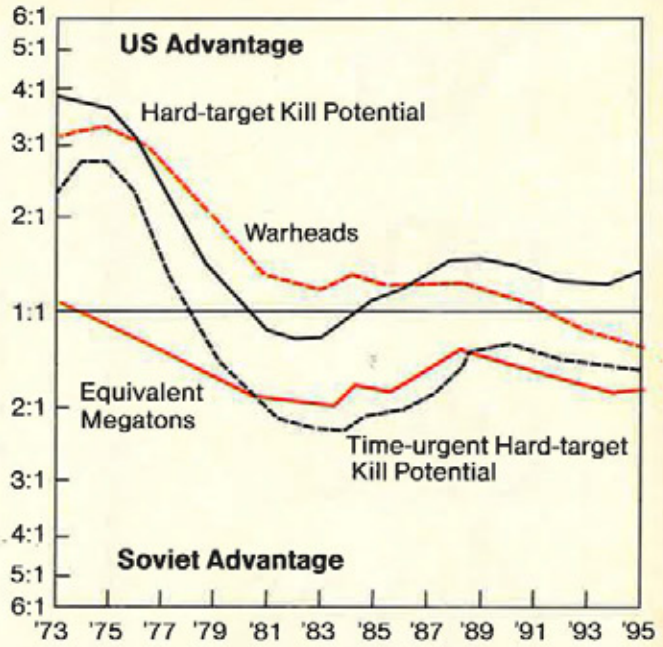
How the Budget Breaks Out

Of the $311.6 billion sought by the Administration in the Pentagon's budget authority for the new fiscal year, $95.8 billion is slated for procurement, $86.4 billion for operation and maintenance, $76.8 billion for military personnel, $42 billion for research, development, test, and evaluation (RDT&E), and $10.6 billion for assorted other functions. The new defense budget request constitutes in outlays an even six percent of the US GNP, or 27.5 percent of all federal spending in the coming fiscal year. Broken down along service lines, the proposed new budget allocates about $105 billion to the Air Force, about $104.5 billion to the Navy/Marine Corps, some $81.5 billion to the Army, and nearly $20 billion to the various defense agencies and the Joint Chiefs of Staff. The services' budgets are calculated with a military and civilian pay hike included that is to be covered by a supplemental funding request.

Active-duty military manpower is to go up by about 14,000 slots over FY '86, from 2,167,000 to 2,181,000. The bulk of the increase accrues to the Navy and is required so that the ships and aircraft that are being added to the fleet can be manned. USAF's active-duty force increases only slightly, from about 606,000 to 607,000. The military reserve components are slated to increase from 1,135,000 in FY '86 to 1,186,000 next year. The Air National Guard is to be upped from about 450,000 to 463,000, and the Air Force Reserve will grow from 77,000 to 81,000. The number of direct-hire civilians is pegged at 1,027,000, up by about 3,000 from the present level. The number of Air Force civil servants goes from about 249,000 to about 250,000.

The congressionally imposed European troop strength manpower ceiling remains the paramount Pentagon concern in the field of military manpower. As the Joint Chiefs of Staff point out in their collective testimony to Congress, "The ceiling ignores the increasing capabilities of the Warsaw Pact, discounts improvements made by our allies, creates the impression that the US is increasing nuclear forces at the expense of conventional forces, and creates a NATO penalty for CONUS defense improvements in the Atlantic islands." The concomitants, the Chiefs warned Congress, are reduced combat capability and the requirement to return to the US combat assets needed badly by NATO. In their Military Posture Statement, the Joint Chiefs of Staff warn that "in the event of a Warsaw Pact attack against NATO, the ceiling's limit on conventional forces has increased the risk and could have the effect of lowering the nuclear threshold."

The Shifting Strategic Advantage



This chart projects the preattack static ratio of US and Soviet strategic forces based on current trends. The weapon system inventory used as a basis for this chart includes FB-111s, Backfires, and 100 Peacekeepers. Hard-target kill potential represents ability to destroy targets reinforced to withstand some effects of a nuclear blast. "Time-urgent" calculations are based on kill potential against identically hardened targets.

Increased R&D Funding

The proposed FY '87 defense budget allocates nearly $42 billion to research and development, of which about $1 billion is earmarked for basic research. Government-wide, the new budget request seeks about $63 billion for research and development as well as for R&D-related facilities. The FY '87 NASA budget request—almost totally counted under the R&D rubric—is pegged at $7.7 billion and includes funds for the design, definition, and development of a "space station" slated for launch in the early 1990s. The R&D function is upped by some $8.5 billion over last year in the defense sector and by some $8.8 billion government-wide.

Included in the R&D funding request is a joint DoD-NASA project referred to as the "Orient Express" by the President in his State of the Union address, but officially designated as the National Aerospace Plane program. The feasibility of such a vehicle, which by the turn of the century might be able to function as an orbital delivery vehicle, a hypersonic military platform, and eventually even as a commercial hypersonic transport (HST), is to be explored by means of an initial $510 million research effort. (A portion of this amount—$60 million—was sought in FY '86, $200 million was proposed in the new budget, and the bogey for FY '88 is $250 million.) With a subsequent investment of about $3 billion, it might be possible beginning in 1995 to build and test prototypes of such an aerospace plane. ■

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Canada's Air Command

Our neighbor to the north, a partner in both NORAD and NATO, is in the midst of an air force modernization program unparalleled since World War II.

BY JOHN L. FRISBEE, CONTRIBUTING EDITOR

—Canadian Forces Photo

Canada's Air Command is undergoing its first major revitalization in twenty years with the addition of 138 CF-18 (US designation F/A-18) Hornet fighters. Here CF-18s from 410 (Cougar) Squadron fly over their home base at Cold Lake, Alberta.

LOOK through *The Military Balance* or any other publication that describes the armed forces of nations around the world, and you'll find many countries that have an air force in name but not in fact. Canada, on the other hand, has an air force in fact though not in name. Through a series of administrative and Parliamentary actions culminating in the Canadian Forces Reorganization Act of February 1968, Canada's Army, the Royal Canadian Navy, and the Royal Canadian Air Force (RCAF) were unified in a defense organization known simply as the Canadian Forces. *(See "Unification of the Canadian Forces," p. 118.)*

Over a period of twenty sometimes painfully turbulent years, the Canadian Forces have evolved into their present organizational structure. Air, land, and sea resources are assigned to three functional commands: Air Command, Mobile Command, and Maritime Command, respectively, and one joint geographical command—Canadian Forces Europe. Support activities that are common to all the commands, such as recruiting and many elements of training, communications, research and development, and logistics, are the responsibility of the integrated National Defence Headquarters at Ottawa.

The air arm, initially fragmented by the 1968 reorganization, has regained much of the centralized control that World War II proved essential in order to exploit the flexibility of airpower. As the Canadian Government has gradually backed away from the more draconian and unreasonable aspects of unification, there has been a resurgence of the morale and esprit inherited from the RCAF, which had earned a reputation for professionalism in more than a half-century of hot and cold war and peacetime services to the nation. Those years were not without their ups and downs, however.

Through the Wars

Although Canada was a pioneer in the development of aviation, it did not have an air force until 1920. During World War I, some 22,000 Canadians served with Britain's Royal Flying Corps and its successor, the RAF. Two of the leading aces of that war were Canadians Billy Bishop and Billy Barker.

In 1924, Canada's air arm became the Royal Canadian Air Force, a separate service coequal with the army and navy. During the 1920s and '30s, it played a major role in opening the country's vast, resource-rich northern areas, most of which were accessible only by air. As the European situation grew increasingly tense, the RCAF's scattered units, generally equipped with obsolete aircraft, were augmented with five new squadrons, and in 1938, the Director of the RCAF was made Chief of Air Staff, giving him equal status with his army and navy counterparts. By the outbreak of the war in 1939, the expansion program was far from complete. There were only twenty squadrons, with three more authorized but not yet formed.

During the war, the RCAF grew to a force of eighty-nine squadrons, more than half of them serving in combat theaters. Canada became a training base for British Commonwealth air forces, graduating 131,500 aircrew members. By war's end, Canada, with a population of fewer than 15,000,000, had fielded the fourth largest Allied air force of World War II, with more than 181,000 men and women in uniform. Seventeen thousand Canadian airmen lost their lives in combat and in training. But with peace, there began the wild gyrations in military strength that were not unique to Canada among the Western nations.

The Postwar Years

Early plans to reduce Canada's armed forces to a total of 50,000 were scrapped when the Soviet threat became apparent. In 1949, Canada joined the North Atlantic Treaty Organization as a charter member, sending an air division of twelve squadrons to Europe. Later the RCAF provided a transport squadron to UN forces fighting in Korea, and some RCAF fighter pilots flew with distinction in USAF fighter units.

In the early 1950s, the government was investing eight percent of the country's GNP in defense, nearly half of the defense budget going to the air force. By the end of 1955, the RCAF had forty-one squadrons of all types. First-rate aircraft, engine, and electronics industries had produced the CF-100 jet fighter for air defense and were developing the CF-105 Arrow, which promised to be a world-class fighter. In 1958, Canada joined the US in forming the North American Air Defense Command.

As the 1960s approached, the country began to feel the economic pinch of maintaining relatively large and well-equipped standing forces. In 1959, the CF-105 program was canceled in favor of buying US-designed fighters, many of them built under license in Canada. For the next two decades, the first-line fighter force was equipped largely with McDonnell Douglas CF-101s, Canadair-Lockheed CF-104s, and Canadair-Northrop CF-5s. The percentage of GNP devoted to defense dropped from a peacetime high of eight percent to a low of 1.8 percent, and Canada's contribution to NATO was severely reduced. The economic squeeze was exacerbated by a conviction that Canada could not compete in the dawning missile age, a public revulsion toward nuclear weapons, opposition to the Vietnam War, growing inflation and unemployment, and a burgeoning national debt. There was widespread feeling that the nation's defense policy, and hence its foreign policy, was too much influenced by its NATO and NORAD partners.

By the early 1970s, Canada was investing a smaller portion of its GNP in defense than any other NATO member except Luxembourg, and less than ten percent of the defense budget was for new equipment. Ottawa was accused of seeking a free ride in defense at the expense of its allies. While that was an exaggeration, it could be said that the country was, and still is, traveling at a reduced fare. The military itself is, of course, exempt from that charge.

At any rate, by the mid-1970s, it was apparent that Canada's faltering military capabilities were not in line with its commitments. Capital expenditures to correct obsolescence in all the commands rose to about twenty-seven percent of the defense budget, with Air Command the principal early beneficiary. In April 1980, Canada signed a contract with McDonnell Douglas, subject to a budget ceiling of $5.19 billion, for 138 F/A-18 Hornet fighters (CF-18 in Canada) that will replace all first-line fighters in the inventory by the late 1980s. One hundred thirteen of the Hornets are single-seat As and twenty-five are two-seat Bs. For Canadian airmen, a new and brighter day had dawned.

Air Command, 1986

Air Command, headquartered at Winnipeg, Manitoba, is headed by Lt. Gen. Donald M. McNaughton, who reports to National Defence Headquarters in Ottawa. The command has about 23,000 uniformed people identified as members of the air service and 9,000 civilian employees. Its inventory includes some 680 fixed-wing aircraft of all types, approximately 180 of them combat-capable, and 150 helicopters. AIRCOM operates seventeen major bases, most of them within 300 miles of the US border—a narrow belt in which eighty-five percent of Canada's population is concentrated.

The command is organized and operates on the principle of centralized control with maximum feasible decentralization of execution down to base level. It has six functional groups as shown in the accompanying chart *(p. 121)* and provides combat-ready units for a seventh—1 Canadian Air Group (Germany), an element of Canadian Forces Europe, which reports directly to the Ministry of Defence in Ottawa. The Air Group comes under the operational control of NATO's Fourth ATAF.

General McNaughton is responsible for air doctrine and the training standards, readiness, and safety of all air activities in the Canadian Forces, but he does not exercise operational control over two of his own component groups: 10 Tactical Air Group (10 TAG), equipped entirely with helicopters, is controlled operationally by Mobile Command, and Maritime Air Group (MAG) comes under Maritime Command.

Air Command's role within the Canadian Forces is defined largely by the country's alliances. It is responsible for providing trained forces for the aerospace defense of North America under NORAD and for Canada's air commitment to NATO, contributing to international peacekeeping efforts, largely under the United Nations, and patrolling Canadian territory and coastlines to prevent infringement of national sovereignty. The last role is no small task. Next to the USSR, Canada has the largest contiguous land area of any nation, most of it inhabited by a tiny fraction of the country's 25,000,000 people, and thousands of miles of mainland and island coasts.

The Operational Groups

AIRCOM's modernization program centers on **Fighter Group,** which has its headquarters at North Bay, Ontario. The Group is responsible for the operational training and readiness of six fighter squadrons of about twelve planes each, three of them based in Germany at Baden-Söllingen and, as noted earlier, not an element of Air Command. At bases in Canada are two CF-18-equipped air defense squadrons (one of them the CF-18 training squadron at Cold Lake, Alberta, that temporarily doubles in air defense) and three tactical fighter squadrons, one a training unit flying CF-5As and Ds. The CF-5 operational squadrons are NATO-assigned, with the mission of reinforcing NATO's northern flank in a crisis. There also is an electronic warfare squadron at North Bay that uses several types of aircraft, including the last of the CF-101 Voodoos.

The squadrons in Germany are presently flying both CF-104s and CF-18s, the former to be replaced by Hornets before the end of this year. Conversion of two CF-5 squadrons to CF-18s is scheduled to be completed about 1988, the older fighters being retained for transition pilot training. The Canadian air force then will have a fighter force equipped with a single, state-of-the-art fighter type. That should result in significant savings in training, maintenance, logistics, and operating costs.

By the end of January 1986, seventy-four CF-18s, for which Canadian industry supplies many components, had been delivered to Air Command. Essentially the same as the US Navy and Marine Corps F/A-18, the Canadian version is fitted with a General Electric M61 20-mm Vulcan cannon and AIM-7 Sparrow and AIM-9 Sidewinder air-to-air missiles. In an attack configuration, it usually carries 6,000 pounds of bombs and rockets. It has the latest electronic equipment for systems integration and management, navigation, target acquisition and tracking, warning, and electronic countermeasures. Pilots like the margin of safety provided by two F404-GE-400 engines and the plane's maneuverability, range, and survivability. General McNaughton says it provides commanders "a quantum leap in capability" over the three fighters it is replacing.

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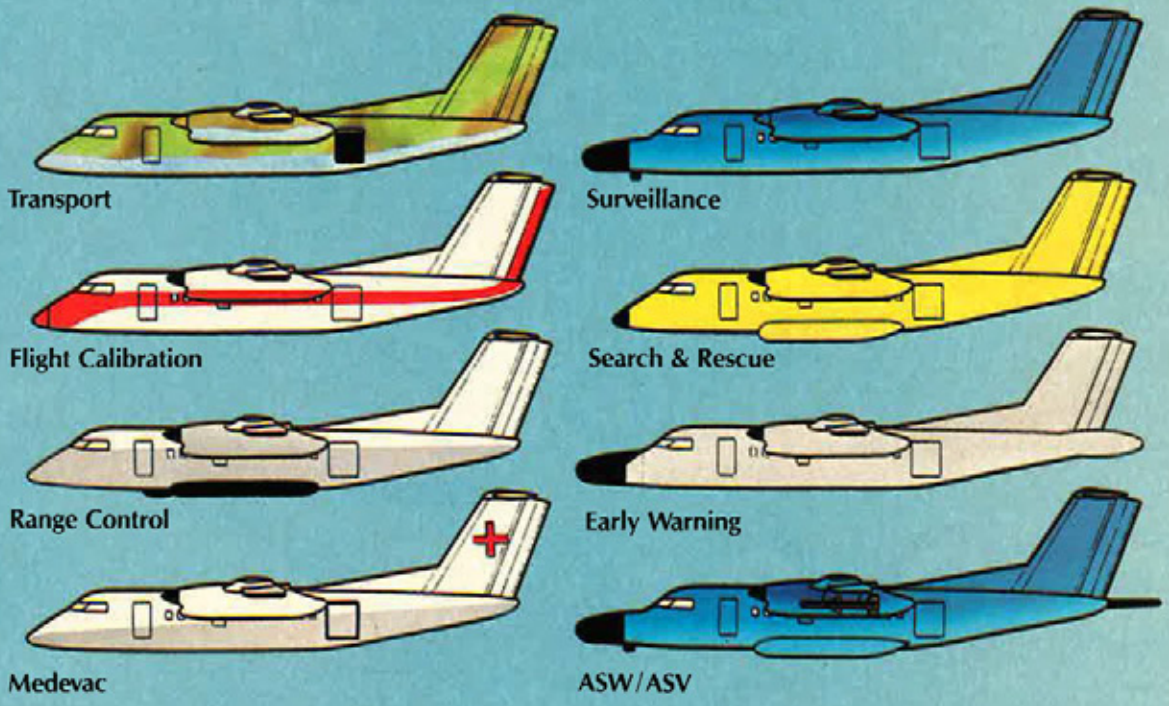

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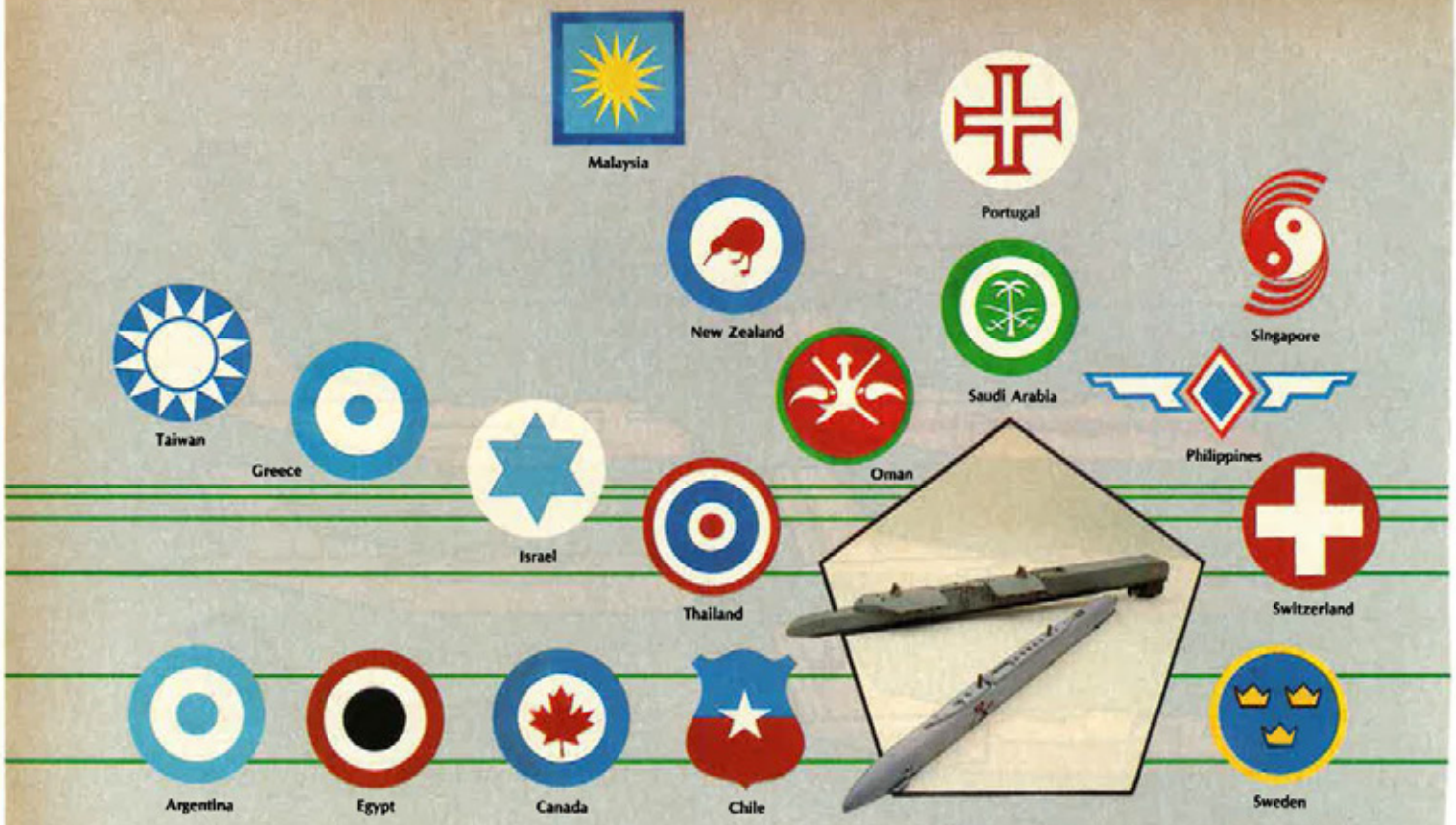

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*WEBSTER'S NEW COLLEGIATE DICTIONARY, G & C Merriam Co., 1981, page 551.

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About a third of the transition training for new CF-18 pilots is in simulators. Air Command also has an Air Combat Maneuvering Range at Cold Lake that was built and is operated by Cubic Corp. The range, used extensively in air-to-air combat, intercept, and attack training, is similar to the one at Nellis AFB, Nev., but of smaller capacity. It and the uninstrumented range at Goose Bay, Newfoundland, are also used by the air forces of other NATO members.

In addition to his responsibility for providing trained units to meet Canada's defense commitments, the head of Fighter Group, Maj. Gen. R. W. Norton, commands the Canadian NORAD Region. Under his operational control are two Region Operations Control Centers (ROCC), one for eastern and one for western Canada, both located in an underground facility at North Bay that is similar to the larger US facility at Cheyenne Mountain, Colo. Data for peacetime surveillance of Canadian airspace or for combat operations is fed into a Hughes H5118ME computer at the ROCCs from the four main and seventeen auxiliary Distant Early Warning (DEW) Line sites and nineteen long-range Cadin-Pine Tree Line radar stations that are assigned to Fighter Group. Most of the Pine Tree Line radars are being phased out, and the DEW Line is being updated with minimally attended and unattended radars to form the North Warning System, funded jointly by Canada and the United States.

With the increasing threat of long-range Soviet cruise missiles launched from bombers or submarines, Air Command has begun deploying interceptors at three austere airfields in the far north. These fields, at Whitehorse in the Yukon, Yellowknife in the Northwest Territories, and Frobisher Bay on Baffin Island, are to be augmented by three more Arctic operating strips to support a forward deployment defense strategy.

Air Command's other combat elements are **10 Tactical Air Group** and Maritime Air Group, with headquarters at Montreal and Halifax, respectively. 10 TAG, which supports Canada's ground forces and comes under the operational control of Mobile Command, has six squadrons of helicopters for tactical troop movement, battlefield resupply, and observation. The transport function is discharged by Bell CH-135 Twin Hueys and CH-147 Boeing Vertol Chinooks, while the Bell CH-136 Kiowa serves as an observation and forward air control vehicle. One squadron of Kiowas is based in Germany at Lahr, where it works with the Canadian Mechanized Brigade Group assigned to NATO.

Maritime Air Group (MAG) is responsible for guarding the sea and Arctic approaches to Canada and contributing antisubmarine warfare forces to NATO under Allied Command Atlantic. MAG is considered one of the best ASW forces in NATO. The group is equipped with thirty-five torpedo-armed Sikorsky Sea King helicopters that operate from destroyers, eighteen CP-121 Grumman Tracker fixed-wing aircraft built under license in Canada and used for maritime surveillance, and eighteen new Lockheed CP-140 Aurora long-range patrol and ASW planes. Delivery of the CP-140s, fitted with sophisticated electronics and ASW ordnance, began in 1981. MAG aircraft are stationed on both the Atlantic and Pacific coasts.

The Support Groups

Air Transport Group (ATG), with headquarters at Trenton, Ontario, supports all Canadian armed forces with fixed-wing strategic and tactical airlift. The nucleus of its airlift capability comprises twenty-six Lockheed CC-130E/H Hercules aircraft operated by three squadrons. The group also has five Boeing 707-320C strategic transports, two of which can be configured as tankers to support deployment of NATO-assigned fighters.

The Canadian Forces have primary responsibility for coordinating search and rescue (SAR) operations in Canada and off its shores. Four dedicated SAR squadrons are assigned to Air Transport Group. They are equipped with de Havilland Canada CC-115 Buffalo and CC-138 Twin Otter fixed-wing aircraft and CH-113 Lab-

—Canadian Forces Photo

Four dedicated search and rescue (SAR) squadrons are assigned to Air Transport Group. This CH-113 Labrador helicopter is from 103 Rescue Unit stationed at CFS Gander, Newfoundland.

rador helicopters that respond annually to more than 10,000 incidents involving both military and civilian personnel.

Air Command's **14 Training Group** operates schools for pilots, navigators, meteorologists, electronic warfare specialists, air traffic controllers, and aviation technicians. Pilot training is conducted at primary fixed-wing and basic helicopter schools at Portage la Prairie, Manitoba, and a basic jet school at Moose Jaw, Saskatchewan. Fixed-wing pilots get 200 hours of jet time in the Canadair CT-114 Tutor and helicopter pilot candidates 140 hours, after which they go to the basic helicopter school for a three-month course in the Bell CH-139 JetRanger. There is also a Central Flying School at Winnipeg that supervises instructor training and monitors all phases of aircrew training.

Competition for pilot and navigator training is intense, with only the most promising candidates making it. As a result, elimination from basic jet training is only about ten percent. There have been no washouts in several recent classes. Of the approximately 140 pilots trained each year, most come from three Department of National Defence military colleges and from Canadian universities. (Basic military training and other training common to all the services is provided by the Canadian Forces Training System, which comes directly under National Defence Headquarters.)

Finally, the command's **Air Reserve Group** administers seven reserve squadrons and augmentation flights with a total of 950 personnel. The men and women of most of these units train with active-duty squadrons.

A Look Ahead

Air Command will complete reequipping its fighter squadrons with CF-18s in about two years. After that, it can look forward to a period of relative stability in its fighter force for many years. The CF-18 will remain in the inventory well into the next century, probably with some updating of its electronic components in line with the growth of Warsaw Pact air defenses. To retain its present attack capabilities, it may eventually need an improved all-weather attack system and a relatively long-range launch-and-leave air-to-ground missile, but General McNaughton sees no need to replace the CRV-7 air-to-ground rocket in the near future. As the CF-5s phase out of operational squadrons, the air force will be left with no tactical reconnaissance capability. If tac recce should prove to be essential, it could be provided with reconnaissance pods fitted to some CF-18s.

When the conversion program is completed, Canada will have seven operational CF-18 fighter squadrons and one training squadron. Two of the operational squadrons will be dedicated to continental air defense and national sovereignty roles, two will be NATO-assigned but based in Canada, and three will comprise 1 Canadian Air Group in Germany.

There is little likelihood that the government will reverse its policy barring the use of nuclear weapons by Canadian Forces. Air Command's combat units will almost certainly remain limited to conventional munitions, which somewhat reduces the deterrent value of Canadian fighters in the NATO area.

General McNaughton sums up in two phrases the

Unification of the Canadian Forces

The purpose of unification, as seen by the Canadian Government, was to reduce costs by eliminating overlap in weapons acquisition and support activities, to streamline decision-making, and to improve interservice cooperation. The process began in April 1964 with formation of an integrated armed forces headquarters. The three service chiefs, who had been members of the Chiefs of Staff Committee, were replaced by a single Chief of Defence Staff, a position now held by Gen. G. C. E. Thériault.

Through administrative decisions and the Canadian Forces Reorganization Act of 1968, the services were assigned to four new commands. The Army became Mobile Command and the Navy Maritime Command, both with some changes in internal organization. The Air Force, however, was fragmented into Air Defence and Transport Commands. Its considerable antisubmarine warfare capability was transferred to Maritime Command and its tactical aviation, including the new CF-5 fighters, to Mobile Command. These four operational commands were supported by integrated Training and Materiel Commands, both under National Defence Headquarters. (Today, logistics is administered by an Assistant Deputy Minister [Materiel]. A Communications Command serving all Canadian Forces has been added, and the Training Command became the Canadian Forces Training System. Engineering and Test Establishments also come under National Defence Headquarters.)

Unification put the members of all services in the same uniform, using the same rank designations. Group captains became colonels and pilot officers second lieutenants. The RCAF ceased to exist as an identifiable organization, along with its traditions and binding loyalties. Repercussions in all the services, particularly among airmen, were immediate and violent, with a number of senior officers quitting the service.

It soon became apparent that while there might be economies to be realized from unification, it also had serious flaws, most notably in the case of aviation. Fragmentation of the air arm ignored the lesson of World War II that to capitalize on airpower's flexibility, it must be centrally controlled. There also was no single source of air doctrine or standardization and no focus of leadership.

In 1975, a major step was taken toward recentralizing airpower with the formation of Air Command, responsible for training and supporting all air activities of the Canadian Forces. The command has undergone organizational changes in the ensuing years, the most important being the establishment of Fighter Group in 1982, bringing air defense and territorial surveillance (formerly the responsibility of Air Defence Group) and tactical aviation under one commander. This is particularly important as Air Command equips its combat units with a modern multirole fighter.

Recently, airmen and sailors have been authorized distinctive uniforms, though not preunification style, but airmen still use the same rank designations as their army counterparts.

In its report of March 1980, a task force that had been appointed to review unification found it difficult to document in detail the degree to which the original goals had been achieved. However, organizational, operating, and policy modifications have resolved many of the early problems inherent in any drastic reorganization. The evolutionary trend has been in the direction of a more traditional defense structure, but there appears to be no strong impetus for a return to the pre-1964 status.

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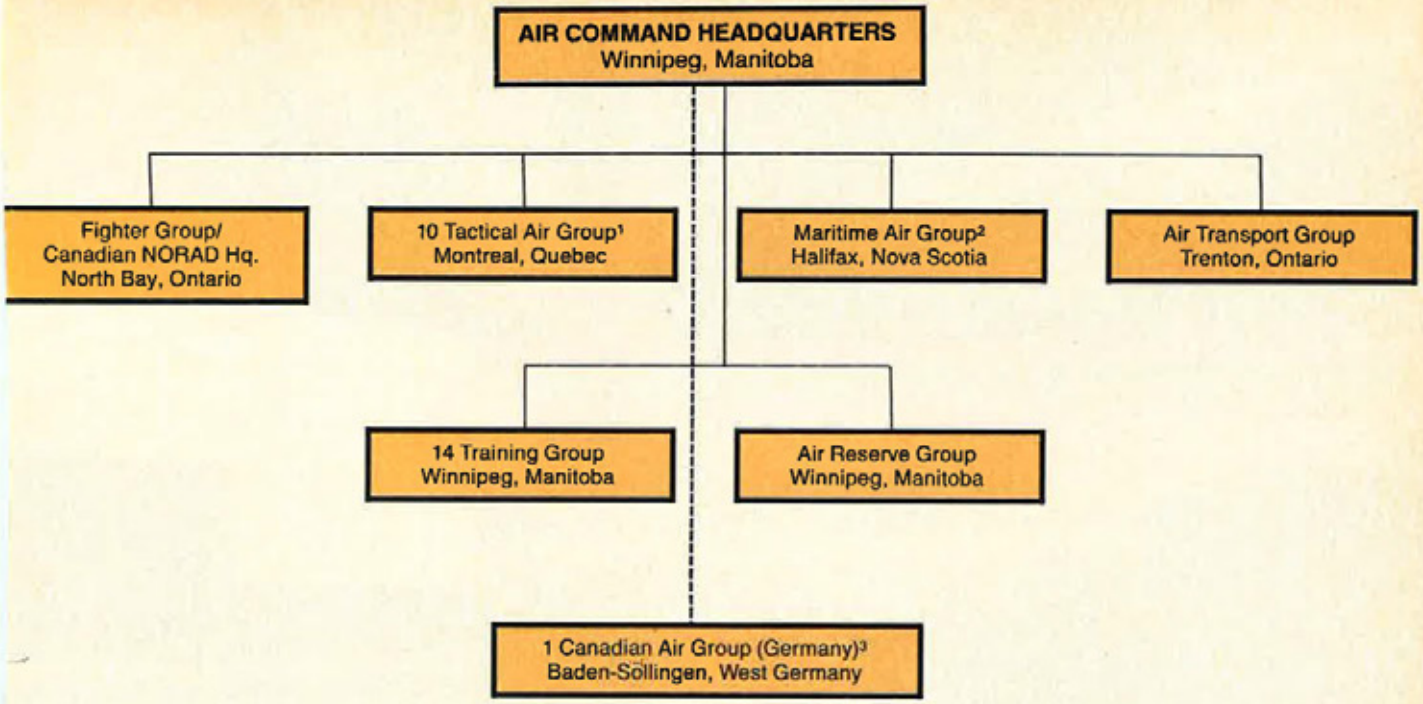

[1] Under the operational control of Mobile Command.

[2] Under the operational control of Maritime Command.

[3] Part of Canadian Forces Europe, which reports to National Defence Headquarters, Ottawa. The Air Group is under the operational control of NATO's Fourth Allied Tactical Air Force.

remaining major problems confronting Air Command: "shortage of aircraft" and "aging fleets." The small helicopter force of 10 Tactical Air Group has only a limited capability for troop and supply lift in the battle area and for Canada's peacekeeping role under the United Nations. More and newer helicopters are needed.

In the next few years, Maritime Air Group will have to replace its CH-124 ASW helicopters, now approaching a quarter century of service, and its CP-121 fixed-wing patrol planes, a design that goes back to the early 1950s. The CP-140 long-range patrol/ASW planes are new and should last for twenty years or more, but there are not enough of them to patrol Canada's vast continental and maritime areas adequately.

The life of Air Transport Group's CC-130s is being extended to at least the mid-1990s by replacing outer wings, but the force is too small to meet fully Canada's internal and external commitments. The group's tanker capacity of only two modified Boeing 707s seems marginal for rapid deployment of reinforcements to the NATO area.

Overall, however, the Canadian air force is achieving the best operational posture it has enjoyed in many years. Barring a major international crisis, there is no early requirement for new equipment expenditures on the scale of the CF-18 buy. That is fortunate, for Canada's defense budget is being strained by the modernization demands of the other services as well, the most expensive being a multibillion-dollar program to replace six of Maritime Command's frigates and to update other vessels. The country now is paying for the years when its defense forces were neglected by the government of Prime Minister Pierre Trudeau, who was in office, with one brief interlude, from 1968 to 1984.

Across-the-board modernization of the services is no light task when Canada's per capita national debt is higher than that of the US and is accompanied by serious inflation and ten percent unemployment. But despite the parallel and legitimate demands of extensive social service programs, which few Canadians would be willing to curtail, Canada has been meeting its commitment to an annual real increase of three percent in defense expenditures, though no dramatic increase in the percentage of GNP devoted to defense appears to be in the cards.

Even so, by the end of this decade, Canada's small air force will be, in terms of fighter aircraft at least, on a par qualitatively with any nation. In terms of professionalism, it is, and will continue to be, among the world's best. ■

John L. Frisbee was Editor of AIR FORCE *Magazine from December 1969 until June 1980. During a distinguished Air Force career, from which he retired as a colonel, he served as fighter and bomber pilot, a planner on the Air Staff and at major commands, and as a teacher at West Point and the Air Force Academy. He served also as special assistant to the Secretary of the Air Force and holds bachelor's degrees in economics and Latin American studies and a master's in international relations. Mr. Frisbee is a graduate of the Armed Forces Staff College and the Canadian National Defence College. His "Valor" series is a regular monthly feature of this magazine.*

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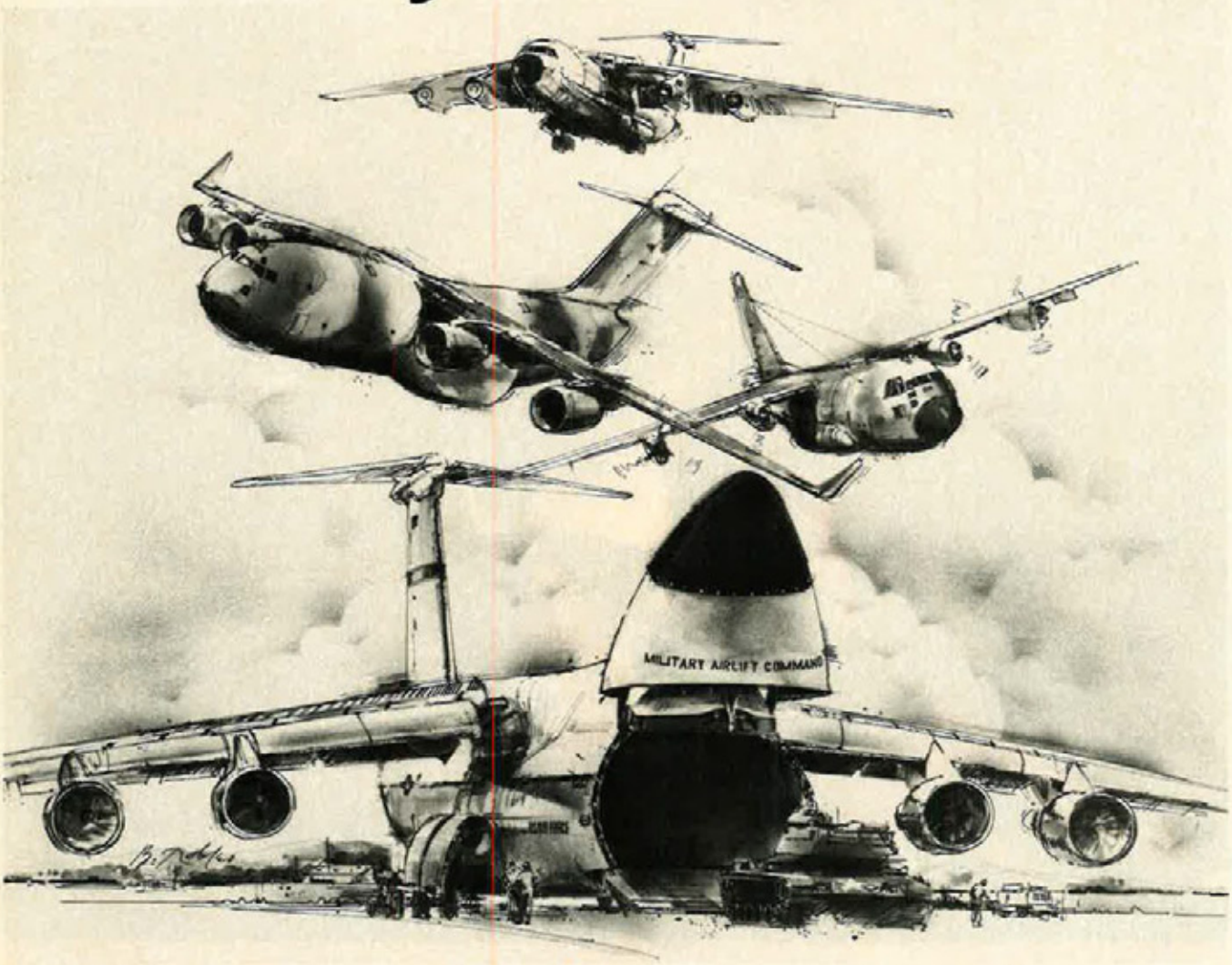

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Senator Wilson says that the SICBM should be a larger missile with three warheads.

The Case For a Bigger Midgetman

BY BRIAN GREEN
AFA DIRECTOR OF LEGISLATIVE RESEARCH

SEN. Pete Wilson (R-Calif.), an influential member of the Senate Armed Services Committee, is a man with clear—and sometimes controversial—views concerning the US strategic arsenal. In a recent interview with AIR FORCE Magazine, he explained his strong advocacy of the Strategic Defense Initiative (SDI) and his serious reservations about the current configuration of the Small ICBM (SICBM, also known as Midgetman).

Senator Wilson faults Congress for failing to live up to "its part of the bargain" regarding this nation's strategic missile modernization program.

His opinions about the SICBM have placed him at the center of what could be an extended debate over the best design for the missile. Congress has mandated that the missile carry only one warhead and weigh no more than 33,000 pounds. That concept was endorsed by the Scowcroft Commission Report, which recommended a three-part strategy to modernize the ICBM leg of the US strategic triad: the deployment of 100 MX ICBMs, arms control to limit missile throw-weight and warheads, and the development of a small, mobile ICBM to enhance stability.

According to Senator Wilson, however, "[E]ven if you accept the Scowcroft Commission [report] as . . . gospel, Congress has not lived up to its part of the bargain." Congress has limited to fifty the number of MXs to be deployed in existing Minuteman silos, and the prospects that the second fifty will be approved are, according to the Senator, "gravely in doubt." The absence of an arms-control agreement that limits warheads and the failure to approve the full MX deployment call into serious question the current design of the small missile, which, he says, is "just too small."

Senator Wilson likes the concept of mobility. He agrees that stability is promoted by survivability of strategic forces and that survivability, in turn, is enhanced by mobility. Without arms-control limits on warheads, however, developing a mobile single-warhead ICBM "is an enormously costly proposition" because of the sheer numbers needed to achieve an adequate deterrent force.

On technical grounds, Senator Wilson parts company with many congressional supporters of the SICBM who demonstrate a "slavish adherence" to the idea that smallness equates to mobility. Senator Wilson would like to see a three-warhead missile weighing on the order of 70,000–80,000 pounds. This, he says, would entail no decrease in mobility. A missile of that size, he claims, would involve a total vehicle/missile load of 260,000 pounds (compared, according to DoD figures, to 150,000 pounds for a combination employing a 30,000-

pound missile) and would preserve all the mission capabilities of the smaller missile, including a fifty-mph on-road dash capability.

While the redesign of a hard mobile launcher able to handle a heavier missile would involve some additional expense, that cost would pale in comparison to building the additional launchers needed to carry the same number of warheads on a single-warhead missile. Senator Wilson maintains that "enormous cost savings" can thus be achieved by putting multiple warheads on the small missile.

Senator Wilson also disagrees with those who maintain that the small ICBM must carry only a single warhead because it would otherwise be strategically destabilizing. Advocates of that position maintain that a multiple-warhead small missile would be too tempting a target for the Soviets to pass up. According to the Senator, "[T]he ultimate extension of that argument is that we should arm the thing with a hand grenade."

He also says that the 33,000-pound weight limit would preclude the deployment of penetration aids designed to assure that the missile's warhead evades active Soviet ballistic missile defenses. The expected penetrability of the SICBM warhead against Soviet defenses is, according to the Senator, "shockingly low."

Senator Wilson is quick to point out that survivability of the ICBM leg of the triad can be accomplished by means other than mobility. Among these means are hardening and deception. He continues to support the deployment of the second fifty MX ICBMs, although he acknowledges that congressional supporters of doing so are a distinct minority.

While Senator Wilson strongly supports continued US modernization of its offensive deterrent forces, he states unequivocally that "it is critical that we give the highest priority to the pursuit of a defensive deterrent" through SDI. Work should proceed on all promising technologies, he believes, but there is a clear priority for antitactical ballistic missile (ATBM) development. Recent testimony before the Senate Armed Services Committee indicates that the accuracies of Soviet theater ballistic missiles have improved greatly. Armed with conventional warheads and expected to be used in conjunction with *Spetsnaz* (the Soviet special forces) and larger operational maneuver groups, these ballistic missiles constitute a serious threat to major US and NATO military assets in the opening phases of a European conflict and pose a greater risk to peace than the threat of a nuclear first strike on the US, Senator Wilson believes.

He would like to see SDI development and deployment occur in the context of dramatic reductions in offensive arms. Reductions in strategic, theater, and conventional arms should be explicitly linked, he says. Otherwise, Europe would be exposed to superior Soviet conventional capabilities, without the protection of an effective nuclear deterrent. He emphatically rejects the notion that SDI and deep arms reductions are contradictory. He points out that the goals of both are the same: mutual safety. ■

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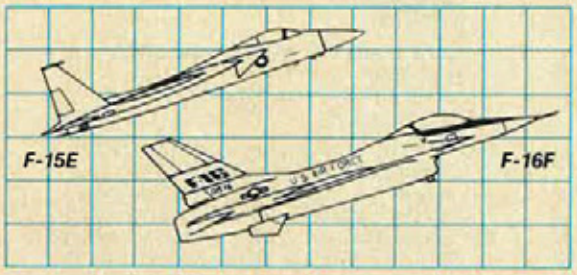

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Artist's impression of the midlife updated BAe Sea Harrier FRS. Mk 2, armed with four AMRAAM missiles

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Drawing on this experience, and taking account of future requirements, the Royal Navy selected the

improved Sea Harrier FRS. Mk 2 as the fixed-wing element of its carrier air groups into the 21st century. The initial contract, awarded by the UK Ministry of Defence in January 1985, covered the project definition phase of a midlife update of Royal Navy FRS. Mk 1s, of which 34 had been delivered by that time, with 23 more on order. Engineering will start during the current year, and weapon systems development on an HS 125 trials aircraft is scheduled to begin before the end of 1987.

Operational Sea Harrier FRS. Mk 1s will be returned to BAe for conversion from early 1988, and will re-enter squadron service one year later. Delivery of new production FRS. Mk 2s could begin in 1990.

Externally, the Mk 2 will differ from the Mk 1 in having wingtip extensions that will increase the span by 61 cm (2 ft); a less pointed nose radome; a longer rear fuselage, resulting from insertion of a 35 cm (1 ft 1¾ in) plug aft of the wing trailing-edge; and revisions of the antennae and external stores.

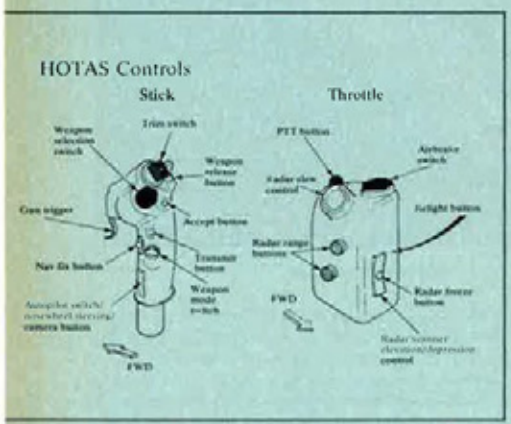
Installation of Ferranti Blue Vixen pulse-Doppler radar, instead of the original Blue Fox, will give the Sea Harrier all-weather lookdown/shootdown capability, with inherent track-while-scan, multiple target engagement, greatly increased missile launch range, enhanced surface target acquisition, and improved ECCM performance. In addition to the wide range of weapons with which the current operational Sea Harrier is compatible, the FRS. Mk 2 will be equipped to carry the new air-to-air AIM-120 AMRAAM.

Improved systems will be built around a MIL 1553B databus. This uses a dual redundant data highway, allowing computerised time sharing of information processed in the databus control and interface unit.

Redesign of the cockpit will allow presentation of the total fleet defence picture, radar picture, threat data, target priority, and navigational information on dual multi-purpose displays. All time-critical weapon systems controls will be positioned on the up-front control panel, or on the throttle and stick.

Operational efficiency will be improved by the ergonomic integration of additional switches as part of the control column and throttle handle functions. HOTAS (hands on throttle and stick) controls will provide simultaneous control of the aircraft, radar, and weapons systems without the need to operate separate controls and switches.

The Sea Harrier FRS. Mk 2 will retain two external stores pylons under each wing, an underbelly centreline pylon, and mountings under the fuselage for two 30 mm Aden or new 25 mm gun packs, or AMRAAM missile pylons. Two 455 or 864 litre (100 or 190 Imp gallon) combat drop tanks, or 1,500 litre (330 Imp gallon) ferry tanks, can be carried on the inboard underwing pylons. Alternative loadings include five free-fall or retarded 1,000 lb bombs, five cluster bombs, six Matra 115/116 packs of 68 mm rockets, eight Bofors Lepus flares, four Sidewinder, Magic, or AMRAAM air-to-air missiles, two Sea Eagle air-to-surface missiles, or two ALARM anti-radiation missiles. Other standard weapons with which the aircraft will be compatible include 250, 500, and 1,000 lb LDGP free-fall bombs, 250 and 500 lb Snakeye retarded bombs, LAU-10A, LAU-68A, and LAU-69A rocket launchers, Mk 77 fire bombs, APAM cluster/Mk 7 dispensers, Rockeye II cluster/Mk 7 dispensers, and PMBR practice bomb racks.



The HOTAS stick and throttle controls of the Sea Harrier FRS. Mk 2

With its midlife update, the Sea Harrier will receive a less pointed nose radome for the Blue Vixen pulse-Doppler radar that will replace the Blue Fox fitted to these Sea Harrier FRS. Mk 1s of 801 Naval Air Squadron *(HMS Heron)*

Typical combat profiles from a carrier fitted with a 12° ski-jump ramp, at ISA + 15°C, and with a 20 knot (37 km/h; 23 mph) wind over the deck, are as follows:

Combat air patrol: Up to 1½ hours on station at a radius of 100 nm (185 km; 115 miles), carrying four AMRAAMs, or two AMRAAMs and two 30 mm guns, plus two 190 Imp gallon combat drop tanks.

Reconnaissance: Low-level cover of 28,000 nm² (96,000 km²) at a radius of 525 nm (970 km; 600 miles) from the ship, with outward and return flights at medium/high level, carrying two 30 mm guns and two 190 Imp gallon combat drop tanks. Overall flight time 1 h 45 min.

Surface attack (hi-lo-hi): Radius of action to missile launch 200 nm (370 km; 230 miles), carrying two Sea Eagle sea skimming missiles and two 30 mm guns.

Take-off deck run for the above missions is 137 m, 107 m, and 92 m (450 ft, 350 ft, and 300 ft) respectively, with vertical landing.

The Sea Harrier's VTOL capability enables it to perform air defence missions from almost any naval or merchant ship capable of operating a helicopter. A typical deck-launched interception could be performed against a Mach 0.9 target at a radius of 116 nm (215 km; 133 miles), or a Mach 1.3 target at 95 nm (175 km; 109 miles), after initial radar detection of the approaching target at a range of 230 nm (425 km; 265 miles), with the Sea Harrier at 2 min alert status, carrying two AMRAAM missiles.

The general description of the Sea Harrier FRS. Mk 1 in the current edition of *Jane's* applies also to the FRS. Mk 2.

DIMENSIONS, EXTERNAL:

Wing span	8.31 m (27 ft 3 in)
Length overall	14.10 m (46 ft 3 in)
Length, nosecone folded	13.16 m (43 ft 2 in)
Height overall	3.71 m (12 ft 2 in)

HILLER

HILLER HELICOPTERS (Subsidiary of Rogerson Aircraft Corporation): William R. Fairchild International Airport, Port Angeles, Washington 98362, USA

HILLER RH-1100

The original Hiller FH-1100 was a refined civil development of the OH-5A helicopter, which the former Hiller Aircraft Company designed for the US Army's LOH (Light Observation Helicopter) competition. A total of 246 FH-1100s had been built when production ended in 1974.

The current, improved, RH-1100 production version has a more powerful engine and main rotor blades of 76 mm (3 in) greater chord, together with a larger diameter tail rotor and a new drive coupling between the engine and the main rotor transmission, to allow operation at higher gross weight and increased maximum speed.

In early 1985 Hiller announced a multi-mission variant of the helicopter, designated **RH-1100M Hornet**, the prototype of which made its public debut at the Paris Air Show in June 1985. The RH-1100M can carry interchangeable weapons systems including two 2.75 in folding fin rocket pods, 7.62 mm machine-guns, 0.50 calibre machine-guns, and four TOW missiles, the weapons being mounted on stub wings on each side of the engine compartment. The RH-1100M has provision for an autopilot, forward-looking infra-red anti-missile warning systems, air-to-air missile system capability, and chin or roof mounted sight. Hiller believes the RH-1100M's primary markets would be in Africa, parts of Asia, and South America. The RH-1100M could be available for customer delivery about 18 months from initial orders.

The following description applies to the standard civil RH-1100 except where indicated:

TYPE: Five-seat utility helicopter.

ROTOR SYSTEM: Two-blade semi-rigid main rotor of all-metal construction. Blade section NACA 63₂015. Each blade attached to rotor head by single main retention bolt and drag link. Droop stops standard. The main rotor blades each have a rolled stainless steel leading-edge spar bonded to an aluminium trailing-edge section with a honeycomb core. Two-blade tail rotor of stainless steel and honeycomb construction. Main rotor blades fold. Rotor brake optional. Electrically controlled trim system.

ROTOR DRIVE: Mechanical drive through single-stage bevel and two-stage planetary main transmission, with intermediate and tail rotor gearboxes. Main rotor/engine rpm ratio 1:16·30. Tail rotor/engine rpm ratio 1:2·47.

FUSELAGE: Aluminium alloy semi-monocoque structure of pod and boom type.

TAIL UNIT: Vertical fin, and fixed horizontal surface, both of aluminium alloy and honeycomb construction. Tubular guard to protect rotor in tail-down landing.

LANDING GEAR: Skid type with torsion tube suspension, with choice of standard or extended

support struts. Extended struts necessary if optional inflatable float installation is required. Ground handling wheels standard.

POWER PLANT: One 313 kW (420 shp) Allison 250-C20B turboshaft engine, derated to 204 kW (274 shp). Single bladder fuel tank in bottom of centre fuselage with usable capacity of 259 litres (68.5 US gallons). Refuelling point on starboard side of rear fuselage. Oil capacity 2.6 litres (0.7 US gallons).

ACCOMMODATION: Pilot and co-pilot side by side with three passengers to rear, or pilot and four passengers. Four forward hinged doors, two on each side of cabin, with removable centre door post for cargo loading. Dual internal stretcher kit optional. Baggage compartment to rear of cabin, capacity 0.30 m³ (10.5 cu ft). Accommodation ventilated. Cabin heater and windscreen defroster optional.

SYSTEMS: Hydraulic system for cyclic and collective pitch controls. Electrical system includes a 28V 60A DC starter/generator and nickel-cadmium battery.

AVIONICS: A range of nav/com systems is available to customer's requirements.

EQUIPMENT: Standard equipment includes clock, engine hour meter, outside air temperature gauge, fuel filter warning system, night lighting system including two rotating beacons, edge-lit instrument panel, seatbelts, shoulder harness on front seats, sliding rear windows, tinted windows, hardpoint for optional external cargo hook, external power socket, and choice of exterior paint scheme and interior trim. Optional equipment includes stability augmentation system, dual controls, rear seat shoulder harness, cabin fire extinguisher, first aid kit, strobe lights, engine auto relight, reverse scoop intake, heated pitot, loudspeaker/siren, quick-release cargo hook, cargo racks, ambulance kit, dual litter kit, searchlight, and Simplex agricultural spraygear.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.80 m (35 ft 5 in)
Tail rotor diameter	1.83 m (6 ft 0 in)
Distance between rotor centres	6.29 m (20 ft 7½ in)
Main rotor blade chord	0.33 m (13 in)
Length overall, rotors turning	12.57 m (41 ft 3 in)
Length of fuselage	9.08 m (29 ft 9½ in)
Width, rotors folded	1.32 m (4 ft 4 in)
Height overall	2.83 m (9 ft 3½ in)
Skid track	2.20 m (7 ft 2⅛ in)

AREAS:

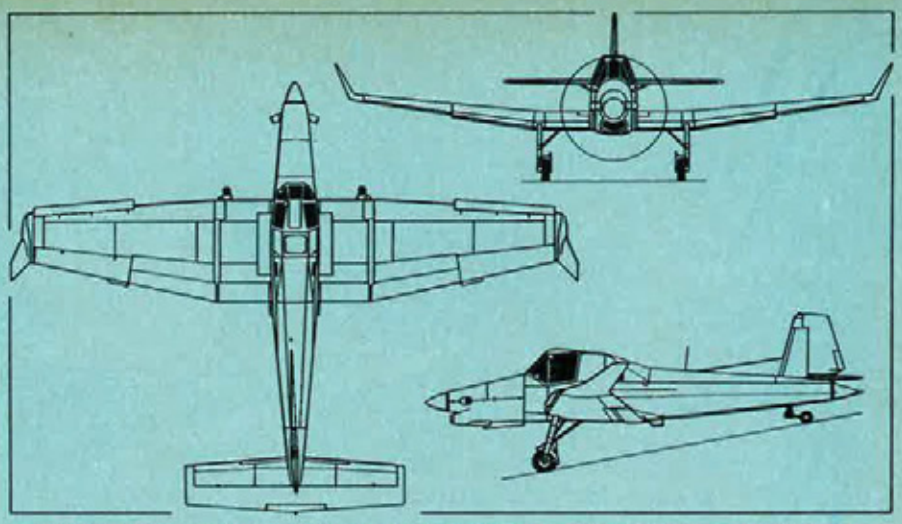
Main rotor disc	91.0 m² (979 sq ft)
Tail rotor disc	2.63 m² (28.3 sq ft)

WEIGHTS (A: RH-1100; B: RH-1100M):

Weight empty: A	687 kg (1,515 lb)
B (TOW)	1,048 kg (2,310 lb)
B (Scout)	726 kg (1,600 lb)
Max payload: A	462 kg (1,020 lb)
Max standard fuel weight: A, B	200.5 kg (442 lb)
Max T-O weight: A	1,292 kg (2,850 lb)
B	1,406 kg (3,100 lb)

PERFORMANCE (at max T-O weight, A and B as above):

Max level speed at S/L:	
A, B	110 knots (204 km/h; 127 mph)
Max cruising speed at 1,525 m (5,000 ft):	
A	110 knots (204 km/h; 127 mph)
Econ cruising speed:	
A	106 knots (196 km/h; 122 mph)
Max rate of climb at S/L	488 m (1,600 ft)/min
Vertical rate of climb at S/L:	
A	244 m (800 ft)/min
Service ceiling: A	5,275 m (17,300 ft)
Hovering ceiling: IGE: A	5,180 m (17,000 ft)
OGE: A	3,650 m (12,000 ft)
Range at 1,525 m (5,000 ft) with max fuel, no reserves:	
A	340 nm (629 km; 391 miles)
B (Scout)	534 nm (990 km; 615 miles)
Max endurance at 1,525 m (5,000 ft), no reserves:	
A	3 h 24 min
B	5 h 0 min



Zlin Z 37T Agro Turbo agricultural aircraft (Motorlet M 601 Z turboprop engine) *(Pilot Press)*

ZLIN

MORAVAN NÁRODNÍ PODNIK (Zlin Aircraft Moravan National Corporation): 76581 Otrokovice, Czechoslovakia

ZLIN Z 37T AGRO TURBO

The piston engined Z-37A Čmelák (Bumblebee) radial engined agricultural aircraft, of which more than 700 were built by the Let (651 plus 26 two-seaters) and Moravan factories, was last described in the 1976–77 *Jane's*. Let then built an XZ-37T prototype (OK-146) of a turboprop version, powered by a 515 kW (691 shp) Walter M 601 B engine, which flew for the first time on 6 September 1981. Brief details of this prototype appeared in the 1982–83 *Jane's*.

In 1982 Moravan began the design and construction of a lower powered turbine engined version known as the Z 37T. Two prototypes of this version were built initially (OK-072 and OK-074), making their first flights on 12 July and 29 December 1983 respectively; a third was completed in 1985. Known as the Agro Turbo, the Z 37T received BCAR Section K certification in 1984, and production began in the following year, the first production aircraft being delivered in mid-1985 to Slov-Air for operational trials.

Moravan plans to build the Z 37T at an initial rate of 60 a year, and expects that at least 500 will be manufactured eventually. Exports to other Comecon countries were expected to begin during the first half of 1986.

TYPE: Single/two-seat agricultural aircraft.

WINGS: Cantilever low-wing monoplane. Wing section NACA 33015 at root, NACA 44012A at tip. Dihedral (outer panels only) 7°. Incidence 3° at root, 0° at tip. All-metal single-spar structure, with auxiliary rear spar, comprising centre-section, built integrally with fuselage, plus two outer panels. Linen covered duralumin ailerons, each with ground adjustable tab. All-metal duralumin skinned double-slotted trailing-edge flaps. Leading-edge fixed slats. Upward/outward canted winglet at each tip.

FUSELAGE: Welded steel tube structure, with part-metal, part-linen covering.

TAIL UNIT: Cantilever all-metal two-spar structure. Elevator aerodynamically and mass balanced. Trim tabs in rudder and centre of elevator, latter controlled from cockpit.

LANDING GEAR: Non-retractable tailwheel type, with Technometra oleo-pneumatic mainwheel shock absorbers, Moravan light alloy wheels, and Barum tyres. Mainwheel tyres size 556 × 163 × 254 mm, tailwheel tyre size 290 × 110 mm; pressure 3.45 bars (50 lb/sq in) on all units. Moravan hydraulic brakes on mainwheels.

POWER PLANT: One 360 kW (483 shp) Motorlet M 601 Z turboprop engine, driving an Avia VJ7-508Z three-blade constant-speed propeller. Two metal fuel tanks in wing centre-section, combined capacity 350 litres (77 Imp gallons; 92.5 US gallons). Fuel can be transported to distant airstrips in four auxiliary tanks with a combined capacity of 500 litres (110 Imp gallons; 132 US gallons). Gravity refuelling point in top of each wing. Oil capacity 7 litres (1.5 Imp gallons; 1.85 US gallons). Air intake filter.

ACCOMMODATION: Pilot in enclosed cockpit, with forward opening window/door on starboard side. Auxiliary seat to rear for one passenger (mechanic or loader). Cockpit heated, and provided with filtered fresh air intake, contoured seat with headrest, rearview mirror, and windscreen wiper. Door can be jettisoned in an emergency. Two-

Armament of the Hiller RH-1100M Hornet includes four TOW anti-armour missiles, with nose-mounted sight and sensors

Zlin Z 37T Agro Turbo in dusting configuration

seat training version under development.

SYSTEMS: Pneumatic system of 50 bars (725 lb/sq in) pressure, reduced to 30 bars (435 lb/sq in) for agricultural equipment and flaps. Electrical power supplied by 28V 5.6kW DC starter/generator.

AVIONICS AND EQUIPMENT: LUN 3524 VHF radio standard. Hopper/tank capacity (max) 1,000 litres (220 Imp gallons; 264 US gallons) of liquid or 900 kg (1,984 lb) of dry chemical. Distribution system for both liquid and dry chemicals is operated pneumatically. Steel cable cutter on windscreen and each mainwheel leg; steel deflector cable runs from tip of windscreen cable cutter to tip of fin. Windscreen washer and wiper standard. Other equipment includes gyro compass, clock, rearview mirror, second (mechanic's) seat, cockpit air-conditioning, ventilation, and heating, and anti-collision light. Can be modified for firefighting role.

DIMENSIONS, EXTERNAL:

Wing span	13.63 m (44 ft 8½ in)
Wing chord: at root	2.39 m (7 ft 10 in)
at tip	1.224 m (4 ft 0¼ in)
Wing aspect ratio	6.96
Length overall (flying attitude)	10.46 m (34 ft 4 in)
Fuselage: Max width	1.70 m (5 ft 7 in)
Height overall	3.505 m (11 ft 6 in)
Elevator span	5.294 m (17 ft 4½ in)
Wheel track	3.30 m (10 ft 10 in)
Wheelbase	6.375 m (20 ft 11 in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance (min)	0.45 m (1 ft 5¾ in)

AREAS:

Wings, gross	26.69 m² (287.3 sq ft)
Ailerons (total)	2.428 m² (26.13 sq ft)
Trailing-edge flaps (total)	4.37 m² (47.04 sq ft)
Fin	1.185 m² (12.76 sq ft)
Rudder, incl tab	1.054 m² (11.35 sq ft)
Tailplane	2.776 m² (29.88 sq ft)
Elevator, incl tab	3.008 m² (32.38 sq ft)

WEIGHTS AND LOADINGS:

Weight empty with basic agricultural equipment	1,350 kg (2,976 lb)
Max payload	900 kg (1,984 lb)
Max fuel	280 kg (617 lb)
Max T-O weight:	
ferry flights	2,260 kg (4,982 lb)
agricultural, forestry, and waterways work	2,525 kg (5,566 lb)
Max zero-fuel weight	2,250 kg (4,960 lb)
Max wing loading	89.9 kg/m² (18.41 lb/sq ft)
Max power loading	6.67 kg/kW (10.95 lb/shp)

PERFORMANCE (at 2,525 kg; 5,566 lb max T-O weight):

Never-exceed speed	153 knots (285 km/h; 177 mph)
Max level speed at 500 m (1,640 ft)	118 knots (218 km/h; 135 mph)
Max cruising speed at 500 m (1,640 ft)	105 knots (195 km/h; 121 mph)
Working speed	78–89 knots (145–165 km/h; 90–103 mph)
Stalling speed:	
flaps up	47 knots (86 km/h; 54 mph)
flaps down	40 knots (74 km/h; 46 mph)
Max rate of climb at S/L	252 m (827 ft)/min
T-O run	250 m (820 ft)
T-O to 15 m (50 ft)	460 m (1,509 ft)
Landing from 15 m (50 ft)	480 m (1,575 ft)
Landing run	200 m (656 ft)
Range with max fuel	188 nm (350 km; 217 miles)
Swath width:	
granules	35 m (115 ft)
liquid	40 m (131 ft)

BOEING

BOEING COMMERCIAL AIRPLANE COMPANY (BCAC): PO Box 3707, Seattle, Washington 98124, USA

BOEING 747-400

Boeing Commercial Airplane Company has received its first major order for the Model 747-400, an advanced long-range version of the 747-300 with a maximum take-off weight of 385,550 kg (850,000 lb). Improvements in this fourth-generation 'Jumbo' include the use of four General Electric CF6-80C2, Pratt & Whitney PW4000, or Rolls-Royce RB211-524D4D turbofan engines in the 249 kN (56,000 lb) thrust class, a two-crew digital flight deck, more flexible interior configurations, increased range, and better fuel economy.

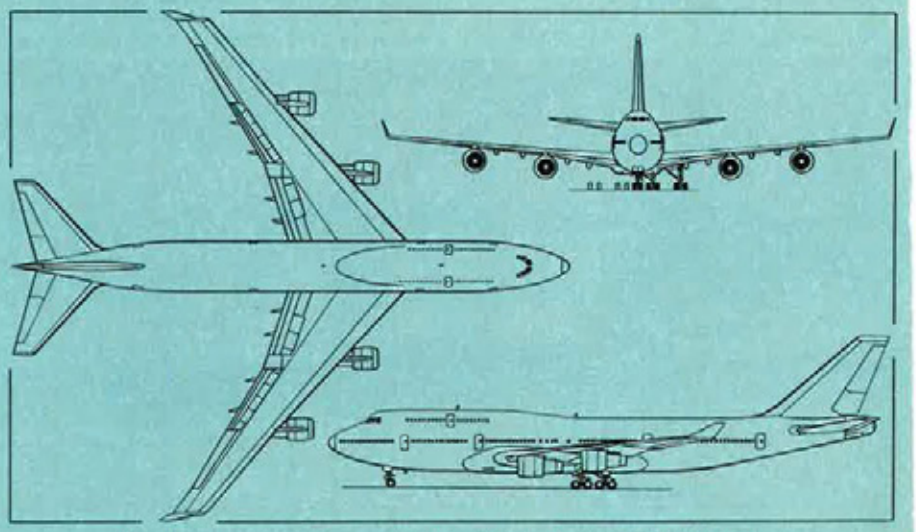
The 747-400 will utilise the extended upper deck fuselage of the 747-300. A 1.83 m (6 ft 0 in) extension will be added to each wingtip, plus a 1.83 m (6 ft 0 in) tall winglet, canted outward at an angle of 22° and swept back at 60°, the combined tip extension and winglet installation offering a likely increase in range of some three per cent. By employing in the 747-400's wing structure advanced aluminium alloys of the kind used on the Boeing 757 and 767, Boeing engineers expect to achieve a weight saving of 2,720 kg (6,000 lb). Substitution of carbon brakes for the usual steel brakes, and use of new 0.56 m (1 ft 10 in) wheels with low profile tyres, will provide a further weight saving of 816 kg (1,800 lb) in the aircraft's landing gear. The new engine nacelles and support pylons will be derived from those used on the Boeing 767.

The 747-400's flight deck is being configured for two-crew operation, with many digital avionics components identical to those in the 757 and 767. Introduction of a basic six-screen display will result in a 50 per cent reduction in the number of lights, gauges, and switches compared with the 747-300. The final arrangement may include a head-down display of fuel status on the engine indicating and crew alerting system (EICAS) CRTs rather than on overhead panels.

Improvements to the cabin area of the 747-400 will include increased overhead stowage facilities, alternative galley and toilet positions, a wireless cabin entertainment system in which audio and visual signals will be picked up from floor-mounted transmitters, and greater flexibility in interior design to permit airlines to react more quickly to changes in market requirements that demand differing mixes of first, business, and economy class seating.

A new feature of the 747-400 will be provision for carrying 11,356 litres (3,000 US gallons) of fuel in the horizontal tail surfaces, in tanks located between the front and rear spars. It will not be possible for this fuel to be transferred as a means of adjusting longitudinal trim, or maintaining an aft centre of gravity, as on the Airbus A310-300; but it will make possible a 320 nm (593 km; 368 mile) increase in range. Together with the greater fuel economy of the new-generation engines, the winglets, and structural weight savings, the additional fuel will enable the 747-400 to offer a 1,000 nm (1,850 km; 1,150 mile) increase in range over the 747-300.

Maximum range, with a payload of 412 passengers in three-class accommodation, will be in excess of 6,950 nm (12,875 km; 8,000 miles), making possible nonstop flights over routes such as London-Singapore, Los Angeles-Sydney, or Chicago-Seoul. Depending on the type of engines selected, the 747-400 is expected to burn 10–12 per cent less



Winglets and extended upper deck identify the Boeing 747-400 *(Pilot Press)*

fuel than a 747-300, and to offer reductions of 22–24 per cent in fuel burned per passenger seat compared with the 747-200.

Design go-ahead for the 747-400 was granted in July 1985. Construction of the first aircraft is scheduled to begin in mid-1986, with rollout planned for January 1988, followed by FAA certification and first customer deliveries before the end of that year. In October 1985 Northwest Airlines became launch customer for the 747-400, by placing an order for ten aircraft for delivery in 1988–90. The contract, with spares, is valued at about $1.5 billion. The Northwest aircraft will be powered by PW4000 engines, and configured for 450 passengers. They will enter service on the carrier's transpacific routes.

DIMENSIONS, EXTERNAL:

Wing span, over winglets	64.67 m (212 ft 2 in)
Length overall	70.67 m (231 ft 10¼ in)
Length of fuselage	68.63 m (225 ft 2 in)
Height overall	19.30 m (63 ft 4 in)
Tailplane span	22.17 m (72 ft 9 in)
Wheel track	11.00 m (36 ft 1 in)
Wheelbase	25.60 m (84 ft 0 in)

WEIGHTS:

Max brake release weight:	
basic	362,875 kg (800,000 lb)
optional	377,840 kg (833,000 lb) or 385,550 kg (850,000 lb)

PERFORMANCE (estimated):

Max high-speed cruise	above Mach 0.85
Range with max payload (approx 65,315 kg; 144,000 lb)	5,600 nm (10,370 km; 6,445 miles)
Range with max passenger payload (approx 39,460 kg; 87,000 lb)	7,200 nm (13,335 km; 8,285 miles)

PANAVIA

PANAVIA AIRCRAFT GmbH: 8 München 86, Postfach 860629, Arabellastrasse 16, Federal Republic of Germany

PANAVIA TORNADO ECR

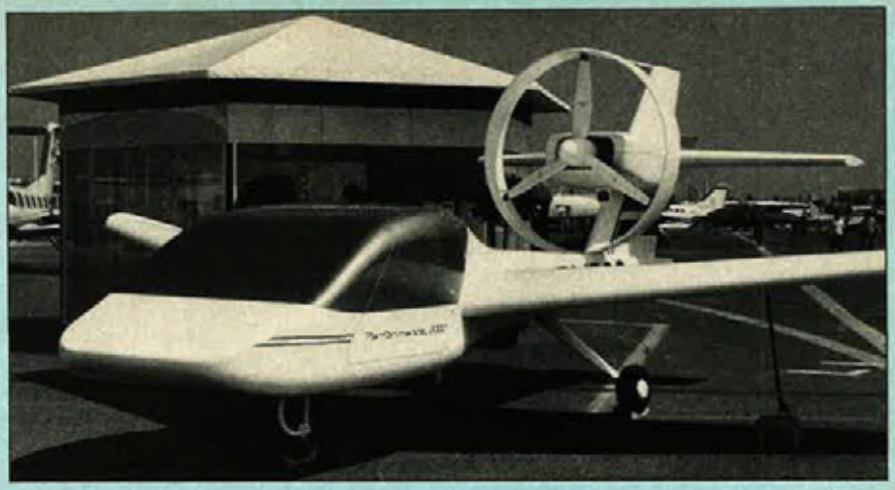
The West German armed forces have established a requirement for an ECR (electronic combat and reconnaissance) version of the interdictor/strike (IDS) Tornado, able to replace tactical reconnaissance aircraft already in operation and to complement or supersede such NATO airborne electronic warfare types as the F-4G Phantom.

To meet this requirement MBB's Military Aircraft Division has conducted a study based on the IDS Tornado, which is currently being adapted to the present threat situation in what is known as a 'first upgrade'. This involves doubling (to 128K) the computing capacity of the aircraft's central computer, installation of a digital avionics bus according to MIL 1553B, and integration of the Texas Instruments HARM anti-radar guided missile.

Retaining its air-to-surface role, the ECR Tornado is intended for standoff reconnaissance and border control, armed reconnaissance via image-forming and electronic means, electronic support, and employment of anti-radar guided missiles. For this purpose, it is to be equipped with a direction-finding system for ground based radar installations (emitter locator); built-in infra-red sensors (IRLS, possibly FLIR); onboard systems for processing, storing, and transmitting reconnaissance data; and advanced tactical displays for the pilot and weapons officer. The external load stations on fuselage and wings may be used in ECR or fighter-bomber missions, or a combination of both.

A HARM-equipped Tornado began flight testing in the second half of 1985, following the first flight of ALARM on a Tornado, made on 13 February 1985. The ECR version could typically be configured to carry HARMs or ALARMs and Sidewinders on the inboard wing stations, with an ECM pod (starboard) and chaff/flare dispenser (port) on the outboard pylons. Additional HARMs, or Kormoran anti-ship missiles, could be carried on the underfuselage stations.

The current Luftwaffe requirement is for 40 ECR Tornados, additional to the 212 IDS aircraft ordered to date.



Mockup of Cagny Performance 2000 three-seat trainer *(Brian M. Service)*

CAGNY

RAYMOND DE CAGNY: 5 Square des Bégonias, 91370 Verrières le Buisson, France

M de Cagny is developing a unique side by side three-seat light aircraft, which was first displayed in the form of a full scale mockup at the 1985 Paris Air Show.

CAGNY PERFORMANCE 2000

The design of this all-composites light aircraft was based on the results of a survey carried out among flying clubs in France and overseas. Answers to two of the questions showed a general preference for an Avco Lycoming engine and a three-seat cabin. M Cagny decided to place the three seats of his Performance 2000 side by side, so that the third occupant would share the excellent field of view of the pilots and, being aware of their actions during flying training, might be encouraged to become a pupil pilot.

Current high costs of flying training are expected to be reduced in the Performance 2000 by use of sturdy but lightweight composites, which offer a smooth surface finish, minimal maintenance requirements, easy replacement, and long service life. Positioning of the engine on the fin leading-edge reduces cabin noise, while the shrouded propeller eliminates danger for those around the aircraft on the ground.

First flight of the prototype Performance 2000 is scheduled for December of this year. Its construction is being financed by the Nord Pas-de-Calais regional council.

TYPE: Three-seat light training aircraft.

WINGS: Cantilever mid-wing monoplane. Dihedral and sweepback constant from roots, except for inboard trailing-edges, which are unswept. All-composites structure with slightly upswept tips. Inset aileron in each outer wing panel; trailing-edge flap in each inboard panel. Wings easily removable.

FUSELAGE: All-composites semi-monocoque structure of pod and boom form. Retractable steps.

TAIL UNIT: Cantilever all-composites structure, with sweepback on all surfaces. Tailplane mid-mounted on fin. Elevators and two-section rudder. Shallow ventral fin/bumper on each bottom edge of tailboom.

LANDING GEAR: Non-retractable tricycle type, with single wheel on each unit. Cantilever main units with composite spring legs. Disc brakes on mainwheels.

POWER PLANT: One 80 kW (108 hp) Avco Lycoming O-235 flat-four engine, mounted on leading-edge of fin and driving a shrouded three-blade tractor propeller. Shroud braced from fin-tip leading-edge. Provision for alternative engines. One fuel tank, capacity 75 litres (16.5 Imp gallons).

ACCOMMODATION: Three seats side by side in fully enclosed and soundproofed cabin. Seats of semi-reclining type. Baggage hold aft of seats. Access to cabin by means of a downward hinged door. Large wraparound windscreen and canopy, each in one piece. Cabin heated and ventilated.

DIMENSIONS, EXTERNAL:

Wing span	8.60 m (28 ft 2½ in)
Length overall	6.80 m (22 ft 3¼ in)

MBB artist's impression of ECR Tornado in German Navy insignia, with Kormoran anti-ship missiles under the fuselage, HARM missiles underwing (inboard), and outboard pylons occupied by a chaff/flare dispenser (port) and ECM pod (starboard)

Height overall	2.80 m (9 ft 2¼ in)
Wheel track	1.80 m (5 ft 11 in)
Wheelbase	2.80 m (9 ft 2¼ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.80 m (5 ft 11 in)
Max width	1.54 m (5 ft 0½ in)
Max height	1.04 m (3 ft 5 in)
AREA:	
Wings, gross	10.80 m² (116.3 sq ft)
WEIGHTS AND LOADINGS (estimated):	
Weight empty	375 kg (827 lb)
Max baggage	20 kg (44 lb)
Max T-O weight	665 kg (1,466 lb)
Max wing loading	61.6 kg/m² (12.6 lb/sq ft)
Max power loading	8.31 kg/kW (13.6 lb/hp)
PERFORMANCE (estimated):	
Max level speed	118 knots (220 km/h; 136 mph)
Cruising speed (75% power)	110 knots (205 km/h; 127 mph)
Stalling speed:	
flaps up	46 knots (85 km/h; 53 mph)
flaps down	38 knots (70 km/h; 44 mph)
Max rate of climb at S/L	210 m (690 ft)/min
Service ceiling	4,000 m (13,125 ft)
T-O run	350 m (1,150 ft)
Landing run	160 m (525 ft)
Range with max fuel	432 nm (800 km; 497 miles)

BELL

BELL HELICOPTER CANADA: Suite 460, 3100 Cote Vertu, St Laurent, Quebec H4R 2J8, Canada

The seven-seat Model 400 TwinRanger was announced in February 1983 as the first in a new family of commercial and military single- and twin-engined helicopters on which Bell Helicopter Textron of the USA had been working for the previous three years. On 7 October that year the Canadian government announced the signing of a memorandum of understanding under which Bell had been selected to establish a helicopter industry in Canada, which is the second largest user of helicopters outside the Soviet bloc. A formal contract for this programme, valued at approximately US $210 million in 1982 dollars, was confirmed in January 1984.

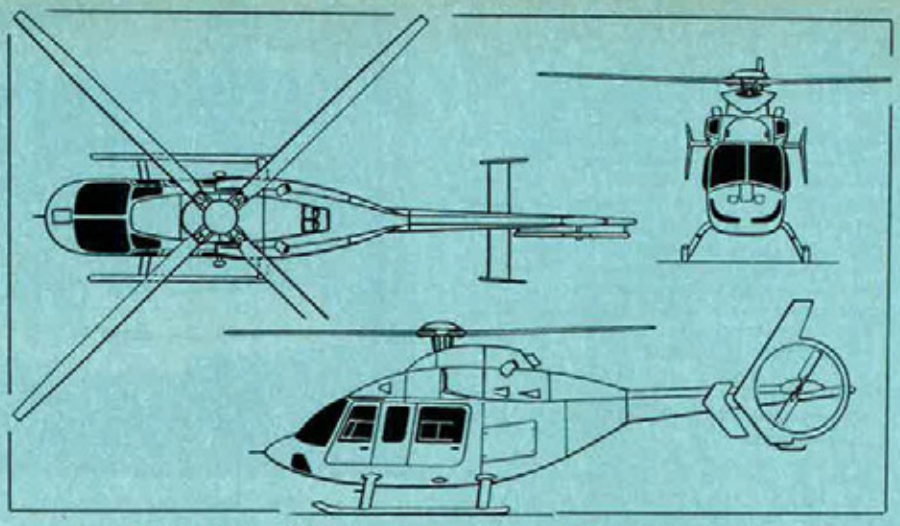
Construction began later that year of a new 34,560 m² (372,000 sq ft) facility at Mirabel, Quebec, some 32 km (20 miles) from Montreal. This new plant opened in late 1985, and is expected to have a workforce of about 600 people by the end of 1986. Eventually, Bell's Canadian facility will also manufacture the Model 400A TwinRanger, with Pratt & Whitney Canada PW209T turboshaft engines, and the Model 440, which will employ major components manufactured from composite materials.

BELL MODEL 400 TWINRANGER

Features of the Model 400 include Bell's four-blade 'soft-in-plane' main rotor with composite blades and hub, a Ring Guard tail rotor, an advanced technology transmission and drive system with 'run-dry' capability, and twin Allison 250-C20R turboshaft engines mated to a combining gearbox. Flight testing of the dynamic components, which are similar to those of the military Model 406 (OH-58D), began in March 1983 using a modified LongRanger (Model 406LM, registered N206N), and testing was completed later that year. Results achieved with this aerodynamic test prototype, and wind tunnel testing with a one-quarter scale model, enabled Bell to define 95 per cent of the Model 400's configuration by the time of the January 1984 contract.

Construction of the first true Model 400 prototype began on 24 October 1983, and this made its first flight on 30 June 1984. During flight trials it exceeded Canadian government contractual requirements (forward speed of 100 knots; 185 km/h; 115 mph and sideways/rearward speed of 20 knots; 37 km/h; 23 mph), and was subsequently designated to serve as the ground test vehicle. Meanwhile, on 1 June 1984 Bell began building three pre-production Model 400s, the first two of which are being used in the type certification programme; these made their first flights in May and on 26 June 1985. The third pre-production TwinRanger, which flew a few weeks later, is a dedicated demonstration aircraft.

Certification of the TwinRanger by both the FAA (to FAR Pt 27, Normal category) and the Canadian Ministry of Transport is scheduled for late 1986, with deliveries starting immediately afterwards. The standard Model 400 will be FAA certificated for VFR operation; separate configurations will be available that conform to CAA VFR, and FAA or CAA IFR. Initially the rotor heads, rotor blades, transmission, and other complex components are being manufactured at Fort Worth and shipped to Mirabel, which builds the rest of the airframe and is responsible for final assembly, flight testing, and delivery. Bell expects to produce 100 TwinRangers by the end of 1987, achieving an output of ten a month by the middle of that year.



Bell Model 400 TwinRanger light twin-engined helicopter *(Pilot Press)*

The initial Model 400 version is powered by Allison 250-C20R turboshaft engines. Second stage in developing the TwinRanger family will be the Model 400A, due to fly in 1987 and become available in 1988. This will be powered by the 699 kW (937 shp) PW209T twin-turbine engine currently being developed by Pratt & Whitney Canada Ltd. From this, in turn, Bell Canada will develop the Model 440, which will feature a high level of composite materials in its construction. The 440 is planned to fly in late 1988 and become available to customers in 1989. Military derivatives of all three types are expected to be developed.

The following description applies to the Model 400, except where indicated:

TYPE: Seven-seat twin-engined light helicopter.

ROTOR SYSTEM: Four-blade 'soft-in-plane' main rotor and two-blade tail rotor. Each main blade has a high-lift aerofoil section inboard and a high-speed section outboard. Blades are of composite construction, comprising a corrosion resistant Nomex core encased in machine wound glassfibre, strengthened by two upper and two lower filament wound straps, and are interchangeable. Replaceable tip caps are of electroplated nickel. Tail rotor blades are of similar construction. Each main blade has a metal tab at approx 70 per cent radius, and an abrasion protection strip on its leading-edge. Two of the main rotor blades can be folded manually; a rotor brake is optional. Lightweight, advanced composites flex-beam hub has elastomeric bearings and, for each main rotor blade, a one-piece glassfibre yoke to which the blade is attached by two bolts (one quick-release) in a clevis type grip, providing redundant blade retention. Three-degree flapping action is built in, and system requires no lubrication.

ROTOR DRIVE: Transmission is rated at 429 kW (575 shp) for T-O and max continuous operation, and has a 30 min 'run-dry' capability. It is of conventional construction (steel gears in aluminium and magnesium casings), and embodies a liquid inertia vibration eliminator system (LIVE) mounted on the main rotor pylon to absorb rotor vibration. Both engines drive into a combining gearbox that has a rating of 529.5 kW (710 shp) with both engines operating or 343 kW (460 shp) with one engine only. Kaflex greaseless driveshaft for main rotor is driven via main rotor gearbox having one spiral bevel and one single-stage planetary reduction gear. Tail rotor driven via four interchangeable driveshaft sections and a 90° gearbox with a single spiral bevel reduction gear. Four single-system powered actuators (two cyclic, one collective, and one directional). Main rotor/engine rpm ratio 0.0639:1, tail rotor/engine rpm ratio 0.4215:1.

FUSELAGE: Fail-safe semi-monocoque cabin structure, comprising roof beam, skin/stringer and

Pre-production Model 400 TwinRanger in flight test configuration

honeycomb panels (mainly of conventional aluminium alloys, with some glassfibre and graphite epoxy). Tailboom is an aluminium alloy/honeycomb sandwich monocoque.

TAIL UNIT: Non-moving horizontal stabiliser with small, sweptback (arrowhead) endplate fins. Ring Guard combined fin/tail rotor guard, with small tailskid at its base.

LANDING GEAR: Skid gear, consisting of two longitudinal tubular skids connected by two arched cross-tubes. Each skid is fitted with replaceable wear shoes along bottom, a tow ring on the forward end, and four eyebolts for installation of optional ground handling wheels. Crew boarding step on front cross-tube each side; maintenance steps on rear cross-tube. Emergency flotation kit (optional) includes six skid mounted flotation bags (three each side), an inflation system consisting of a compressed nitrogen filament wound bottle, actuation valve, and associated tubes and flexible lines for gas distribution. Float inflation initiated normally by electrical actuation system energised by water immersion switches, but can also be initiated manually.

POWER PLANT (Model 400): Two Allison 250-C20R free turbine turboshaft engines, each rated at 330 kW (443 shp) for T-O and 30 min single-engine operation. Fuel in five rupture-resistant aluminium honeycomb tanks (two under cabin floor, two under rearward facing seats, and one main tank at rear of passenger compartment) with a total usable capacity of 719 litres (158 Imp gallons; 190 US gallons). Refuelling point on starboard side at rear of passenger cabin. Oil capacity 5.7 litres (1.25 Imp gallons; 1.5 US gallons) per engine. Engine anti-icing and fire detection systems standard.

POWER PLANT (Model 400A): One Pratt & Whitney Canada PW209T coupled twin-turboshaft engine, rated at 699 kW (937 shp) max for T-O. Otherwise generally as described for Model 400.

ACCOMMODATION: Foam filled seat for pilot, with in-flight adjustable lumbar support. Seating for up to six passengers: one beside pilot, two rearward facing, and three forward facing in main cabin. Dual controls optional. Crew door and passenger door on each side; between these, on port side, is an additional door that, when opened with passenger door, provides a wider opening for stretcher or cargo loading. Two stretchers and an intensive care team can be carried in ambulance role; all main cabin seats are removable for cargo operation. Tinted acrylic transparencies, those in doors being openable. Baggage compartment aft of passenger cabin, with external access via door on port side. Entire accommodation heated, ventilated, and optionally air-conditioned. Demisting for cockpit and cabin windows.

SYSTEMS: STC approved vapour cycle air-conditioning system optional. Hydraulic system (nominal pressure 69 bars; 1,000 lb/sq in) for cyclic, collective, and directional control actuation. Electrical system powered by two 160A engine driven starter/generators and a heavy duty 17Ah nickel-cadmium battery. Nitrogen bottle, pressurised at 207 bars (3,000 lb/sq in), for inflation of emergency flotation bags when fitted.

AVIONICS AND EQUIPMENT: Aircraft is provided with landing lights, position lights, strobe light, instrument lighting, and polyurethane exterior paint finish as standard. Flight instruments are conventional, but engine instruments are mounted in a new, solid state, liquid crystal display offering greater reliability. A priority panel warning system can display, in words, up to six hazards in appropriate order of urgency. To these can be added an electrical system controller developed and produced by VDO of West Germany. Interfaced with the engine starting system, this can monitor electrical power distribution and record, in a diagnostic memory bank, all data required for maintenance following a component failure.

Many FAA approved kits of avionics and equipment, already available for other Bell helicopters, are available as options on the Model 400. These include King Silver Crown VHF radio (KX 155 transceiver and KMA 24H audio); King navigation equipment (KN 153 VOR/LOC/glideslope receiver, KR 21 marker beacon receiver, KR 87 ADF, KR 10A radio altimeter, KN 63 DME, KI 76A transponder, and KNS 81/KY 196 R/Nav); King IFR package (KMA 24H, KI 229, RMI, and two KX 165); Sperry SPZ-7000 digital AFCS with King KA 52 flight director; stability control augmentation system; dual controls; heater with automatic temperature control; freon type environmental control system; forced-air ventilation; additional soundproofing; deluxe, economy, or mesh seating; shoulder harnesses for all seats; carpet for cabin and crew area; aft cabin audio; engine particle separator, snow deflectors, and fire extinguisher; ground handling wheels; emergency flotation bags; rotor brake; stretchers (two, stowable); electric hoist; and 907 kg (2,000 lb) capacity hook for external sling load. Other optional kits, to customer's requirements, can include such items as secure voice communications, full telemetry, loudspeakers, searchlight (up to 30 million candlepower), camera windows, protective armour, and wire-cutting cables.

DIMENSIONS, EXTERNAL:

Main rotor diameter	11.28 m (37 ft 0 in)
Main rotor blade chord:	
max	0.27 m (10¼ in)
effective	0.24 m (9½ in)
Tail rotor diameter	1.57 m (5 ft 2 in)
Tail rotor blade chord (constant)	0.16 m (6.35 in)
Distance between rotor centres	6.82 m (22 ft 4⅓ in)
Length overall, rotors turning	13.39 m (43 ft 11 in)
Fuselage: Length	11.02 m (36 ft 2 in)
Max width	1.31 m (4 ft 3½ in)
Height:	
to top of rotor head	3.20 m (10 ft 6 in)
over tail fin	4.01 m (13 ft 2 in)
Ground clearance:	
fuselage (min)	0.51 m (1 ft 8 in)
tailskid	1.12 m (3 ft 8 in)
Skid track (undeflected)	2.26 m (7 ft 5 in)
Crew/passenger/stretcher doors:	
Height (all)	1.04 m (3 ft 5 in)
Width: crew	0.63 m (2 ft 1 in)
passenger	0.91 m (3 ft 0 in)
stretcher	0.37 m (1 ft 2½ in)
Height to sill (all)	0.61 m (2 ft 0 in)
Baggage door: Height	0.58 m (1 ft 11 in)
Width	0.94 m (3 ft 1 in)
Height to sill	0.69 m (2 ft 3 in)

DIMENSIONS, INTERNAL:

Cabin:	
Length: fwd	1.07 m (3 ft 6 in)
rear	1.52 m (5 ft 0 in)
Max width: fwd, rear	1.17 m (3 ft 10 in)
Max height: fwd, rear	1.14 m (3 ft 9 in)
Floor area: fwd	0.53 m² (5.7 sq ft)
rear	0.58 m² (6.2 sq ft)
Volume: fwd	1.13 m³ (40.0 cu ft)
rear	2.26 m³ (80.0 cu ft)
Baggage compartment:	
Length	1.24 m (4 ft 1 in)
Max width	1.07 m (3 ft 6 in)
Max height	0.53 m (1 ft 9 in)
Floor area	0.69 m² (7.4 sq ft)
Volume	0.57 m³ (20.0 cu ft)

AREAS:

Main rotor blades (each)	1.36 m² (14.645 sq ft)
Tail rotor blades (each)	0.13 m² (1.365 sq ft)
Main rotor disc	99.89 m² (1,075.2 sq ft)
Tail rotor disc	1.95 m² (20.97 sq ft)
Ring Guard fin	1.28 m² (13.78 sq ft)
Tailplane	1.04 m² (11.24 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty:	
400, 400A	1,427 kg (3,146 lb)
Max usable fuel:	
400, 400A	577 kg (1,272 lb)
Max payload: 400	491 kg (1,082 lb)
400A	717 kg (1,582 lb)
Max T-O and landing weight:	
400	2,495 kg (5,500 lb)
400A	2,721 kg (6,000 lb)
Max cabin floor loading:	
400, 400A	420 kg/m² (86 lb/sq ft)
Max disc loading:	
400	24.94 kg/m² (5.11 lb/sq ft)
400A	27.23 kg/m² (5.58 lb/sq ft)

PERFORMANCE (preliminary for standard Model 400. A at gross weight of 2,041 kg; 4,500 lb, B at 2,268 kg; 5,000 lb, C at max T-O weight of 2,495 kg; 5,500 lb):

Never-exceed speed	150 knots (278 km/h; 172 mph)
Max level speed at S/L:	
A	133 knots (246 km/h; 153 mph)
B	132 knots (244 km/h; 152 mph)
C	130 knots (241 km/h; 150 mph)
Operating range cruising speed, S/L to 1,220 m (4,000 ft), ISA:	
A	123 knots (228 km/h; 141 mph)
B, C	124 knots (230 km/h; 143 mph)
Cruising speed for max endurance, S/L, ISA:	
A	50 knots (92 km/h; 57 mph)
B	53 knots (98 km/h; 61 mph)
C	57 knots (105 km/h; 65 mph)
Max rate of climb at S/L, ISA:	
A	660 m (2,165 ft)/min
B	556 m (1,825 ft)/min
C	471 m (1,545 ft)/min
Service ceiling, one engine out, 30 min contingency power, ISA + 20°C:	
A	3,445 m (11,300 ft)
B	2,375 m (7,800 ft)
C	1,310 m (4,300 ft)
Hovering ceiling OGE at T-O power:	
ISA: A	5,090 m (16,700 ft)
B	4,145 m (13,600 ft)
C	3,110 m (10,200 ft)
ISA + 20°C: A	4,360 m (14,300 ft)
B	3,260 m (10,700 ft)
C	2,255 m (7,400 ft)
Operating range, 20 min reserves:	
S/L, ISA:	
A, with 537 kg (1,184 lb) of fuel	327 nm (606 km; 376 miles)
B, max fuel	356 nm (660 km; 410 miles)
C, max fuel	351 nm (650 km; 404 miles)
at 1,220 m (4,000 ft), ISA:	
A, with 537 kg (1,184 lb) of fuel	368 nm (682 km; 424 miles)
B, max fuel	397 nm (736 km; 457 miles)
C, max fuel	386 nm (715 km; 444 miles)
Max endurance (S/L, ISA), no reserves:	
A	4 h 27 min
B	4 h 41 min
C	4 h 31 min

GENERAL AVIA

GENERAL AVIA COSTRUZIONI AERONAUTICHE SRL: Via Trieste 22–24, 20096 Pioltello, Milan, Italy

General Avia was established by Dott Ing Stelio Frati in early 1970, primarily to develop prototypes of his own design for production by other companies. These have included the F15E and F15F, marketed as the Procaer Picchio, the F.20 Pegaso and F.20 TP Condor, and the F.600 Canguro transport aircraft now in production by SIAI-Marchetti as the SF.600TP. Dr Frati's latest prototype under construction is the F.1300 Jet Squalus, which is to be produced by a Belgian manufacturer.

GENERAL AVIA F.1300 JET SQUALUS

Developed as a joint venture with the Belgian company Promavia, of Charleroi Airport, the Jet Squalus is a two-seat initial, basic, and proficiency training aircraft intended for low-cost operation. Construction of a prototype was started by General Avia at the beginning of March 1985, and this is expected to make its first flight during 1986. Certification under FAR Pt 23 is planned. Production aircraft, with a Garrett F109 engine, will be marketed under the designation Promavia PF.1300.

Composite materials are used for fairings and some non-structural components; otherwise the aircraft is basically of metal construction throughout.

Lockheed-Georgia's all-black high technology testbed (HTTB) conversion of an L-100-20 Hercules

TYPE: Two-seat basic training aircraft.

WINGS: Cantilever low-wing monoplane, with GAW-2 wing section. Dihedral 5° from roots. Incidence 1° at root, −1° 30' at tip. All-metal single-spar structure in light alloy with flush riveted stressed skin. Differentially operated all-metal ailerons and hydraulically operated metal trailing-edge flaps.

FUSELAGE: All-metal semi-monocoque structure with flush riveted aluminium alloy skin. Hydraulically operated airbrake in lower central part of fuselage. Avionics and equipment bay in nose. Large quick-disconnect panel in lower rear fuselage permits rapid engine access or removal.

TAIL UNIT: Cantilever all-metal structure with flush riveted skin. Fixed incidence tailplane. Trim tab in port elevator.

LANDING GEAR: Retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Hydraulic actuation, with built-in emergency system. Nosewheel steerable 18° left and right. Mainwheels and tyres size 5.00–5. Goodyear brakes.

POWER PLANT: One 5.92 kN (1,330 lb st) Garrett F109-GA-100 turbofan engine, mounted in rear fuselage. Alternative engines include the 6.67 kN (1,500 lb st) Williams WJ-44. Semi-integral fuel tank in centre-fuselage, max usable capacity 800 litres (176 Imp gallons; 211 US gallons). Single gravity refuelling point atop fuselage. Electric fuel pump for engine starting and emergency use.

ACCOMMODATION: Side by side seats for two persons in non-pressurised air-conditioned cockpit under one-piece framed canopy that opens upward hydraulically. Provision for optional Martin-Baker Mk 11 lightweight ejection seats for both occupants, capable of operation at altitudes up to 12,190 m (40,000 ft) and at any speed between 60 and 400 knots (111–741 km/h; 69–461 mph), including ejection through canopy.

SYSTEMS: Environmental control system for cockpit air-conditioning. Hydraulic system for actuation of airbrake, landing gear, flaps, and canopy. Electrical system is 28V DC, using an engine driven starter/generator and nickel-cadmium battery.

AVIONICS AND EQUIPMENT: Basic radio and nav equipment.

DIMENSIONS, EXTERNAL:

Wing span	9.04 m (29 ft 8 in)
Wing chord: at root	1.90 m (6 ft 2¼ in)
at tip	1.00 m (3 ft 3¼ in)
mean aerodynamic	1.575 m (5 ft 2 in)
Wing aspect ratio	6.018
Length overall	9.60 m (30 ft 0½ in)
Height overall	3.60 m (11 ft 9¾ in)
Tailplane span	3.80 m (12 ft 5½ in)
Wheel track	3.60 m (11 ft 9¾ in)
Wheelbase	3.61 m (11 ft 10¼ in)

AREAS:

Wings, gross	13.58 m² (146.17 sq ft)
Vertical tail surfaces (total)	2.04 m² (21.96 sq ft)
Horizontal tail surfaces (total)	3.67 m² (39.50 sq ft)

WEIGHTS:

Weight empty, equipped	1,300 kg (2,866 lb)
Max T-O weight	2,000 kg (4,409 lb)

PERFORMANCE (estimated at max T-O weight):

Never-exceed speed	Mach 0.65 (345 knots; 638 km/h; 397 mph)
Max cruising speed	Mach 0.60 (280 knots; 518 km/h; 322 mph)
Max manoeuvring speed	210 knots (388 km/h; 241 mph)
Stalling speed, flaps down	67 knots (124 km/h; 77 mph)
Max rate of climb at S/L	853 m (2,800 ft)/min
Service ceiling	11,280 m (37,000 ft)
T-O run	396 m (1,300 ft)
Landing run	366 m (1,200 ft)
Range at 6,100 m (20,000 ft), no reserves	1,045 nm (1,936 km; 1,203 miles)
Design *g* limits	+6/−3

LOCKHEED

LOCKHEED-GEORGIA COMPANY (GELAC): 86 South Cobb Drive, Marietta, Georgia 30063, USA

LOCKHEED HTTB

Lockheed-Georgia designed and built the HTTB (high technology testbed) conversion of a commercial model L-100-20 Hercules as a platform with which to evaluate new technologies in an airborne environment. Funded through the company's internal research and development budget, and supported by some 45 participating vendor companies, it flew for the first time on 19 June 1984, and is being used for STOL flight research as well as the development of avionics subsystems. In particular, it provides Lockheed-Georgia with a vehicle in which to develop high-lift systems, advanced flight controls, cockpit displays, navigation, guidance, and en route survivability systems for future tactical airlift aircraft.

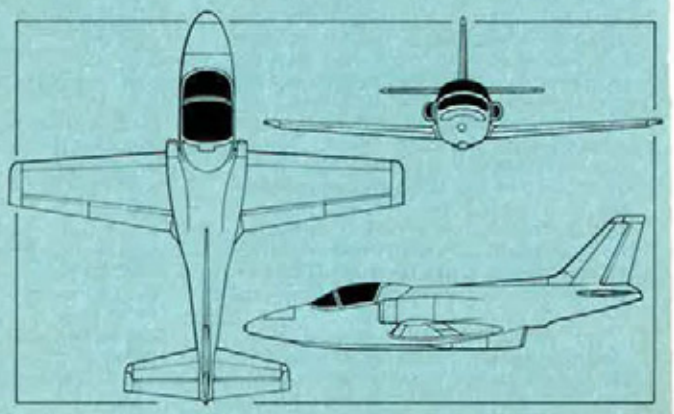
Externally apparent features of the HTTB include a long dorsal fin, similar extensions known as 'horsals' (horizontal dorsals) forward of each tailplane root, and an electrically isolated sensor boom of composite materials forward of each wingtip. Initial flight tests in 1984 established the aircraft's baseline performance and flying qualities. Then, during the first of several planned modification layups, the HTTB was fitted with a 1,000-channel data gathering, analysis, and display system known as LADS (Lockheed airborne data system). This permanent system enables engineers to run tests and evaluate data in real time aboard the aircraft. Initially, some 200 channels of data are being used. In addition to LADS, the HTTB carries in its cargo compartment a 10 m (33 ft) long mobile data centre van equipped with TV and telemetry links so that data can be analysed on the ground at remote sites.

Early HTTB test flights also verified a new electronics mission pod known as SAMSON (Special Avionics Mission Strap-On Now). This uses a Hercules external wing fuel tank, containing its own generator, to house an easily attachable special avionics package, providing the basic C-130 aircraft with special mission capability without physical modification of the airframe. Lockheed believes that the SAMSON facility will offer worldwide C-130 operators a viable low-cost electronics mission capability.

Planned modifications to the HTTB, which were due to be incorporated during 1985/86, include the installation of fully-powered flight control actuators, fast-acting double-slotted trailing-edge flaps, drooped high-camber wing leading-edges, spoilers for roll control, long-chord ailerons and rudder with servo tab, improved elevators, and high sink rate landing gear. Wind tunnel testing of a one-tenth scale model of the aircraft indicated that the planned external modifications may result in an increase in lift of up to 25 per cent. STOL experiments with the HTTB are expected to begin in 1986. On completion of the STOL modifications Lockheed intends to incorporate a number of systems improvements, including a cockpit head-up display, night vision goggles, a cockpit management system, mission computers, weather/mapping radar, FLIR, and conformal phased array low-sidelobe antennae. An underwing pod housing for FLIR and LLTV sensors will also be evaluated.

Lockheed has been awarded a contract by NASA to design and build a C-130 wing centre-section from composites materials, and hopes to obtain a contract to install and flight test the composites wing on the HTTB testbed by 1988. In addition to industry research programmes, the HTTB is being offered to university faculties and graduate students who will have opportunities to place experiments aboard the aircraft and to take part in the flight testing of their equipment.

The HTTB, which made its public debut at the 1985 Paris Air Show, achieved new FAI Class N time to height records on 5 March 1985. Taking off at a gross weight of 44,724 kg (98,600 lb), using only 427 m (1,400 ft) of runway, it climbed to 3,000 m in 3 min 59.4 sec; to 6,000 m in 9 min 19.75 sec; and to 9,000 m in 18 min 33.72 sec.



General Avia F.1300 Jet Squalus two-seat basic trainer
(Michael A. Badrocke)

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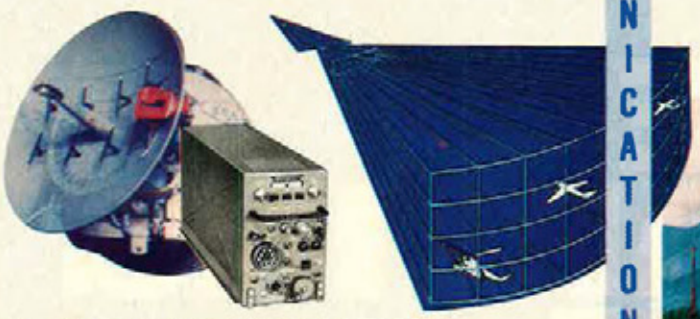

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VIEWPOINT

From the Empire to the Chunnel

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

Britain's military forces have prospered under the Thatcher government, but political uncertainties cloud the future of the UK defense posture.

According to the London newspapers, some 3,500,000 British fans watched the Super Bowl. How long they endured that lopsided contest has not been reported, but the fact that American football has become an export item, along with "Dynasty," is a measure of how times have changed.

I remember, for instance, one dreary Saturday forty-odd years ago in Northamptonshire. Our group was playing another Eighth Air Force team for some forgotten trophy. A puzzled but fascinated elderly Englishman with a question tugged on an American sergeant's sleeve. "Look, Pop," said the sergeant, "I'll tell you for the last time. The idea of the game is to grab the man with the ball and throw him through the goalpost." Now, it appears, large numbers of British even understand the nickel DEE-fense.

A lot of things have changed in the years since World War II. The British Empire, for one thing, has become the United Kingdom, a medium-sized country with European aspirations. The cross-Channel tunnel, or "Chunnel," a project first contemplated by Napoleon, is to become a reality. When Prime Minister Thatcher and President Mitterrand signed the agreement this past January, England ended its status as an island, according to the triumphant headline of a Paris paper. There are still those who favor insularity, like the man who wrote in a letter to the *Times* that he did not wish to cross the Channel like a rat in a drainpipe, but it is clear that an era is coming to an end. Passage to the Continent will be over or under the Channel, not on it.

What has not come to an end, or even changed much in the years since World War II, are the easy and close ties between the British and US military. They are perhaps closest between the two air forces, or so it seems from this prejudiced point of view. This is not to say there are not differences and sometimes real quarrels. The RAF has learned to be suspicious of the American tendency toward bureaucratic dominance. Still, the basic relationship is one of friendly partnership.

Ground-launched cruise missiles—GLCMs—are now firmly in place at Greenham Common, and the British keep a close, and expensive, watch on activities outside the fence. A grubby little band of females still camps near the gate, but the antimissile campaign has lost most of its steam. What will happen, however, should Labor come back to power is another story.

Labor's platform calls for the elimination from the United Kingdom of all US nuclear weapons. Laborites are no longer adamant about the removal of US forces—just the nuclear weapons—but it is hard to see USAF remaining on those terms.

Whether a Labor government, once faced with responsibility, would be bent on disarmament is an unanswerable question, but Labor's out-of-power stand is a grave worry to the British defense establishment.

Britain's armed services have prospered under the Thatcher government, certainly in comparison to the previous years when Labor was last in power. Salaries, once a source of shame and low morale, are competitive, and there has been a general improvement in the quality of life for the British forces, which are, like our own, all volunteer. They are not only volunteer but also highly professional. The Falklands campaign is evidence of that, and anyone who has watched the British pilots in a Red Flag exercise can have no doubt as to their low-level flying ability.

Nevertheless, like the rest of us, they have their problems. When NATO decided on the Boeing E-3A AWACS after a good US hard sell, the British said they would build their own. Ten years and more than $1.4 billion later, the Nimrod doesn't work. The RAF, still trying to do the job of maritime surveillance with thirty-five-year-old Shackletons, would like a few E-3As. Politics will stand in the way of that solution.

Otherwise, the Royal Air Force has done well these past several years. Although the Tornado sale to Saudi Arabia came out of the active inventory, replacement aircraft will make up that, and the Tornado will soon replace the Buccaneers and Jaguars. The Trident submarine program has not yet reached the truly expensive point on the acquisition curve. It will in a few years, and the UK will have some difficult choices to make—whether to stick with Trident and cut back other parts of the defense budget, increase the defense budget to accommodate Trident, or cut Trident. So long as Mrs. Thatcher is Prime Minister, the last option is not mentioned in her presence.

If Trident does not make too heavy an intrusion on future defense budgets—and that can only happen for one of the above reasons—the Royal Air Force is looking ahead to a new fighter in the 1990s. Like the Tornado, the Eurofighter will be the product of a consortium—West Germany, the UK, Italy, and Spain, with France, as usual, going it alone.

The same consortium turned out the Tornado, an excellent all-weather fighter-bomber and interceptor, but consortiums do have their problems, especially with cost and compatibility. No single European country, however, has a chance of building the Eurofighter, as France's Dassault is finding out. United States industry will doubtless be counted on for contributions to the Eurofighter, but selling the projected Advanced Tactical Fighter to Europe, at this point anyway, seems a long shot. ■

Marauders at Midway

Jim Collins and his four crews were given a mission that had never before been attempted by AAF bombers.

BY JOHN L. FRISBEE
CONTRIBUTING EDITOR

In the six months following Pearl Harbor, undermanned and ill-equipped US forces in the Pacific suffered a series of humiliating defeats, mitigated only by Jimmy Doolittle's April 18, 1942, raid on targets in the Tokyo area and by the standoff Battle of the Coral Sea in May.

Buoyed by a string of easy victories, Admiral Isoroku Yamamoto sold the Japanese high command on his plan to extend Japan's perimeter by seizing the Midway Islands, our westernmost outpost in the Pacific still in American hands, while carrying out a simultaneous diversionary attack on the Aleutians. Yamamoto held all the high cards, or so he thought: numerically superior naval forces—including carrier aircraft that were also qualitatively superior, flown by first-class veteran pilots—and surprise.

He did not know that, several weeks earlier, US Navy cryptanalysts had broken the Japanese code and knew in detail the disposition and timing of the attacks. With that knowledge, Admiral Chester Nimitz judged correctly that the main thrust at Midway would be a carrier battle. He held his three carriers, *Enterprise*, *Hornet*, and *Yorktown* (which Yamamoto thought to be out of action after the Coral Sea), and reinforced Midway as best he could with some 100 aircraft, many of them obsolete.

On June 4, 1942, the decisive day of the Battle of Midway, a US force of three carriers supported by about fifty other ships engaged the Japanese fleet of 150 ships built around four heavy carriers. Yamamoto's fleet was harassed by AAF B-17s and Navy torpedo bombers that broke up his formations, diverted his fighters, and enabled Navy dive bombers to sink the four carriers with the loss of only the *Yorktown* and one destroyer. Tales of heroism by Navy and Marine aviators, especially the torpedo bomber crews, only ten percent of whom survived, would fill a book.

Before dawn on June 5, Yamamoto ordered a general withdrawal to save what was left of his fleet. From that day on, Japan was on the defensive in the Pacific. Midway was one of the decisive battles of World War II.

Buried in the many, often disparate, accounts of the battle is the story of a unique mission flown by four AAF B-26 Martin Marauder bombers led by Capt. James J. Collins. In May, Jim Collins, assigned to the 69th Squadron, 38th Bombardment Group, had led the first flight of Australia-bound B-26s from the mainland to Hawaii, for which he was awarded the DFC. A few of the Marauders were detached in Hawaii and jury-rigged to carry torpedoes in anticipation of the attack on Midway. Collins and his crews were given sketchy instruction by the Navy in torpedo bombing, the most nearly suicidal air tactic of the war, but had never dropped a torpedo when a flight of four, commanded by Collins, was sent 1,200 miles westward to Midway on May 29.

Elements of the Japanese naval force were first sighted on June 3. Early the next morning, Jim Collins's B-26s were on runway alert when word came that enemy bombers were approaching Midway. The B-26s took off immediately with no fighter escort and headed for the Japanese carriers that lay 180 miles to the northwest and that were protected by a screen of fighters and escort ships. As the B-26s approached their target, they were met head-on by Zeros that stayed with them right through a barrage of flak in a desperate attempt to save the carriers.

Collins led his Marauders in a circle over the carriers' screen to set up the long, straight-and-level run essential to the proper functioning of a torpedo. Before the B-26s could release, two were shot down by either fighters or the dense wall of flak erupting from a battleship, three cruisers, several destroyers, and two carriers.

Collins was hit from below, losing his hydraulic system, before he launched his torpedo at an altitude of 200 feet about 800 yards from a carrier. He and the fourth B-26, flown by Lt. James Muri, roared across the fleet with throttles firewalled and made it into an overcast, pursued by an estimated fifty Zeros. Both badly damaged bombers limped back to Midway, where they crash-landed and were junked. Collins's plane was riddled by 186 flak and bullet holes.

Captain Collins was given permission to return to Hawaii on a B-17, pick up another plane, fighter or bomber, and rejoin the battle. The next morning at Hickam Field, he was told that none of his B-26s had been expected to survive—and that the battle was over.

On August 4, 1942, Capt. Jim Collins was awarded the Distinguished Service Cross for leading "the first torpedo attack ever entered into by an airplane of this type or by the US Army Air Forces." Lt. James Muri also received the DSC. According to Air Force historians, the AAF never again sent torpedo-armed bombers into combat. That mission against one of the greatest armadas of naval history is unique in the Air Force chronicle of valor. ■

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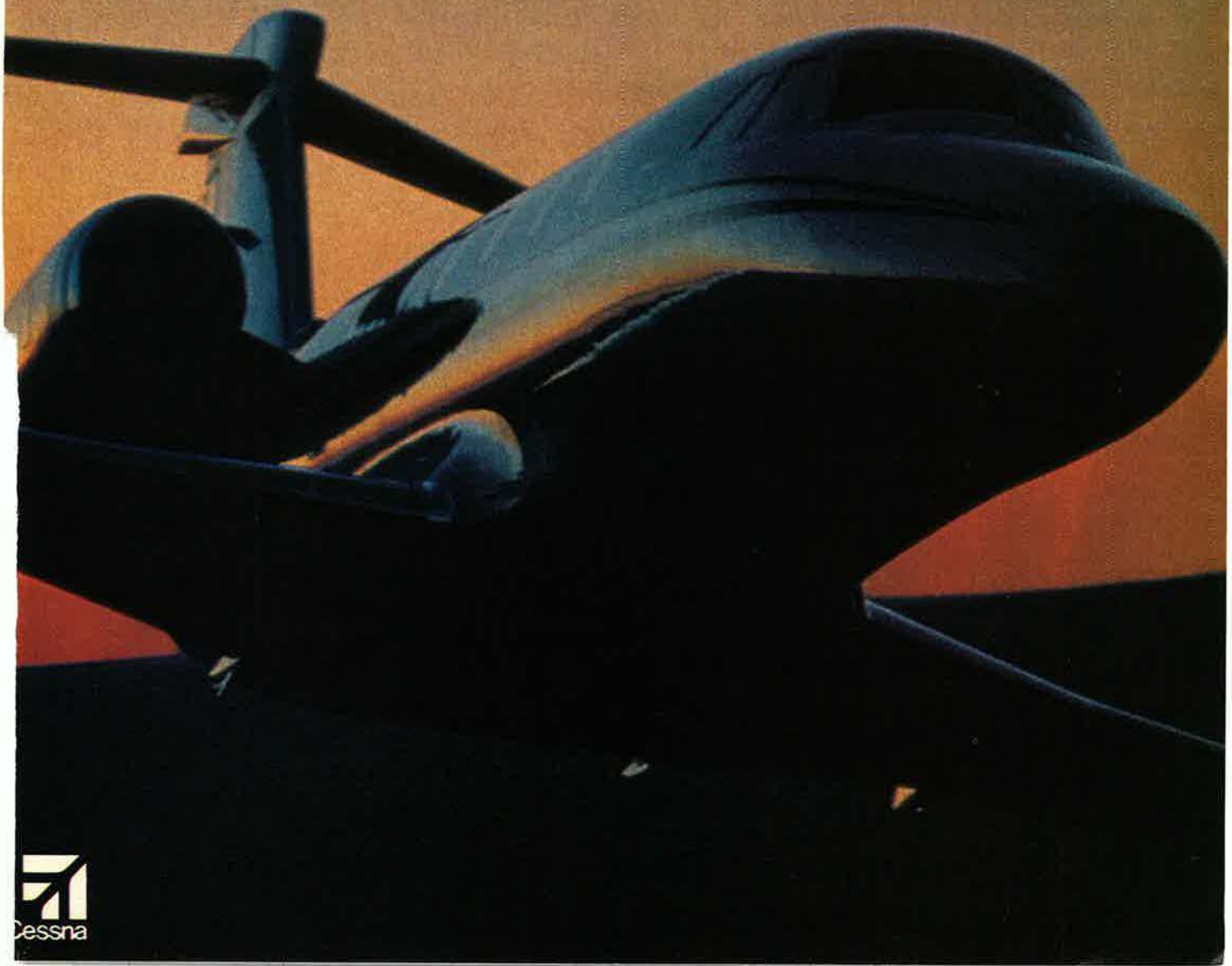

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Honest Differences

Military Reform: The High-Tech Debate in Tactical Air Forces, by Col. Walter Kross, USAF. National Defense University Press, 1985 (available from the Government Printing Office). 240 pages with charts, graphs, tables, endnotes, and index. $7.50.

The military reform movement is feeling its oats. Its adherents can no longer be dismissed out of hand as mere annoyances to the US defense establishment. Their numbers and power are on the rise in Congress, academe, the press, and the establishment itself, and they have begun drawing blood with their charges that the US military is poorly structured, overblown, and inadequate to its task.

It is now obvious, with great import for the future of national defense, that the military reformers have mounted a credible challenge, warranted or not, to long-accepted US military policies, strategies, and practices. Consequently, the military reform movement commands the attention of the citizenry at large.

The movement is hard to comprehend as a whole, however, because it usually manifests itself piece by piece, as in the reformers' attacks on this or that Pentagon program. Seldom if ever have the movement's philosophical underpinnings and thrusts been explained in the full context of their connection with existing US strategies, tactics, and weapons.

This gem of a book does that for us, with emphasis on how tacair, in all its ramifications, fits into—indeed, dominates—the debate between the reformers and their rebutters.

Reading Colonel Kross's book is like having the lights come on, room by room, as you walk through a house that had been shadowy when you entered. His is a remarkable piece of work, one of solid scholarship, clear writing, exemplary organization of material, and fairness of treatment.

Colonel Kross explains weapons and tactics as well as he does the reformers' arguments against them, because the reader needs to understand weapons and tactics in order to understand the arguments. As a result, his book is a valuable reference on many matters besides military reform.

A fighter pilot with 100 missions over Vietnam, Colonel Kross began working on his book while a Senior Fellow at the National Defense University in 1981–82, just as the military reform movement began picking up steam. He himself is clearly no military reformer, yet he painstakingly and ungrudgingly gives the reformers their due.

He writes, for example, "The Reformers' most profound contribution has been their crusade to recast the entire basis of US military thought, restructuring it on a foundation of maneuver-war precepts."

Such recasting is evident in latter-day changes of Army and Marine Corps weapons and tactics. The Air Force and the Navy have been tougher nuts for the reformers to crack, however.

As a general rule, the reformers are against complex weapon systems on grounds that they cost too much, are unreliable, and are designed for such missions as offensive counterair attacks against enemy airfields that, in the reformers' view, aren't worth the candle. The reformers want tacair to give up on interdiction and to concentrate on close air support with cheaper, less sophisticated aircraft.

In the air-superiority arena, the reformers want tacair to forgo beyond-visual-range (BVR) engagements with radar-guided missiles and to concentrate instead on short-range engagements with guns and heat-seeking missiles.

The reformers cite the F-86 Sabre of Korean War fame as a prime example of how an inexpensive, relatively uncomplicated air-superiority fighter was sufficient to dominate air combat. What they do not point out, Colonel Kross reminds us, is that the F-86 was considered a high-technology aircraft in its day and that its low cost by today's standards (but the highest of its own era) was largely a factor of its mass-quantity production rate—something that might hold true for today's high-tech fighters, were they also to be produced at such economies of scale.

Without dwelling on it, the author puts his finger on an irony in the reformers' arguments against high-tech weapons. He makes it clear that in their pitch for simpler weapons and less ambitious missions on the part of tacair, the reformers, who fancy themselves as forward-looking, are actually living in the past—in "the good old days that never were." They most certainly do so, he contends, in their claim that USAF devotes too many resources to electronic combat, without which, he says, no aircraft, no matter how sophisticated, could survive over today's battlefields.

"Defense Planners," Colonel Kross writes, "have elected to pursue high-tech weapons in *modest* quantities to address these compelling theater war requirements—in full knowledge that the necessary high-tech weapons will be less cost-effective to accomplish their demanding task than those simpler weapons designed solely for more efficient missions, such as close air support or day/visual dogfighting."

A great beauty of this book is that it puts the reformist-conformist debate squarely in the context where it belongs, one of warfighting realities and requirements.

"The Defense Planners see certain warfighting requirements as far more pertinent and as much too compelling to ignore," he writes. "The Reformers would focus down to a few high-payoff, combat-proven tasks. In the process, the Reformer leaves serious gaps, clearly evident gaps, for the Soviet Planner to exploit."

Moreover, he asserts, "Recent combat experience [in the Middle East and around the Falklands] has tended to underscore the importance of the very combat tasks that the Reformers deemphasize or discount." For example, he notes, the Falklands campaign might have turned out much differently had a British bomber on an offensive counterair mission not de-

stroyed an Argentine airstrip at the outset of combat.

One of Colonel Kross's many essential points is that the reformers tend to downplay the Soviet threat, which leads them astray in their examinations of weapons and tactics.

He does not scoff at them for this, however—far from it. He plays fair with their assessments of the threat and emphasizes that "honest men can differ."

Honest men also treasure honest books, and this one fully deserves such a characterization.

—Reviewed by James W. Canan, Senior Editor.

The Fighter Pilot's Bible

Fighter Combat: Tactics and Maneuvering, by Robert L. Shaw. Naval Institute Press, Annapolis, Md., 1986. 417 pages with diagrams, notes, appendices, bibliography, and index. $28.95.

Anyone who has flown fighters or has wanted to understand what fighter pilots do during aerial combat has wished for an unclassified fighter tactics textbook like this one.

Older heads will remember such previously published aerial combat treatises as *The Long Reach,* compiled by VIII Fighter Command in May 1944. In it, a couple dozen leading Allied fighter pilots offered advice to inexperienced pilots just coming into the European Theater of Operations. Primarily, although the writers followed most of the same procedures and used many of the same tactics, it was a series of individual pieces of "inside dope" on shooting down enemy fighters. In the absence of anything else, it was extremely valuable.

Later, during the Korean War era, Maj. Frederick C. "Boots" Blesse (now a retired USAF major general) wrote *No Guts, No Glory,* a slim, invaluable volume on battling in jet fighters. It became an unclassified Tactical Air Command manual. At frequent intervals over the years, *USAF Fighter Weapons Review,* published by the USAF Tactical Fighter Weapons Center at Nellis AFB, Nev., has featured unclassified articles on aspects of fighter tactics. The Navy Fighter Weapons School has also published similar material.

In the civilian world, numerous books on tactics have appeared, but most were little more than war stories in which the tactics employed in aerial encounters were discussed for realism and color, not for instruction. An exception was *Fighter Tactics and Strategy, 1914–1970,* by Edward H. Sims, but jet tactics occupied only a small section at the end of that book. All of the civilian books describe tactics as they used to be. While many of the modern techniques are the same, such newer aircraft as the F-15, F-16, and F/A-18, with their high thrust-to-weight ratios, have brought a new—vertical—dimension to aerial conflict that is not covered in civilian publications.

AIRMAN'S BOOKSHELF

For pilots still on active duty, there is USAF Multi-Command Manual 3-1, Tactical Employment, which, among other things, covers, in depth, fighter tactics used today. It is, of course, classified "secret" and is not available to the public.

Now, Robert L. Shaw, a former active-duty US Navy fighter pilot and current US Navy Reservist, has written a book that includes, in one volume, all the information on fighter flying that previous volumes have covered piecemeal, plus a wealth of information not previously covered in unclassified publications anywhere.

Most veteran fighter pilots thought this book couldn't be written. The subject was too complex, there were too many variables to be covered in three-dimensional air-to-air fighting, they said, and, most of all, luck plays such an important part in the outcome of any engagement that there are too many unpredictables. Shaw confounds the naysayers by handily linking it all together to provide, in very readable form, a body of information of interest to pilots, wargamers, model builders, and air combat enthusiasts of all kinds. He has coalesced all the history, theory, mechanics, and even the spirit of aerial combat since its inception in 1915.

Most of all, this book was written for every fighter pilot who, as a fledgling, remembers getting "waxed" repeatedly when he went out to practice air combat with his more experienced squadron mates. When he asked their secrets, more often than not he was told, "Just hang out there on my wing, kid, and do what I do. If you live long enough, maybe someday you'll be almost as good as I am." Even today's pilots who have had the secrets revealed to them in modern military training programs should find this book valuable because of the sheer breadth of its coverage—from energy maneuverability theory right on through actual techniques for "hassling."

Shaw starts with a description of air-to-air weapons, and the reader may be surprised to discover that the gun is still the most widely used and dependable aerial combat weapon—not the old-fashioned machine gun, to be sure, but the 6,000-rounds-per-minute Gatling type, mated with radar, the laser, and the computer. The relative effectiveness of various sizes of projectiles—smaller rounds spitting out at higher rates of fire, larger rounds yielding more effectiveness per "hit"—is explained. One interesting chart shows the effects of missile velocity on lead collision trajectory, including that portion of the missile's flight that takes place after motor burnout.

There are more than 150 charts and drawings that make the author's points with crystal clarity. These are especially helpful when Shaw takes the reader through basic fighter maneuvers, explaining the high- and low-speed yo-yo, the scissors, the lag-pursuit roll, and various turn options. The barrel roll, as used in fighter maneuvering, for example, turns out not to be a barrel roll at all. An explanation of how to apply knowledge of the opponent's capabilities—thrust-to-weight ratio, turn rates, wing loading, most effective altitudes for maneuvering, as well as his weapons employment parameters—is provided. Disengaging—that is, knowing when and how to break off aerial combat and get out of the fight alive—is covered as well.

He then progresses into the secrets of "angles" fighting, or defeating the enemy's weapons by staying out of their effective envelope. This section reveals many of the weaknesses of those air-to-air missiles that are effective only when fired from behind the target.

As the reader's knowledge and sophistication increase, Shaw puts him on his wing and takes him into the realm of team fighting—Two v One, Two v Two, and finally Four v Four. When he ventures into the tactics used in multiple-ship engagements, the reader finds himself in one of the more bewildering aerial combat arenas, but Shaw brings him through alive and with a good understanding of what he would have to do in a real fight—providing he had a fighter to fly and the physical ability to pull nine Gs. He analyzes successful principles for flying the four primary fighter missions—sweeps, point defense, area defense, and escort.

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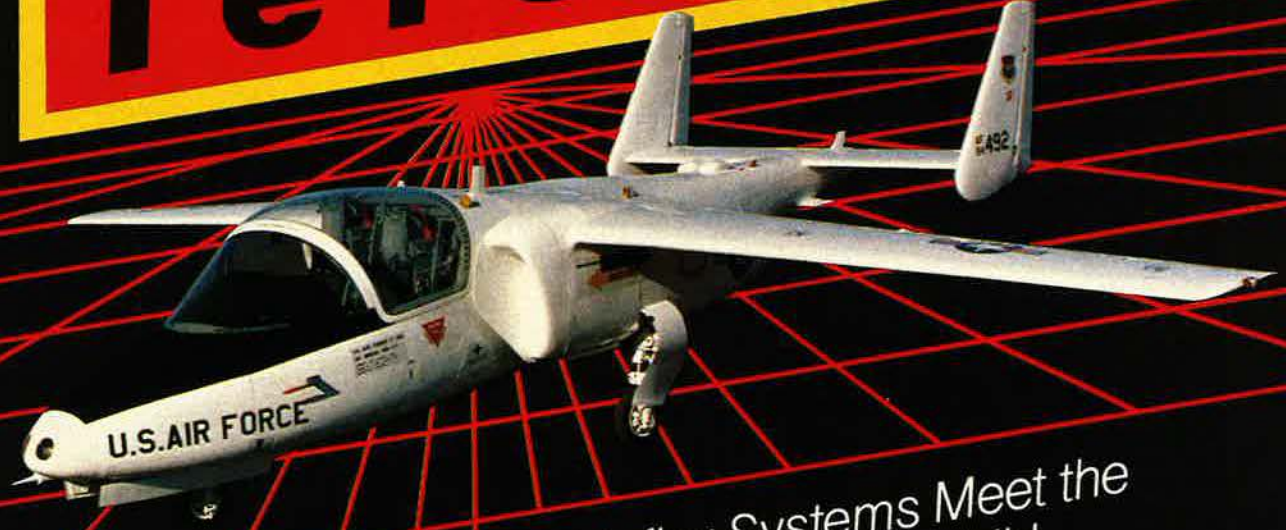

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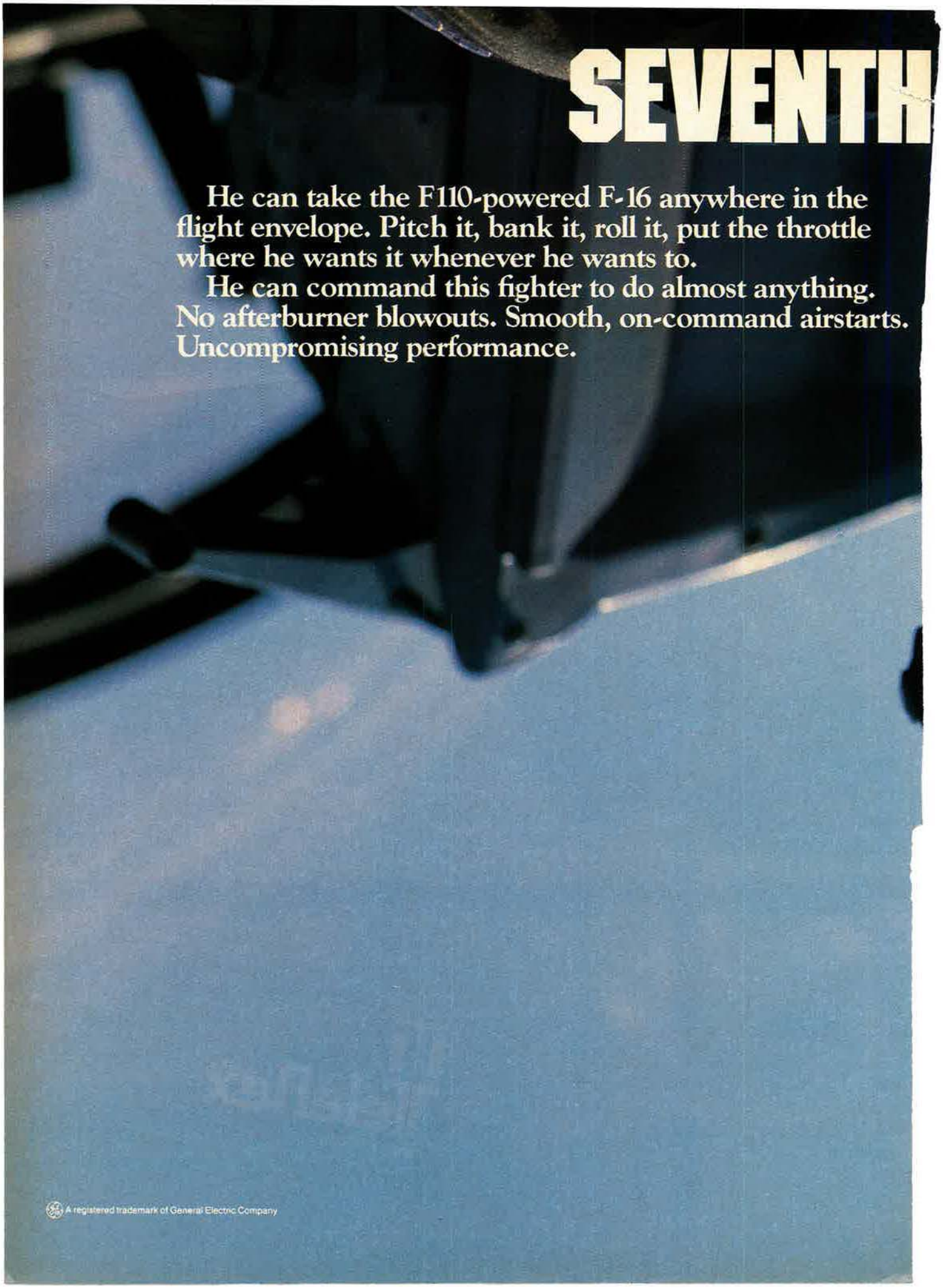
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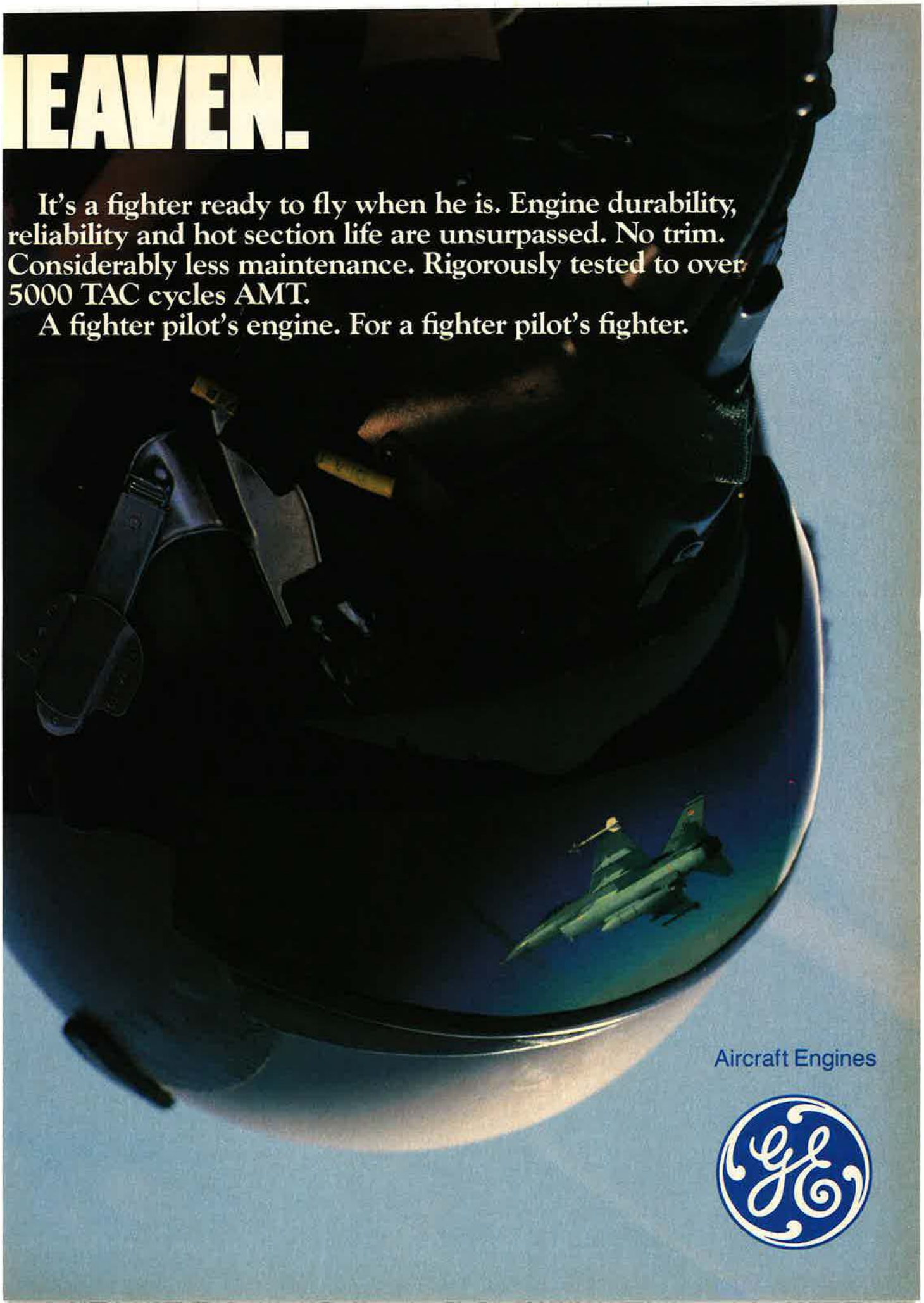
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AIRMAN'S BOOKSHELF

pendix with formulas, graphs, and charts that explain the basic principles of energy management in fighter combat. Throughout the book, Shaw includes quotations from well-known and some not-so-well-known fighter jocks to emphasize his points. In the energy maneuverability section, for example, he quotes a Vietnam-era pilot: "Beware the lessons of a fighter pilot who would rather fly a slide rule than kick your butt!"

This book is undoubtedly the definitive text on air combat today. It is likely to remain so for some time.

—Reviewed by James P. Coyne, Senior Editor. For more on fighter tactics, see Mr. Coyne's article "Twos" starting on p. 75 of this issue.

New Books in Brief

Aerospace Facts and Figures 85 86, compiled by the Economic Data Service of the Aerospace Industries Association. The thirty-third edition of this yearbook will undoubtedly prove an aerospace statistician's delight. It is chock full of those often hard to nail down numbers on aircraft, missile, and space programs, research and development activities, foreign trade, and aerospace industry employment and finance. The volume is laid out in an uncomplicated fashion, relying on straightforward charts and graphs to facilitate easy reference. Readers will be impressed by its comprehensiveness. McGraw-Hill Publishing Co., New York, N. Y., 1985. 188 pages with glossary and index. $10.95.

Fifty Glorious Years: A Pictorial Tribute to the Douglas DC-3 1935–1985, by Arthur Pearcy. The golden anniversary of the ubiquitous Gooney Bird is an appropriate occasion for this photographic retrospective. Author Pearcy has gathered in this slick, four-color volume a choice collection of photos of the DC-3 in its panoply of guises—as airliner, troop transport, research aircraft, and even as mobile home or gigantic weathervane! The affectionate text and copious captions yield many interesting nuggets of information and support the striking photos squarely. Few airmen would find this book a burden on their bookshelves. Aeolus Publishing, Ltd., Vista, Calif., 1985. 168 pages. $18.95.

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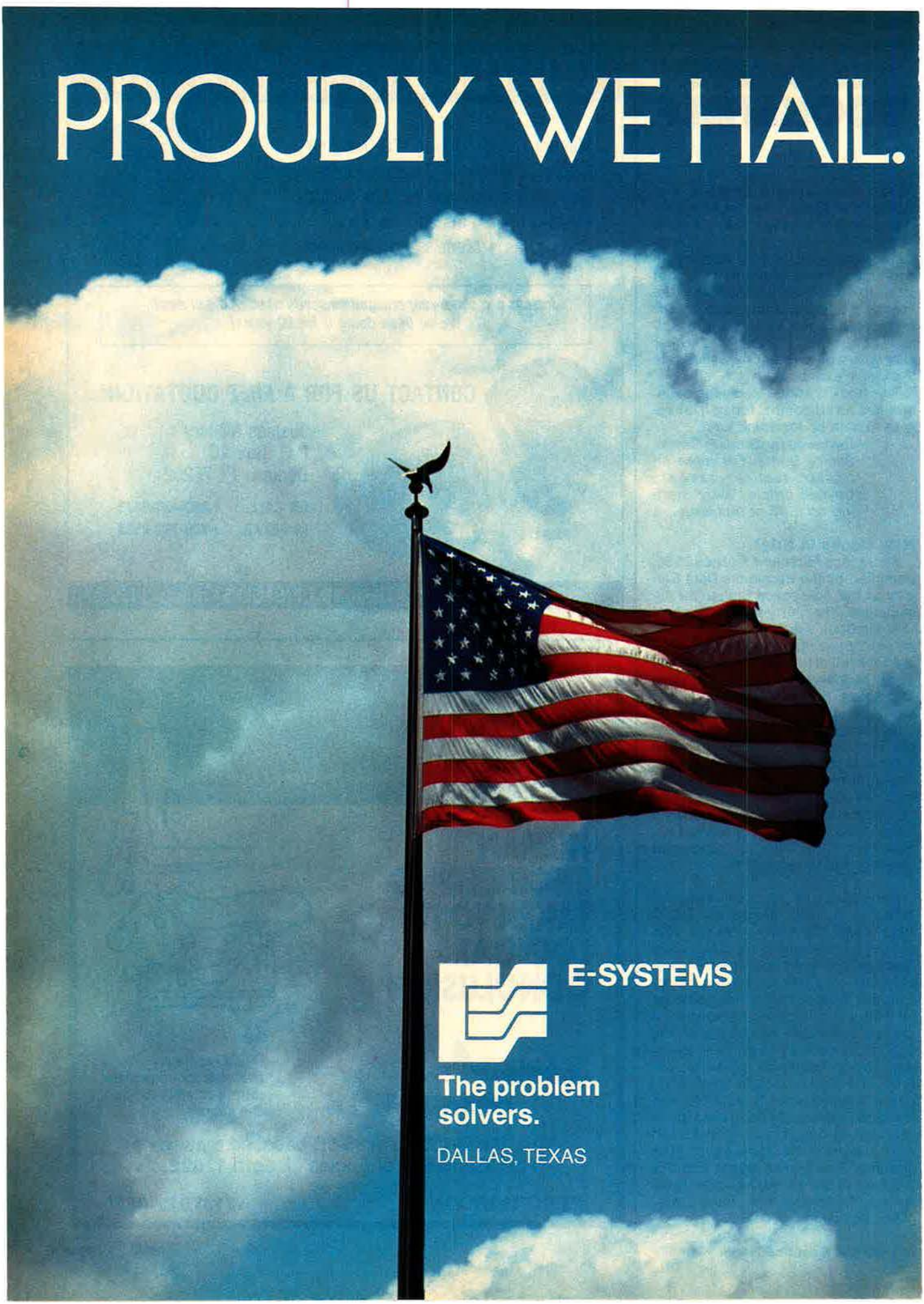

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By Robin L. Whittle, AFA DIRECTOR OF COMMUNICATIONS

The Search for a B-17 Crew

Christian H. "Ace" de Guitaut gripped his bicycle handles in fear and horror as his fifteen-year-old eyes followed the B-17's tumble into a flat spin and then a flaming crash near to where he and a friend were standing. As a member of the French Resistance, the boy had been trained to rescue and hide any surviving American airmen, retrieve documents or other items that might help the Germans, and recover ammunition for use by the Underground.

The two boys hurried to beat the Germans to the B-17 and found no one alive. They gathered up ammunition belts, and de Guitaut picked up some partially burned navigation charts, thinking they might be of value. It was January 3, 1943, in German-occupied St.-Nazaire on the Bay of Biscay in France. The mighty B-17F, ironically named *Snap! Crackle! Pop!* had been on a bombing raid against the heavily defended German submarine pens on the bay.

Two details of the crash burned into de Guitaut's memory—the inexplicable nose art and the two parachutes he'd seen escape the doomed aircraft. He wondered if the two men made it. Were they captured?

After the war, in 1948, de Guitaut came to this country and settled in Fresno, Calif. He joined AFA in the 1960s and became involved in the Association's Fresno Chapter. In 1971, he founded and organized the Chapter's first "Gathering of Warbirds" airshow, a highly successful event that is now in its fifteenth year and that has been featured in this column several times.

As luck would have it, de Guitaut was handed a publication at the Chapter's 1973 "Gathering of Warbirds" that contained an article on B-17s. Busy and unable to look at it until he got home that evening, de Guitaut froze when he recognized the "Snap! Crackle! Pop!" on the nose of a B-17F in a photo accompanying the article. The caption identified the aircraft as having been shot down on January 3, 1943, over St.-Nazaire after its fifth mission.

The wartime crash of a B-17 named* Snap! Crackle! Pop! *was the event that linked former French Resistance fighter Chris de Guitaut (left) and then-2d Lt. Glen Herrington. De Guitaut watched Herrington bail out in 1943, but the two men had never met before this recent dinner in Las Vegas.

Stunned yet excited at the prospect of finding answers to a thirty-year mystery, de Guitaut contacted the article's author, who suggested he get in touch with the 91st Bomb Group Memorial Association. Association members, in turn, invited him to speak at their reunion, during which he recounted his story. He also presented the charred and yellowed navigation charts to the 91st's Commander, retired Maj. Gen. Stanley T. Wray, who later turned them over to the Air Force Museum at Wright-Patterson AFB, Ohio.

In time, de Guitaut received from the Museum the names of two crew members—2d Lt. Glen M. Herrington, the B-17's navigator, and Sgt. James I. Gordon, a gunner. Herrington had a Las Vegas address, and Gordon was listed as being from Humboldt, Kan. De Guitaut finally located Gordon in Corpus Christi, Tex. Gordon was startled at the call, but when de Guitaut asked him about Herrington and a possible third survivor, Allan Magee, Gordon told him that all three had been taken prisoner. Gordon, however, doubted that Magee was alive, because he had crashed through the glass roof of the local railroad station. The Germans had given him only six months to live. Gordon had no idea where Herrington was or even if he survived the war.

Two weeks after the wire services picked up the story, de Guitaut received a call from Glen Herrington, who said, "I understand you're looking for me." They met in Las Vegas, and Herrington remarked that de Guitaut was his first contact about the incident since World War II.

Severely wounded, Herrington had lost his leg and had been sent by troop train to a Luftwaffe hospital in Paris and then to an interrogation center. He later became one of the first AAF men repatriated. After an arduous journey through four countries, Herrington landed in a hospital in Washington, D. C. The nurse who treated him in the hospital later became his wife.

Herrington revealed that there had indeed been a third survivor—waist gunner Allan Magee. His crash through the roof of the railroad station broke both his legs, Herrington recalled.

De Guitaut was doggedly determined to learn the fate of the waist gunner. He contacted his local con-

gressman, whose legislative assistant started the search.

After some time, a letter with the name and address of Magee's mother in New Jersey came from the Albert F. Simpson Historical Research Center at Maxwell AFB, Ala. A New Jersey congresswoman, contacted by the legislative assistant, recalled knowing some Magees in the North Plainfield area. The aide called Earl W. Magee, who happened to be the waist gunner's brother. One more call and de Guitaut was in touch with Allan Magee.

"The last thing he remembered was that he was at twenty-some thousand feet, trying to get out of a burning plane without a chute," de Guitaut remembers Magee telling him. The next time Magee came to, he got hit again, sustaining altogether some twenty-eight wounds before blacking out as he went through the roof of the St.-Nazaire railroad station.

He came to again and asked who was trying to help him—German or French. When they said German, he blacked out again. Magee's left arm was nearly torn off, and his body was shot up. The doctor who operated on his face, nose, arm, and back told the nurse, who spoke English, that he would try to save Magee's arm and that if he couldn't, it wasn't because the American was the enemy, de Guitaut recalled.

As it turned out, the German doctor saved Magee's arm and his teeth and put his leg, knee, and ankle back into good shape. Magee told de Guitaut that he was treated well by the Germans in the hospital.

Magee has attended the Fresno Chapter's "Gathering of Warbirds" and, in fact, returned for the 1985 event last August, according to de Guitaut. "He looked terrific, and he had just gotten married," de Guitaut said of Magee.

"I had arranged for Dave Tallichet to bring his B-17 to the airshow and at one point asked Allan if he'd like to go up," de Guitaut recalled. Magee told the AFA leader that he had felt no nostalgia for the old warbird for years, but would now jump at the chance for one more flight.

De Guitaut said the former waist gunner was up for about half an hour in the old Fort. "He told me that he immediately recognized the smells, the oil and hydraulics, that had remained a distant part of his memory but that sprang to life the minute he was up there," de Guitaut said. Interestingly, Tallichet, who owns many old warbirds and who flies all of them himself, flew several missions against the sub pens at St.-Nazaire.

As for the "Snap! Crackle! Pop!" on the B-17F's nose, Glen Herrington gave an explanation. The bomber had been named by Capt. Jacob Fredericks, who had been assigned to the 360th Bomb Squadron of the 303d Bomb Group and who had flown the new B-17F from the US to England. Before entering the AAF, he had worked for the Kellogg Co., the creators of Rice Krispies cereal and its "Snap! Crackle! Pop!" promotional slogan.

De Guitaut returned to France this past summer and looked up his boyhood friend in the Resistance who had witnessed the plight of the B-17 as well.

"We traded memories of the event, and I brought Francois [de Marion] up to date on the survivors," de Guitaut said. "He has remained in our little town of La Baule and believes the ammunition we hid beneath the porch of my old house is still there." De Guitaut said that his next mission is to work with French authorities to unearth the ammunition that he and Francois de Marion assiduously hid from the Germans forty-three years ago.

INTERCOM

Tacoma Chapter Sponsors Golf Tourney

AFA's Tacoma, Wash., Chapter sponsored its fifth annual Howard O. Scott/Coca-Cola ProAm Golf Tournament at McChord AFB's Whispering Firs Golf Course, reports Tacoma Communications Director Jack K. Gamble.

Forty-two teams of five golfers, each led by a professional, competed for top pro honors and the $1,000 first prize. Don Bies, the 1983 champion and former touring professional who played out of the Seattle Golf and Country Club, won with a course record-tying sixty-five. The low amateur was SSgt. Steve Holshouser, 62d Supply Squadron, who turned in a score of seventy-two. Both names have been engraved on the Howard O. Scott Trophy. The winning fivesome included Maj. Gen. Lee V. Greer, Commander of the Sacramento Air Logistics Center, and Jack Sandstrom, Tacoma Chapter Second Vice President. Other participants included Gary Justice, evening news anchor for KIRO-TV; Rene LeVitre, senior vice president of the local Coca-Cola Co.; Maj. Gen. Donald Brown, Commander of MAC's Twenty-second Air Force; and Elbert Baker, publisher of the Tacoma *News Tribune*.

After expenses, Tacoma Chapter officials were able to present a check for $1,500 to the McChord Base Youth Activities Fund and provide for the Chapter's scholarship program.

The Howard O. Scott Trophy winners were honored at a Tacoma Chapter dinner, during which the 1986 officer team was installed. Taking the helm as the first woman president of the Tacoma Chapter was Wanda Scott, widow of the former Tacoma Chapter president and respected civic and business leader for whom the trophy is named. The evening's speaker was Maj. Gen. Lee V. Greer.

Winners of Chapter scholarships were AFROTC Cadets Tanya Johnson

Almost $1,500 was raised for the McChord Base Youth Activities Fund at the golf tournament sponsored by AFA's Tacoma (Wash.) Chapter. Here Rene LeVitre (center), senior vice president of the local Coca-Cola bottling company, and Maj. Gen. Donald Brown (right), Twenty-second Air Force Commander, stroll down the first fairway.

and Steve Brown from the University of Puget Sound. They were honored at the Chapter's Christmas party.

Washington state President Ed Hudson also presented individual copies of National AFA's Lt. Gen. William H. Tunner Award to SSgt. Gerry Danielson and SSgt. Donald R. Buescher, part of the crew who showed presence of mind and skill in boarding and stopping a moving C-141 StarLifter. The transport was caught in a high wind and jumped its chocks, moving dangerously close to other parked aircraft. Speaker for the evening was Lt. Gen. Spence M. Armstrong, Vice CINCMAC, who discussed strategic and tactical airlift and the need for the C-17, Mr. Gamble reported.

Texas AFA officials recently presented a Life Membership to Rep. Albert G. Bustmante (D-Tex.). Shown here, from right: Texas State AFA Executive Secretary George Weinbrenner, Treasurer P. D. Straw, Congressman Bustmante, State President Ollie Crawford, and Executive Vice President Dan Fulgham.

On the Scene

"We (not me, not your executive board, not the individual members, but WE) have kept AFA a secret long enough in our community," Cleveland Chapter President **Leo Johnson** reported in the Chapter's news magazine, *Hangar Talk*. Two Chapter objectives for 1986 are the Young Astronaut Program and the Community Partner Program. "We must reach out to our local community (business, politicians, news media, etc.) and work on programs to attain the objectives of AFA," Johnson wrote. In encouraging greater participation, Johnson concluded, "Life is like a ten-speed bike. Most of us have gears we never use."

General Robert F. Travis Chapter President **Betty A. Hazeleaf** reports that the Chapter planned to host its fourth annual defense roundtable with **Rep. Vic Fazio** (D-Calif.) so that members could gain his perspective on a number of AFA concerns in five key areas: defense spending, readiness and sustainability, force projection, space, and people issues. The event was scheduled for February 15 at the Vacaville City Council Chambers and was open to the public. Another highly successful event for the Travis Chapter is its annual Vacaville Air Fair, cosponsored with the local Chamber of Commerce and attended by thousands from Vacaville and surrounding communities.

Lt. Rod Zastrow was honored two years ago at AFA's national convention as the outstanding AFROTC cadet. AFA National Director **Dave Blankenship** reports that the Lieutenant was at the top of his pilot training class at Sheppard AFB, Tex., and had the good fortune of having his wings pinned on by **Brig. Gen. Chuck Yeager,** USAF (Ret.). "We obviously pick the right people for our awards," the AFA leader noted.

"AFA-1" is the license plate of Tennessee AFA President **Jack Westbrook,** who suggests that, for only $25, other AFA leaders can spread the word on the nation's highways. **Eugene LeRoy Riser** has done for the skies what Westbrook has done for the highways. He's promoting AFA's "Gathering of Eagles" and the reunion of Pilot Class 43-D (Delta Eagles) by means of an "aerial bumper sticker" that adorns his Piper Seneca III. "We ought to be able to find quite a few lost souls with this," reports Pilot Class 43-D leader **Don Connor.** The Class is made up of surviving members of one of the largest classes of pilots turned out during World War II. "In all, 5,275 young men graduated from twenty-eight separate flying fields in April 1943," Connor says.

Lt. Rod Zastrow (left), who finished at the top of his pilot-training class at Sheppard AFB, Tex., had his wings pinned on by Brig. Gen. Chuck Yeager, USAF (Ret.)

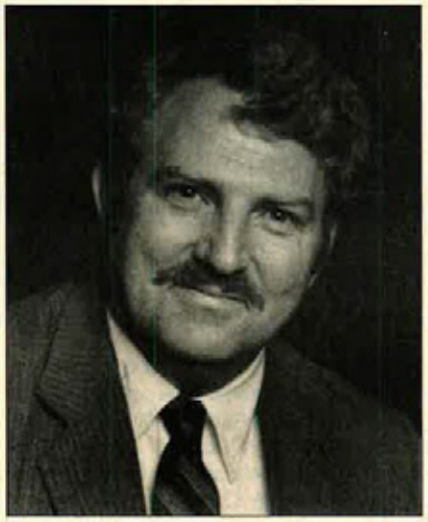
Sen. Jeff Bingaman (D-N. M.) (left) presented V. R. Woodward the AFA National Medal of Merit. Mr. Woodward, AFA's Albuquerque Chapter President, was cited for his "unusual expertise in promoting US airpower."

New England Region—The Herita

New England has a rich and colorful history dating back to the founding of this Republic. We are proud that many of our AFA chapter members are descendants of the courageous men and women who fought for the freedoms we now enjoy. This link to the heritage of our nation is a treasure New Englanders proudly share with people from all over the world. We do so in the hope that no one will forget that freedom rested in the hands of the people of this community, the "grass roots" of this new land, who formed the militia and ended the tyranny of a colonial power.

We New Englanders continue to show our concern for America's freedom by belonging to the Air Force Association. Many of us have been members since its founding. We are proud to have chartered AFA chapters that are still active decades later. And we are committed to the importance of the American "grass roots" as the ultimate guarantor of our freedoms as well as the security necessary for their continued protection.

—Arley McQueen, Jr., National Vice President for the New England Region.



Arley McQueen, Jr., is the National Vice President for the New England Region.

Maine

Maine AFA is led by Alban E. Cyr, Sr., and has three chapters. Eastern Maine, led by Ron Albreck, meets periodically with the local Air National Guard, Southern Maine, led by Robert N. Bailey, has sent representatives to the AFA national convention, and the Spudland Chapter, led by Maine AFA President Alban E. Cyr, Sr., has participated in AFA regional workshops.

New Hampshire

Robert N. McChesney leads New Hampshire AFA and its two chapters. The New Hampshire AFA convention was held at Pease AFB in May and featured a golf tournament, business meeting, and awards banquet. The state organization and its two chapters participated in a fundraising drive sponsored by the local public broadcasting station, which afforded AFA enhanced visibility in the community while serving the public interest. The state and its chapters also sponsored an AFA booth at the Pease AFB Open House in 1985.

New Hampshire's Amoskeag Chapter is led by Gualter F. Silva. During the year, Chapter officials started publishing a newsletter and developed closer contacts with key businesses and civic organizations as well as with local airport officials and students and faculty at Daniel Webster College.

The other chapter in New Hampshire is AFA's Pease Chapter, led by Lee Blythe Lilljedahl. During the year, Pease Chapter officials sponsored their annual bring-a-guest brunch, which attracted Brig. Gen. Martin J. Ryan, 45th Air Division Commander, Col. Frederick A. Fiedler, Commander of the 509th Bomb Wing, and Rep. Robert C. Smith (R-N. H.), who spoke during the brunch. The Congressman answered questions and was made a Pease Chapter member.

Chapter members participated in a dinner cruise with the local Reserve Officers Association, held regular meetings with important speakers, published a newsletter on a regular basis, and presented a $500 scholarship at an awards ceremony in May to AFROTC Cadet Nancy Michaud of the University of New Hampshire. In other activities, the Chapter honored AFROTC Cadet James M. Lacasse with an AFA medal and a citation, initiated a new Pease Chapter award honoring the outstanding Air National Guard recruiter for the first quarter of 1985 (first won by TSgt. Paul Edgar), sponsored a dinner that featured Lt. Gen. Charles J. Cunningham, Jr., deputy chief of staff/programs and resources, Hq. USAF, as speaker, and held another dinner meeting with Maj. Gen. Carl D. Black, ANG assistant to the Commander, AFLC, as speaker. The Chapter also mailed 900 AFA membership applications to potential members.

Massachusetts

Massachusetts AFA is led by John White and has ten chapters. The business session of the state convention was held April 13 at the John F. Kennedy Library, and an awards dinner was held in the evening after AFA's Electronics Symposium at the Wakefield Colonial Hilton. Mr. White addressed a Veterans Day celebration in Boston, and Massachusetts AFA led a procession of veterans and civic groups in the Hall of Flags at the State House in Boston. Mr. White has addressed several organizations on issues of concern to AFA and was presented a Presidential Citation at the AFA national convention.

AFA's Boston Chapter is led by Mary Anne Gavin, who was honored with an AFA Medal of Merit in 1985. Chapter officials participated in the MIT Tri-Service Awards Dinner in May at the MIT Student Center. AFA's Silver Medal was presented to the outstanding AFROTC cadet at MIT. President Gavin also addressed the Arnold Air Society's initiation ceremonies at the MIT Faculty Club, and Boston Chapter officials worked to increase congressional attendance at AFA's "Salute to Congress" at the national convention.

Andrew W. Trushaw leads the Chicopee Chapter, which participated in AFA's national convention and made donations to the National League of POW/MIA Families in 1985. Chapter officials presented AFA's Silver Medal to the outstanding AFROTC cadet at the University of Massachusetts at Amherst, AFA's Bronze Medal to the outstanding AFJROTC cadet at Tech High in Springfield, and established a new scholarship award.

AFA's Laurence G. Hanscom Chapter is led by Aarne Kolhonen. Regular business meetings were held, and one featured Fred McGary from General Electric, who discussed his experiences in training African and Egyptian Air Forces in the repair of their aircraft and equipment. The Chapter sponsored a number of social outings, supported the VA Hospital in Bedford in collecting clothing and magazines for patients, and honored the local Civil Air Patrol unit.

Peter Colerico leads AFA's Minuteman Chapter, which was honored with Massachusetts AFA's "Chapter of the Year" award for the second consecutive year.

AFA's Otis Chapter is led by Dan McDuffie. Chapter activities included support for the Open House at the ANG Museum at Otis ANGB and Veterans Day activities at the Hall of Flags in Boston.

AFA's Paul Revere Chapter was organized in early 1985 and chartered last April by AFA President Marty Harris at the Massachusetts AFA awards dinner.The Chapter is led by Bill Lewis. During the year, the Chapter grew from twenty-eight members to ninety-five as of October. A number of meetings were held, with briefings by Hanscom AFB officials. The year's highlight was the ambitious Chapter-sponsored symposium on the Strategic Defense Initiative. The symposium drew speakers from the Army, Air Force, Navy, DoD, and the White House technical staff. Some 250 attended the event. Other programs include support to the local base, sponsorship of children to summer camp,

# of Fighting for Freedom

and efforts to initiate a memorial to a local Air Force pilot.

AFA's Pioneer Valley Chapter is led by Robert J. Picknally, who has worked to revitalize the Chapter. AFA's Pace Chapter, led by Raymond Valle, was being reactivated during the year. Chapter officials presented an AFA medal to the outstanding AFJROTC cadet from a local high school and participated in the commissioning ceremonies for the USS *Matignon* at Bath Shipyard in Brunswick, Me.

Alan LaCombe leads AFA's Taunton Chapter, which owns its own club house and sponsors many social functions each year. A steak barbecue in May featured films of the Thunderbirds airshow and a presentation by Maj. Richard Penny of the 102d Tactical Fighter Wing at Otis ANG Base. Major Penny showed films of intercepts of Soviet Bear bombers.

AFA's Worcester Chapter is led by Arthur A. Snow. The Chapter presented AFA medals during the year, with one presentation ceremony taking place at the College of the Holy Cross.

Connecticut

Joseph Zaranka leads Connecticut AFA and its nine chapters, two of which were chartered during the portion of last year that Connecticut AFA was led by Raymond E. Choquette.

In addition to chartering two chapters, Connecticut AFA participated in the Memorial Day dedication of the Vietnam Memorial in Manchester and contributed funds to defray its cost. Funds were donated also to the Military Ball Committee of the University of Connecticut AFROTC detachment.

AFA's Central Connecticut Chapter, chartered in 1984 and led by Rosario Rizzo, Jr., hosted the Air Force Band of New England in a concert held for the local community at Mercy High School in Middletown. Chapter officials assisted Pratt & Whitney Aircraft in East Hartford in celebrating its sixtieth anniversary in October.

AFA's Charles A. Lindbergh Chapter, led by John Henry Griffin, is one of the most active in the New England Region. Regular meetings have hosted outstanding speakers, including US Transportation Secretary Elizabeth Dole; Gen. Lawrence A. Skantze, Commander of Air Force Systems Command, who was honored with the Chapter's Lone Eagle Award for outstanding achievements; and Gen. Robert T. Herres, Commander in Chief of Space Command, who was honored with a Gen. Ira Eaker Fellowship.

During the year, the Chapter's Sabre of Excellence award was created and presented to University of Connecticut AFROTC Cadet Susan Strele for her superior performance during summer exercises. The Chapter also sponsored its second annual Memorial Day Service in St. Mary's Church in Norwalk. More than 500 attended the service, and many lingered for a Chapter-sponsored luncheon/reception after the service. A new award named for Chapter founder and active AFA leader Alton G. Hudson was established in order to honor performance in support of the Air Force and the Lindbergh Chapter.

AFA's First Connecticut Chapter is led by Andrew M. Bravo. George H. Damato leads AFA's Flying Yankees Chapter, which cosponsored Flag Day ceremonies with AFA's Northern Connecticut Chapter and the Rockville, Conn., Elks Lodge. Newly chartered this year was AFA's General Bennie Davis Chapter in Brookfield, led by Lily D. R. Coulson.

Kenneth L. Weber leads AFA's General George C. Kenney Chapter, which presents complimentary AIR FORCE Magazine subscriptions to four high schools and the University of Connecticut. Kenneth A. Robinson leads AFA's Igor Sikorsky Chapter, which meets each quarter and, during the year, donated funds to the Air Force Museum Foundation and participated in Danbury High School's annual Military Awards Banquet. The Chapter presented AFA's Bronze Medal to two outstanding AFJROTC cadets.

Northern Connecticut Chapter is headed by Charles E. Luchini. During the year, the Chapter cosponsored Flag Day ceremonies with AFA's Flying Yankees Chapter at the Rockville Elks Lodge. A combined dinner meeting was held with AFA's Central Connecticut Chapter. Newly chartered during the year was AFA's Sergeant Charlton Heston Chapter in Waterbury, led by Dennis Therieault.

AFA's Charles A. Lindbergh Chapter in Westport, Conn., presented its highest honor, the Lone Eagle Award, to Gen. Lawrence A. Skantze, Commander of Air Force Systems Command, at the Chapter's dinner dance last year. The trophy is being presented to General Skantze by Chapter President John Henry Griffin (right).

Pease (N. H.) Chapter President Lee Blythe Lilljedahl presented an AFA tankard to Rep. Robert Smith (R-N. H.) at the Chapter's annual "bring-a-guest-to-brunch" function. Recently, Chapter officials participated in New Hampshire Public Television's fund drive, which gave the Chapter excellent visibility.

INTERCOM

Who will see the aerial bumper sticker? "Longhorns will," Connor reports, since Riser, owner of the Riser Ranch at George West, Tex., often flies his Piper around the state. The "Delta Eagles" also have bumper stickers for their cars, and Connor suggests that if you see one, "give him a toot in salute. If you are up in the air, duck, because you are too damn close!"

Former Hap Arnold Chapter President **Walt Ruina** was honored with a Jimmy Doolittle Fellowship in AFA's Aerospace Education Foundation at the Chapter's annual Military Ball on November 15. Held at the Huntington Town House on Long Island, the event was attended by many distinguished guests, including Marine Corps Medal of Honor recipient **Anthony Casamento** and his wife, **Olivia,** reports Chapter Communications Director **Ruth Miller.**

Sen. Jeff Bingaman (D-N. M.) presented AFA's national Medal of Merit award to Albuquerque Chapter President **V. R. Woodward** recently. Woodward was honored for "dynamic leadership and unusual expertise in promoting US airpower within the civilian and military communities, thus contributing to the strong defense of the United States" . . . Red River Valley Chapter President **Mike Phillips** has ordered thirty copies of AFA's policy book for local Civil Air Patrol and Young Astronaut Chapters, the University of North Dakota Center for Aerospace Studies, area government officials, local base commanders, and media outlets.

AFA's Central Florida Chapter recently hosted its second annual salute, this year honoring the Florida Air National Guard. Fourteen organizations and corporations ranging from Sea World and T & T Travel to Honeywell and Martin Marietta Aerospace supported the event, which also honored the late AFA leader **Morgan S. "Tim" Tyler** with a posthumous Jimmy Doolittle Fellowship. Other honorees were the 125th Fighter Interceptor Group, AFA Special Citation; **Col. Dean T. Biggerstaff,** National AFA Medal of Merit; **Norman Abramson,** Central Florida Vice President, **Donald T. Beck,** Florida AFA President, **H. Lake Hamrick,** National Vice President for the Southeast Region, and **Louis C. Kriebel,** Central Florida Chapter member, AFA Exceptional Service Awards; and the Florida Air National Guard, Florida AFA's Distinguished Service Award.

Robert Arnold, Vice President for Communications for Texas AFA's Wichita Falls Chapter, has begun a newsletter that is attractive, full of good information, inviting to read, and professional in appearance—four typeset pages with photos and an excellent recruiting tool for new members. Wichita Falls Chapter President **Robert Haley** is making things happen in Wichita Falls, and this is evident in the newsletter article, "Chapter Programs in Action." Another effective publication is Pennsylvania AFA's *Pennsylvania Flyer,* which includes a guest column by **Rep. William F. Clinger, Jr.** (R-Pa.), who, in the latest issue, discusses terrorism. Each edition will feature a column by a Pennsylvania Member of Congress. Good work by Pennsylvania President **Jack Flaig** and his executive council!

CINCSAC **Gen. Larry D. Welch** was the featured speaker at AFA's Snake River Valley Chapter winter meeting. It was held at the Mountain Home AFB, Idaho, NCO Club, says **Capt. Jim Tynan,** base public affairs officer, who

helped with the event . . . AFA's Homestead Chapter in Homestead, Fla., recently underwent a name change in honor of **John W. DeMilly, Jr.**, who was a respected civic leader and a local veterinarian and who had served as treasurer of the Chapter prior to his death . . . Union Morris Chapter leader **Tom Gilbert** journeyed to Taiwan for his CBI reunion. His trip was the subject of the February 27 dinner meeting, during which he showed slides.

Former Washington AFA President **Dave Anderson** was honored for his dynamic leadership at a Greater Seattle Chapter meeting on February 9 that featured **Gilbert W. Keyes,** Deputy Manager, Space Station External Affairs at Boeing Aerospace, as speaker. Former National Secretary **Sherm Wilkins** assisted in the honors ceremony, reports **Al Lloyd,** Washington AFA Vice President for Communications . . . Former National Vice President for the South Central Region **Chuck Hoffman** recently spoke on Soviet KGB operations before the Army ROTC unit at the University of Arkansas. ■

Coming Events

May 9–10, **Alabama State Convention,** Huntsville . . . May 16–17, **Oregon State Convention,** Portland . . . May 16–18, **South Dakota State Convention** . . . June 6–7, **Tennessee State Convention,** Tullahoma . . . June 6–8, **Idaho State Convention,** Boise . . . June 7, **Alaska State Convention,** Fairbanks . . . June 13–14, **New Hampshire State Convention,** Pease AFB . . . June 20–22, **Florida State Convention,** Cocoa Beach . . . June 20–22, **Ohio State Convention,** Cincinnati . . . June 21, **Louisiana State Convention,** Barksdale AFB . . . June 26–27, **Massachusetts State Convention,** Boston . . . June 26–27, **New Jersey State Convention,** Cape May . . . June 27–28, **Mississippi State Convention,** Columbus . . . June 28–29, **Georgia State Convention,** Atlanta . . . July 18–20, **Pennsylvania State Convention,** Wilkes-Barre . . . July 25–26, **Indiana State Convention,** Fort Wayne . . . July 25–26, **Texas State Convention,** Wichita Falls . . . August 1–2, **Colorado State Convention,** Colorado Springs . . . August 1–3, **New York State Convention,** Rome . . . August 9–10, **Arkansas State Convention,** Fort Smith . . . August 21–23, **California State Convention,** Riverside . . . September 15–18, **AFA National Convention and Aerospace Development Briefings & Displays,** Washington, D. C. . . . September 19–20, **Washington State Convention,** Tacoma.

UNIT REUNIONS

AFRES at Hanscom
Members of Air Force Reserve units and anyone assigned to Reserve programs at Hanscom AFB, Mass. (1946–86), will hold a reunion on June 28, 1986, at the Marriott Hotel in Newton, Mass. **Contact:** Stephen Keefe, 1099 Washington St., Weymouth, Mass. 02189. Phone: (617) 337-3900.

Air Forces Escape & Evasion Society
Members of the Air Forces Escape & Evasion Society will host their annual meeting on May 21–24, 1986, at the Terrace Garden Inn in Atlanta, Ga. **Contact:** Ralph K. Patton, 720 Valleyview Rd., Pittsburgh, Pa. 15243. Phone: (412) 343-8570.

Combat Control Teams
Combat control team members from the 2d Aerial Port Squadron, Sewart AFB, Tenn., and the 8th Aerial Port Squadron, Saigon, Vietnam (1966–69), have scheduled a reunion for early July 1986. **Contact:** Larry Courtroul, P. O. Box 743, Midland, Tex. 79701. Phone: (915) 683-1027.

Guadalcanal Veterans
Veterans of the Guadalcanal campaign will hold a reunion on May 30–June 1, 1986, at the Stardust Hotel and Country Club in San Diego, Calif. **Contact:** William A. Parker, 805 W. Chase Ave., El Cajon, Calif. 92020. Phone: (619) 444-9734.

Jolly Green Ass'n
Members of the the Jolly Green Rescue Forces will hold a reunion on May 16–17, 1986, at the Ramada Beach Resort in Fort Walton Beach, Fla. **Contact:** Jack Allison, 2007 Bayshore Dr., Niceville, Fla. 32578. Phone: (904) 678-8135.

Mediterranean Allied Photo Recon Wing
Members of the Mediterranean Allied Photo Recon Wing will hold a reunion on May 10–13, 1986, at the Stouffer Hotel in Dayton, Ohio. **Contact:** John Silliman, 5621 W. Bavarian Pass, Minneapolis, Minn. 55432. Phone: (612) 571-2263.

USS *Hornet* Club
The USS *Hornet* Club will hold its thirty-eighth annual reunion on June 6–8, 1986, at the Tides Hotel and Bath Club, North Redington Beach, St. Petersburg, Fla. **Contact:** Connie Massé, P. O. Box 277, Rehoboth, Mass. 02769. Phone: (617) 252-4560.

Wright-Patterson Field
Personnel who served at Wright-Patterson Field during World War II will hold a reunion on April 27–May 1, 1986, at the Flamingo Hilton & Tower Hotel in Las Vegas, Nev., during AFA's "Gathering of Eagles." **Contact:** George J. Burrus III, 21 Lake Eloise Lane, Winter Haven, Fla. 33880. Phone: (813) 324-2089.

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. 35816 (phone 205-837-5087).

ALASKA (Anchorage, Fairbanks): **Michael T. Cook,** P. O. Box 25, Fairbanks, Alaska 99707 (phone 907-456-7762).

ARIZONA (Green Valley, Phoenix, Sedona, Sun City, Tucson): **Robert A. Munn,** 7042 Calle Bellatrix, Tucson, Ariz. 85710 (phone 602-747-9649).

ARKANSAS (Blytheville, Fayetteville, Fort Smith, Little Rock): **Thomas P. Williams,** 4404 Dawson Drive, N. Little Rock, Ark. 72116 (phone 501-758-6885).

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 Monica, Sunnyvale, Vandenberg AFB, Yuba City): **Gerald S. Chapman,** 13822 Via Alto Court, Saratoga, Calif. 95070 (phone 408- 379-6558).

COLORADO (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Littleton, Pueblo, Waterton): **Thomas W. Ratterree,** 5007 Alta Loma Rd., Colorado Springs, Colo. 80918 (phone 303-599-0143).

CONNECTICUT (Brookfield, East Hartford, Middletown, North Haven, Storrs, Stratford, Waterbury, Westport, Windsor Locks): **Joseph Zaranka,** 9 S. Barn Hill Rd., Bloomfield, Conn. 06002 (phone 203-242-2092).

DELAWARE (Dover, Wilmington): **Horace W. Cook,** 112 Foxhall Drive, Dover, Del. 19901 (phone 302-674-1051).

DISTRICT OF COLUMBIA (Washington, D. C.): **Howard W. Cannon,** 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, Miami, Naples, Neptune Beach, New Port Richey, Orlando, Panama City, Patrick AFB, Redington Beach, Sarasota, Tallahassee, Tampa, West Palm Beach, Winter Haven): **Donald T. Beck,** 1150 Covina St., Cocoa, Fla. 32927 (phone 305-636-7648).

GEORGIA (Athens, Atlanta, Columbus, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): **Wilbur H. Keck,** 116 Stillwood Drive, Warner Robins, Ga. 31088 (phone 912-922-0655).

GUAM (Agana): **George W. Baldwin, Jr.,** P. O. Box 8710, Tamuning, Guam 96911 (phone 671-646-4445).

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): **Walter G. Vartan,** 230 W. Superior Court, Chicago, Ill. 60610 (phone 312-477-7503).

INDIANA (Bloomfield, Fort Wayne, Indianapolis, Lafayette, Logansport, Marion, Mentone, South Bend, Terre Haute): **Bill Cummings,** 12031 Mahogany Drive, Fort Wayne, Ind. 46804 (phone 219-672-2728).

IOWA (Des Moines, Sioux City): **Carl B. Zimmerman,** 608 Waterloo Bldg., Waterloo, Iowa 50701 (phone 319-232-2650).

KANSAS (Garden City, 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): **Francis R. O'Clair,** 6604 Groveton Drive, Clinton, Md. 20735 (phone 301-372-6186).

MASSACHUSETTS (Bedford, Boston, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, West Springfield, Worcester): **John F. White,** 49 West Eagle St., East Boston, Mass. 02128 (phone 617-567-1592).

MICHIGAN (Alpena, 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): **Earl M. Rogers, Jr.,** 325 Lake Ave., S., Duluth, Minn. 55802 (phone 218-727-2191).

MISSISSIPPI (Biloxi, Columbus, Jackson): **R. E. Smith,** Route 3, Box 282, Columbus, Miss. 39701 (phone 601-327-4071).

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., S. Great Falls, Mont. 59405 (phone 406-453-2054).

NEBRASKA (Lincoln, Omaha): **Donald D. Adams,** FirsTier Inc., 17th & Farnam, Omaha, Neb. 68102 (phone: 402-348-7905).

NEVADA (Las Vegas, Reno): **David Broxterman,** 1455 E. Tropicana, Las Vegas, Nev. 89119 (phone 702-361-7027).

NEW HAMPSHIRE (Manchester, Pease AFB): **Robert N. McChesney,** Scruton Pond Rd., Barrington, N. H. 03825 (phone 603-664-5090).

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NEW MEXICO (Alamogordo, Albuquerque, Clovis): **Louie T. Evers,** P. O. Box 1946, Clovis, N. M. 88101 (phone 505-762-1798).

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NORTH CAROLINA (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Kitty Hawk, Raleigh): **Bobby G. Suggs,** P. O. Box 1630, Fayetteville, N. C. 28302 (phone 919-323-5281).

NORTH DAKOTA (Concrete, Fargo, Grand Forks, Minot): **Michael Langlie,** 2901 Columbine Court, Grand Forks, N. D. 58201 (phone 701-772-7211).

OHIO (Akron, Cincinnati, Cleveland, Columbus, Dayton, Mansfield, Newark, Youngstown): **John Boeman,** 10608 Lake Shore Blvd., Bratenal, Ohio 44108 (phone 216-249-8970).

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, Altoona, Beaver Falls, Coraopolis, Drexel Hill, Erie, Harrisburg, Homestead, Johnstown, Lewistown, Mon-Valley, Philadelphia, Pittsburgh, Scranton, State College, 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): **Harry E. Lavin,** 28 Little Creek Rd., The Forest, Myrtle Beach, S. C. 29577 (phone 803-272-8440).

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): **Ollie R. Crawford,** P. O. Box 202470, Austin, Tex. 78720 (phone 512-331-5367).

UTAH (Brigham City, Clearfield, Ogden, Provo, Salt Lake City): **Harry Cleveland,** 224 N. Jackson Ave., Ogden, Utah 84404 (phone 801-621-2365).

VIRGINIA (Arlington, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **Charles G. Durazo,** 1725 Jefferson Davis Highway, Suite 510, Arlington, Va. 22202 (phone 703-360-9098).

WASHINGTON (Bellingham, Seattle, Spokane, Tacoma, Yakima): **Edward V. Hudson,** 2902 S. 12th St., Tacoma, Wash. 98405 (phone 206-627-1177).

WEST VIRGINIA (Huntington): **David Bush,** 2317 S. Walnut Drive, St. Albans, W. Va. 25177 (phone 304-722-3583).

WISCONSIN (Madison, Milwaukee): **Gilbert Kwiatkowski,** 8260 W. Sheridan Ave., Milwaukee, Wis. 53218 (phone 414-463-1849).

WYOMING (Cheyenne): **Irene G. Johnigan,** 503 Notre Dame Court, Cheyenne, Wyo. 82009 (phone 307-775-3641).

WWABNCP Communicators
The World-Wide Airborne Command Post (WWABNCP) Communicators will hold a reunion on July 11–13, 1986, at Offutt AFB, Neb. **Contact:** CMSgt. Willie Pelletier, USAF (Ret.), 3322 Willow St., Bellevue, Neb. 68005. Phone: (402) 731-7708. CMSgt. Ed Hersey, USAF (Ret.), 1230 St. Andrews Rd., Bellevue, Neb. 68005. Phone: (402) 291-7709.

7th Bomb Group
Veterans of the 7th Bomb Group, which included the 9th, 11th, 22d, 436th, 492d, and 493d Bomb Squadrons and the 88th Reconnaissance Squadron and Headquarters Squadron, will hold a reunion on June 18–20, 1986. **Contact:** Gail O. Simon, 2036 Giscours Ct., Coeur d'Alene, Idaho 83814. Phone: (208) 772-4534.

In our January 1986 issue, we published a reunion notice for Class 41-B that listed Col. Robert G. Carnahan, USAF (Ret.), as the contact for further information *(p. 115)*. Colonel Carnahan has subsequently contacted us to inform us that while he thinks a reunion is a fine idea, he did *not* submit the notice and is *not* organizing any such event. Readers are hereby advised not to contact Colonel Carnahan regarding a Class 41-B reunion.—THE EDITORS

INTERCOM

8th Fighter Group Ass'n
The 8th Fighter Group and attached squadrons will hold a reunion on July 3–6, 1986, at the George Washington Lodge in King of Prussia, Pa. **Contact:** Vincent Steffanic, 21 Curson St., West Warwick, R. I. 02893. Phone: (401) 828-1769.

9th Bomb Group
Members of the 9th Bomb Group stationed on Tinian Island in 1945 will hold a reunion in Las Vegas, Nev., on April 27–May 1, 1986, during AFA's "Gathering of Eagles." **Contact:** Leonard W. Carpi, 523 E. Oakey Blvd., Las Vegas, Nev. 89104. Phone: (702) 384-5353.

70th Fighter Squadron
Members of the 70th Fighter Squadron "White Knights" will hold a reunion on September 11–14, 1986, at the Raintree Inn in Colorado Springs, Colo. **Contact:** Elbert Major, Rte. 4, Box 573, Lindale, Tex. 75771. Phone: (214) 882-5864.

86th Fighter-Bomber Group
Members of the 86th Fighter-Bomber Group from World War II will hold a re-

Eagle Watch

The aerospace event of the decade will take place this month in Las Vegas, Nev., April 27 through May 1. By March 1, twenty-five AFA affinity groups had signed up to attend the spectacular Gathering of Eagles and help celebrate AFA's fortieth anniversary. Many of these groups are planning their own events to share in the spirit and camaraderie of the Gathering.

Since last month, three additional groups have joined the list of affinity groups that will be attending the Gathering. These three and a complete list of all other affinity groups now scheduled to attend follow:

Pilot Training Class 51-C
8th Fighter Bomber Group
Mr. Jim Ware
1163 Salvadore St.
Costa Mesa, Calif. 92626

48th Tactical Fighter Wing
Mr. Bob Lilac
3631 Winfield Lane, N. W.
Washington, D. C. 20007

Liberandos
376th Veterans Association
Mr. Bill Poynter
1183 Fredkin Dr.
Covina, Calif. 91722

Western P-47 Thunderbolt Pilots
P-51 Mustang Pilots Association
Pilots Class 43-D Association
44th Heritage Memorial Group
Crew-7
18th Tactical Fighter Wing
438th Troop Carrier Group
459th Bomb Group
Reserve Officers Association, Air Section
1st Air Commandos
1st Troop Carrier Squadron
F-86 Sabre Pilots Association
8th Air Force Historical Society
82d Troop Carrier Squadron
86th Fighter Bomber Group Association
Class 41-C, West Coast Training Center
Class 41, USMA
94th Bomb Group
362d Fighter Group, Ninth Air Force
368th Fighter Group
Night Fighters Association
UPT Class 52-G

If you belong to one of these groups, we urge you to join them during the Gathering. For more information on group contacts, call Rick Harris at AFA Headquarters. He can be reached at (703) 247-5800.

See you in Las Vegas!

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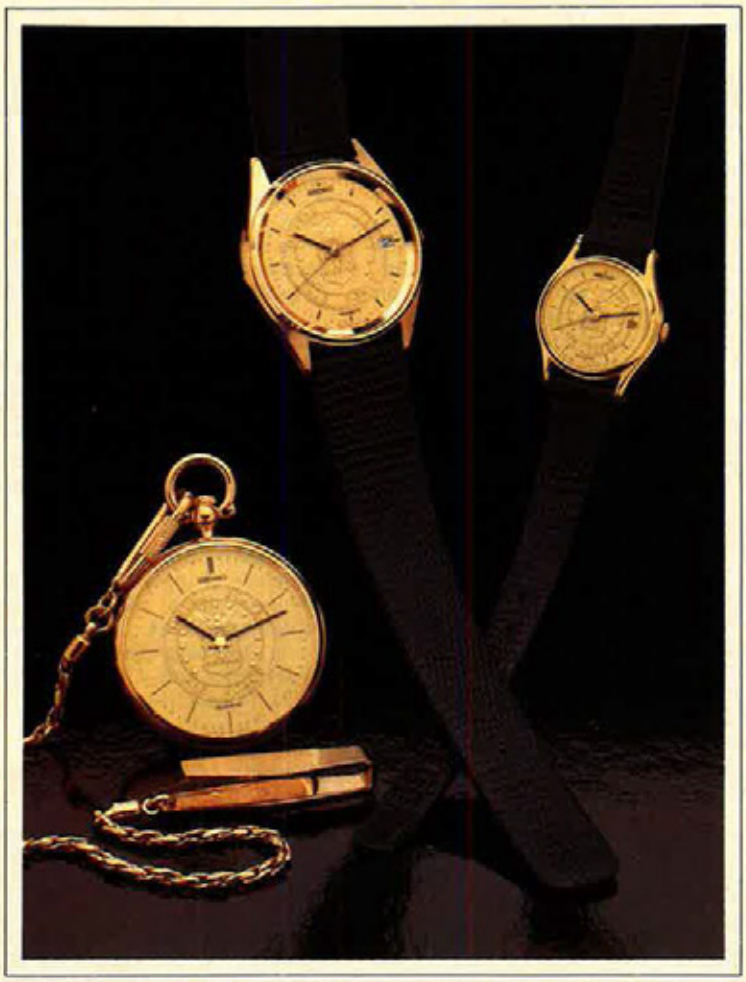

Illustration reduced. Actual diameters of watches are as follows: pocket watch 1-½", men's wrist 1-⅜", and ladies' wrist ⅝".

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_____ Men's Seiko Quartz Wrist Watch (#AFA-SMS) @ $180* each.
QUANTITY

_____ Seiko Quartz Pocket Watch (#AFA-SPK) @ $195* each.
QUANTITY

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☐ By charging the amount of $_____ ☐ ☐ VISA ☐ to my credit card indicated below.

Full Account Number: Expiration:

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union on June 12–14, 1986, in Tulsa, Okla. **Contact:** Gilbert W. Knecht, 4638 S. Maplewood, Tulsa, Okla. 74135. Phone: (918) 627-0834.

308th Fighter Squadron
Members of the 308th Fighter Squadron from World War II will hold a reunion on May 12–14, 1986, in Reno, Nev. **Contact:** Vince Hammerlund, 5431 Bartig Way, Citrus Heights, Calif. 95621.

330th Bomb Squadron
The 330th Bomb Squadron will hold a reunion on June 20–22, 1986, at Castle AFB, Calif. **Contact:** Mike Bogna, 525 Baker Ct., Atwater, Calif. 95301. Phone: (209) 358-5320.

351st Bomb Group
Members of the 351st Bomb Group will hold a reunion on June 5–7, 1986, at the State Fair Inn in Sedalia, Mo. **Contact:** Ben Schohan, 398 Catawba Ave., Westerville, Ohio 43081. Phone: (614) 882-8410.

366th Fighter Group
The 366th Fighter Group of World War II will hold a reunion on October 31–November 1, 1986, at the St. Anthony Hotel in San Antonio, Tex. **Contact:** Col. Dyke F. Meyer, USAF (Ret.), Rte. 2, Box 310, Comfort, Tex. 78013. Phone: (512) 995-2109.

390th Air Service Squadron
Members of the 390th Air Service Squadron will hold a reunion on July 17–19, 1986, in Omaha, Neb. **Contact:** Glenn Bock, P. O. Box 11, Sherman, N. Y. 14781. Phone: (716) 761-6587.

401st Bomb Group
Members of the 401st Bomb Group will hold a reunion on October 16–19, 1986, in Savannah, Ga. **Contact:** Ralph W. Trout, P. O. Box 22044, Tampa, Fla. 33622. Phone: (813) 884-6081.

435th "Black Eagles"
Members of the 435th "Black Eagles" (1943–86) will hold their first reunion on May 23–26, 1986, at Holloman AFB, N. M. **Contact:** Capt. Michael Fischer, USAF, 435th Tactical Fighter Training Squadron (TAC), Holloman AFB, N. M. 88330. Phone: (505) 479-3823.

464th Bomb Group
The 464th Bomb Group will hold a reunion on July 23–27, 1986, at the Sheraton Hotel in Manitowoc, Wis. **Contact:** Henry R. Anderson, 4321 Miller Ave., Erie, Pa. 16509. Norb Kustka, 12324 Hyway JJ, Cato, Wis. 54206.

494th Bomb Group
The 494th Bomb Group will hold a reunion on June 20–22, 1986, at the Marriott Hotel in North Charleston, S. C. **Contact:** Rusty Restuccia, 100 Willard, Quincy, Mass. 02169. Marshall Keller, 7412 Vassar Dr., West Bloomfield, Mich. 48033.

574th/565th SAW Ass'n
The 574th/565th SAW will hold a reunion during July 1986 in Buffalo, N. Y. **Contact:** Angel M. Zaragoza, 1571 9th St., San Bernardino, Calif. 92411.

INTERCOM

913th ARS
Members of the 913th ARS will hold a reunion on April 18–20, 1986. **Contact:** Reginald W. Adams, Jr., 710 Benton Rd., Bossier City, La. 71111. Phone: (318) 746-0252.

6147th Tactical Control Group
Members of the 6147th Tactical Control Group "Mosquitos" who served in Korea (1950–58) will hold a reunion on July 10–13, 1986, at the Air Force Museum, Wright-Patterson AFB, Ohio. **Contact:** Ruey W. Blackburn, 16 Edgewood Dr., Winchester, Ky. 40391. Phone: (606) 744-9640.

2d Bomb Group Ass'n
Former and present members of the 2d Bomb Group and current active members of the 2d Bomb Wing (SAC) who would like to be placed on our mailing list in order to receive reunion notices and newsletters should contact the address below.

C. P. Huntington
721 Cascade Dr.
San Jose, Calif. 95129

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