FEBRUARY 1988/$2

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

Strategic Forces on the Brink of START


THIS IS A
THREAT.

THIS IS A PROMISE.

Today our adversaries have in place a multi-layer gauntlet of surface-to-air weaponry. The most formidable that has ever existed.

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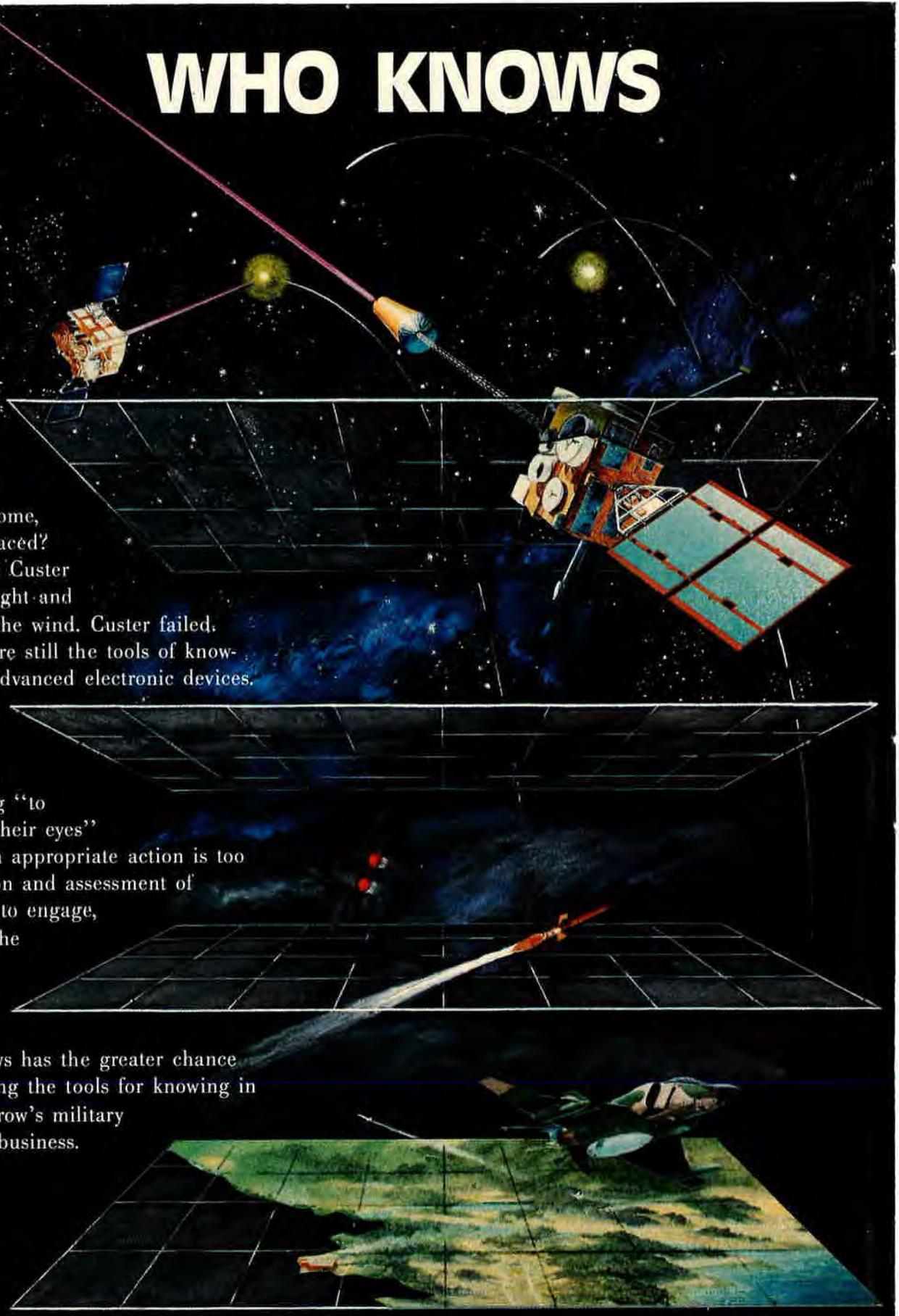
Denying the skies to any foe is the mission of the Advanced Tactical Fighter. The Northrop/McDonnell Douglas ATF will accomplish that mission.

NORTHROP

The Northrop/McDonnell Douglas ATF Team

WHO KNOWS



Who knows what lies ahead, the obstacles to be overcome, the threats to be faced? Lewis & Clark and Custer relied on line of sight and sound carried on the wind. Custer failed. Sight and sound are still the tools of knowing enhanced by advanced electronic devices.

In today's military encounters, waiting "to see the whites of their eyes" before engaging in appropriate action is too late. Early detection and assessment of threats gives time to engage, counter or evade the threat.

The one who knows has the greater chance to survive. Providing the tools for knowing in today's and tomorrow's military encounters is our business.

Enhancing mission success is our commitment.

THE COMMITMENT STANDS.

Litton
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FEBRUARY 1988
VOLUME 71, NUMBER 2

AIR FORCE MAGAZINE

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About the cover: TSgt. Robert Patterson (left) and SSgt. Michael Muller of the 90th SMW maintain a Peacekeeper missile silo at F. E. Warren AFB, Wyo., in this Paul Kennedy photo. A special section on "Strategic Forces/Space" begins on page 36 of this issue.

Special Section: Strategic Forces/Space

Features

Departments

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An Editorial

The Risks of Austerity

By John T. Correll, EDITOR IN CHIEF

OVERSHOOTING the end of the fiscal year by nearly three months, the Administration and Congress finally settled on a budget last December 22. Throughout this extended spectacle, attention was riveted on the federal deficit to the virtual exclusion of all else. It may thus have escaped public notice that, almost as a side issue, three significant changes have just taken place in defense preparedness policy.

- The armed forces are about to become smaller.
- They will be less capable in the years ahead.
- We will accept a higher level of risk to national security.

This position, announced in December by the Pentagon, has absolutely nothing to do with defense requirements. The government, under pressure of the deficit, simply decided to cut spending and worry later about the consequences. *(See "The Five-Year Drought," p. 16 of this issue.)* The Planning, Programming, and Budgeting System (PPBS) has never been a pristine process, but now it is working backwards. The government first sets the budget level, then programs the resources, and leaves planning to be done last and on the shortest notice.

The Defense Department has conceded that radical budget reductions are inevitable, given the prevailing mood of Congress and the voters. It has said clearly, though, that the reductions will mean leaving some contingencies uncovered and some threats unanswered. So far, this warning has not caused much alarm outside the defense community. Many Americans take comfort in assurances by the antidefense propaganda mill that cuts will scarcely be felt in a program that was already too big.

In fact, defense currently consumes less of the Gross National Product and a smaller share of federal spending than it did twenty years ago when no deficit existed. The Reagan Administration's program to rearm America stalled out in 1985. The Senate Appropriations Committee calculates that, after inflation, defense budgets have declined by ten percent in the last three years. Now the armed forces are told that they must cut their plans by ten to twelve percent in each of the next five years.

The sloganeers will call on the troops to "do more with less," and snake-oil salesmen will argue that the cuts do no real damage. Unfortunately, the Pentagon's warning is accurate. We are about to see a degradation of US combat capability.

To take a calculated risk with national security is bad enough. Unwillingness to recognize the risk makes it far more dangerous. Just as the nation has set the budget without regard for requirements, it also tends to adopt strategies that have little connection to capabilities. The United States clings to its traditional aspirations in the world, but all three of its instruments of power—the military, the economic, and the diplomatic—command less respect than they once did.

Advocates of the reduction have been quick to insist that with almost 2,000,000 people on active military duty and a defense budget approaching $300 billion, the United States will hardly be left unprotected. Well, yes. The risk is relative, not absolute. But there are already gaps and weak spots in what US forces can cover now, and soon there will be more.

While Congress was in the middle of its budget cuts, President Reagan and Soviet leader Mikhail Gorbachev were shaking hands on the removal of intermediate-range nuclear missiles from Europe. Arms-control enthusiasts had campaigned long and hard for such an agreement. In the days when talk was cheap, even the foremost critics of defense admitted that a nuclear drawdown would have to be paired with an increase in conventional forces to balance the Warsaw Pact's advantage in tactical units and tank armies. Now that the treaty is in sight, US forces are being reduced instead, and Congress is keeping a tight lid on troop ceilings in Europe. There will also be decreases in weapons production, system modernization, sustainability, and combat support. It does not take a great deal of imagination to see the increased risk here.

The amount of military power a nation needs to secure its interests and carry out its strategy cannot be computed precisely. There are always elements of chance and risk. The adequacy of a weapons package against a given target is an estimate—although a pretty good one—expressed as a percentage of probability. High probabilities of success in most strike missions require a heavy commitment of forces, and when fewer forces are available, the chances of success diminish. Sometimes it is possible to beat the odds, but it's risky to plan that way.

It is at the level of international power politics, however, that uncertainties abound. A defense strategy must take into account not only the deterrence or defeat of an attack on US and allied territory but also the preservation of numerous other interests, including economic ones. History often turns on the unexpected. Nations seldom behave logically and almost never predictably.

At present, the likelihood of a direct attack on the United States is remote, but there is no guarantee that this will continue to be so. Military and political circumstances today put the Soviet Union in a stronger position to influence world events than it was a few years ago. How sure can we be that the Soviets will not try to exploit this advantage in some way injurious to us?

The oil crises of the 1970s demonstrated our dependence on international lifelines and how suddenly they can be placed in jeopardy. Who knows where another Qaddafi or Khomeini might arise or when a crisis could develop in this hemisphere? Who could have predicted the collapse of the US space program in 1986? What are the chances that we will be overtaken and surpassed in some crucial technology? How effective will our more tightly constrained, less flexible strategy be in responding to the next lurch in global affairs?

Perhaps it will work out all right. Risk is not the same thing as inevitability. Our interests may not come under serious challenge, or if they do, our reduced capabilities may still be enough to see us through. The United States has been a lucky nation for most of its 200-year existence. We had better hope that our luck holds out. ■

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Airmail

Missile Forces

I am writing to express my disappointment with your magazine's coverage of Strategic Air Command's ICBM force. In the December 1987 issue on "Training" in the Air Force, there was no mention of the intensive and continuing training given to the men and women of SAC that ensures the highest proficiency possible in dealing with such a complex weapon system as the Minuteman ICBM.

Electronic upgrades and a more demanding tasking from our National Command Authorities force the SAC missile community to be on the cutting edge of national deterrence. To accomplish the mission, we train hard and are avaluated to the highest degree possible. There is no room for error when dealing with nuclear weapon systems.

[Missile crews] feel left out, with too much coverage devoted to the flying mission of the Air Force. I am not alone in this feeling. When was the last time you featured a cover that had an ICBM or missile theme? . . .

My fellow "crew bears" and myself do feel that the Air Force's ICBM leg of the triad is not fairly represented in your magazine.

1st Lt. Robert W. Morningstar, USAF
Minot AFB, N. D.

Foggy Hahn

I enjoyed your article "Hahn's High-Tempo Tradeout" in the December 1987 issue of the magazine. It was great being brought up to date on one of my best duty stations.

The 50th Tactical Fighter Wing continues to be one of the best, even though flying in an area of terrible weather. We always said that Hahn had the world's largest fog machine. It seemed that we always entered a fog bank a half mile from the base.

As a former member of the 496th Fighter-Interceptor Squadron at Hahn, I take my hat off to the officers and airmen of the 50th TFW for the splendid job they are doing.

MSgt. Leland C. Higley, USAF (Ret.)
Tacoma, Wash.

Glenn's Ways

While I am not totally in agreement with all of Sen. John Glenn's ideas as expressed in the December 1987 article "Glenn Goes His Own Path," I find him to be a refreshing breeze from the Democratic side of the Senate. His defense views are rightfully pragmatic and do not attempt to hold to some idea of politicizing our national defense.

The many congressmen who hold up the DoD budget as the problem would do well to remember that if we do not have an adequate defense, then all the rest will become meaningless. They should remember, as Senator Glenn says, that "keeping our people alive, independent, and free is the number-one responsibility of government."

The Senator advocates one thing I believe hits the nail right on the head: the draft and the citizen's obligation to his country. I can remember that the arguments for the All-Volunteer Force (AVF) in the early 1970s were supposedly driven by budgetary constraints (and to some extent, they probably were), but the real reason for the AVF was to do away with the draft after an unpopular war.

Is an individual citizen's obligation any less or any more in early 1988 than in the early 1970s? I believe it is the same, and it *is* an obligation. Why not a draft? Why not spread the obligation throughout the population, rather than tap one particular segment prone to go into the service because of employment conditions? . . .

Maybe Harry Truman's late 1940s idea of Universal Military Training wasn't such a bad idea after all. For the conscientious objector, there are always noncombat duties or perhaps a tour in VISTA or some other social program to help our less fortunate citizens.

Lt. Col. William T. Wilson, USAF (Ret.)
El Dorado Hills, 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.

Bitter Rivalry

I have just read Fred H. Henry's "Airmail" letter in the December 1987 issue of Air Force Magazine. His letter concerning shuttle missions to Russia during World War II was very interesting to a point.

But when he referred to the Eighth Air Force shuttle runs, I could hardly believe my eyes when I read that those in the Fifteenth Air Force in Italy were "smugly pleased" when the UK-based Eighth Air Force lost half of its planes to a surprise German night strafing attack while sitting on a Russian airfield.

Having flown with the Eighth Air Force on a shuttle run to Russia and having spent a few days at a Fifteenth Air Force base on the way back, I knew there was a keen rivalry between the two air forces. However, I never realized that the rivalry was so bitter that the Fifteenth Air Force found pleasure when the Eighth Air Force suffered serious losses at the hands of our common enemy.

I hope Mr. Henry's letter reflects his personal feelings only and not those of the entire Fifteenth Air Force.

Henry W. Schneider
Pittsburgh, Pa.

Chemical Suit

Sgt. Brian L. Moen may have helped his unit win the wideband/record communications event during Combat Challenge '87, but if the chemical attack had been real, he would have transmitted only one message *(see "Aerospace World," p. 26, December '87 issue).*

Sergeant Moen is not wearing his hood properly. The drawstring should go around the neck, not across the forehead over the eyelenses. In addition, the straps that should go from

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behind the hood and under the arms and attach to the front of the hood are not in use. As a result, the hood is not draped over the shoulders, and it appears that the collar of his jacket is outside the hood. This could possibly allow direct entry of chemical vapor and droplets down Sergeant Moen's neck.

Protective equipment cannot save lives if it is improperly worn. If the Sergeant had been working in a chemical environment, he would not have survived. Chemical warfare exercises must be taken seriously in order to be effective in saving lives.

The Sergeant should have had someone to check him after he donned the protective suit. In this case, that procedure might have saved a life under real conditions.

Paul S. Frank, Jr.
Aurora, Colo.

• *Sergeant Moen was photographed during a portion of the meet in which typing while wearing gloves, suit, and hood is evaluated. Proper wear of the protective gear is not graded during this portion of the competition since it is not considered a main purpose of that phase of the test.*—THE EDITORS

Hughes Trophy

The item on page 33 and photograph on page 25 of the December 1987 issue on the winner of the Hughes Trophy are incorrect in claiming that the 67th Tactical Fighter Wing is the first two-time winner of the award.

While assigned to NORAD at Colorado Springs, I compiled a 157-page document on air defense and the Hughes Achievement Award (the proper title). Based on my research, I submit the following:

• The 317th FIS was the first unit to win the award three times—first in 1956, again in 1965, and last in 1967.

• The 32d FIS/TFS was the second unit to win three times (1966, 1979, and 1980) and the first unit to win twice in succession.

• The other two-time winners are the 57th FIS (1970 and 1976); the 43d TFS (1972 and 1977), and the 318th FIS (1975 and 1984).

CMSgt. Bob Ackerman, USAF
Langley AFB, Va.

Different Drone

Your coverage in the December 1987 "Aerospace World" of Teledyne Ryan Aeronautical's new Model 410 Unmanned Aerial Vehicle System and over-the-horizon backscatter support by TRA's AQM-34M drone is appreciated. One slight adjustment is needed, however, in the interest of accuracy.

Teledyne Ryan Aeronautical's BQM-34S Firebee aerial target system was what was intercepted by a MIRACL beam during a September 18, 1987, test of the laser system's beam lethality, not a Northrop BOM-74 target drone as you reported. In addition, a second BQM-34S Firebee was intercepted and destroyed by the MIRACL system in a follow-on test conducted at White Sands Missile Range on November 2, 1987. The range to the target was twice that of the first test. . . .

Jack G. Broward
Teledyne Ryan Aeronautical
San Diego, Calif.

Muffed Moniker

I note on page 30 of the December 1987 issue that you report that former Secretary of Defense Caspar Weinberger had appointed Steven M. Duncan to be the new Assistant Secretary of Defense for Reserve Affairs.

Maybe I am wrong, but shouldn't that be *Stephen* M. Duncan?

George W. Hargraves
Pocatello, Idaho

• *Reader Hargraves is correct.*—THE EDITORS

Real Changes

After months of soul-searching and family discussions, I've submitted my separation papers. I'm not a quitter, I'm not disloyal, and I'm not getting out simply because the airlines are hiring. I'm getting out because the benefits, good times, and opportunities no longer outweigh the irritations, long hours without reason or recognition, and family disruptions.

Real changes need to be made in the Air Force. Bumper stickers, posters, and AFRTS ads telling me that "it's a great way of life" are no longer convincing.

I joined the Air Force to fly and, if need be, fight. I have flown as a T-38 instructor pilot and as an F-111F aircraft commander. Now, however, the writing's on the wall. Flyers need to get out of the cockpit to get staff experience, especially for that all-important major's board. Why? Do flight surgeons hang up their stethoscopes periodically to broaden their careers by pushing paper at headquarters? As a highly trained professional aviator, I resent the notion that I'll be more valuable to the Air Force after I learn to assemble a staff summary package.

As for fighting, the threats the Air

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Force seems most concerned with are budget battles with Congress and inspection team outbriefs. Tactics and warfighting skills aren't even mentioned at SOS or ACSC! The "war games" played there are actually budgeting and acquisition games. . . .

The message becomes clear: Don't take chances, don't get creative, don't be nonstandard, and whatever you do, *don't be wrong!* Being right isn't nearly so important. Rote memorization to please evaluators has replaced in-depth knowledge. Perhaps this is realistic. Who has the time to build a comprehensive knowledge base with twelve-hour duty days full of meetings, reports, and short-notice suspenses? . . .

Over the past eight years, I've watched military raises become a political football again and again. I've seen service members portrayed as greedy, incompetent, wasteful, or unworthy of trust by politicians looking for headlines. A few have had the nerve to say that no raise was required because there was no shortage of volunteers.

I have a suggestion. The next time, don't tie pay to the private sector. Equate raises to the pay and benefits of congressmen. I don't believe they have a shortage of volunteers for those jobs.

[One letter] can't begin to cover the irritations caused by exercises, never-ending inspections, family separations, overcrowded and understaffed family support façilities, and minimal assignment options. . . .

Capt. Clay B. Cook, USAF
RAF Lakenheath, UK

Close Air Support

In reference to the controversy over a follow-on aircraft to the A-10:

I've always felt and believed that a survey of experienced close air support aircrews would reveal the following priority items:

- Four eyes.
- Two engines.
- Survivability.
- Maneuverability/speed.
- Equipment/ordnance.

Your "Valor" article in the March 1987 issue, "Long Night at Mo Duc," demonstrates what two well-qualified individuals in a single airplane can do in a tense situation.

There are a few things in life that we have to do alone, but fighting a war in an all-weather, day/night close air support mission should not have to be one of them.

Clem Pearson, Jr.
Denham Springs, La.

Second Class?

During the twenty-seven years that I served in the Air Force, it was a first-class organization, run and serviced by first-class men and women. Based on my contact with active-duty people in recent years, it still is.

The Air Force Association has long prided itself in furthering this first-class reputation. However, the plastic mailers now used to post AIR FORCE Magazine tell a different story. Receiving this fine journal each month with a prominent "SECOND CLASS" panel overlaying the cover is not the way to promote excellence of either the Air Force or your Association.

Please send the magazine first class or use an opaque mailer. Others must have complained about this obvious public-relations flameout.

Col. Herb J. Suskin,
USAF (Ret.)
Tempe, Ariz.

• *We switched to the plastic mailers some time ago as an economy measure and to help ensure the delivery of the magazine in good condition. The magazine is mailed at second-class rates because of the prohibitive cost of first-class postage. US Postal Service regulations require that the words "second class" appear over the magazine logo. A clear mailer is used to bring heightened visibility to the magazine.*

A few readers have echoed Colonel Suskin's complaint, but the general response to the plastic mailers has been positive.—THE EDITORS

Air Force Paratroopers

I am an Air Weather Service parachutist, one of the few jobs in USAF of its type, and I'm writing in hopes that readers can help me.

I'm writing a book on USAAF and USAF paratroopers from World War II to the present, and I need any information and especially pictures on this subject. I'm looking for pictures of troops in uniforms that can be identified as USAF paratroop uniforms, CCT tabs as worn in Vietnam, World War II paratroops in jump uniforms with USAAF shoulder patches, and any pictures in dress uniforms. Any information on units or detachments would be helpful as well.

I will be writing on the following units: special operations weather team, pararescue, combat control team, tactical air control party, USAFA parachute instructors and the cadet parachute team, and survival school instructors. If I've left out any categories, please let me know.

Any help that readers can give will be appreciated. All pictures in the book will be credited, and all items sent will be returned unless donated.

Johnny Reid
Corbin Ave., Box 12
Spring Lake, N. C. 28390
Phone: (919) 497-2996

Hobbs Army Airfield

I am researching information about the history and activities at Hobbs Army Airfield, which was used as a B-17 training base during World War II. This information will be used for an upcoming reunion in Hobbs, N. M., that is a project of the Chamber of Commerce.

I would like to hear from any former AAC/AAF personnel who were stationed at Hobbs Army Airfield. Any information, letters, diaries, journals, etc., would be appreciated. Extreme care will be taken with any personal material, and I will return all material after copying.

Please contact me at the address below.

S. A. Haktanir
1506 Caprock
Hobbs, N. M. 88240

1st/479th Antisub Group

I am researching the activities of the 1st Antisubmarine Group (Provisional)/479th Antisubmarine Group and of the 1st, 2d, 4th, 6th, 19th, and 22d Antisubmarine Squadrons, USAAF, during the time that these units operated from the United Kingdom (roughly late 1942 to mid-1943).

I would be grateful for information from anyone who served in these units while they were stationed in England. Please contact me at the address below.

Max Schoenfeld
Department of History
University of Wisconsin,
Eau Claire
Eau Claire, Wis. 54702-4004

453d FTS

The 453d Flying Training Squadron is researching its history. The squadron plans to produce a publication detailing the squadron's heritage and symbols.

We would like to hear from any former members of the 453d Bomb Squadron or the 453d Fighter-Bomber Squadron who can help us trace the history of the squadron, its aircraft, and its symbols.

Please contact the address below.

Lt. Col. Steven E. Cady, USAF
Commander, 453d FTS
Mather AFB, Calif. 95655-5000

Airmail

Collectors' Corner

I am a serious collector of USAF and AAF insignia (fighter and bomber). I am especially interested in Vietnam-era mission patches and Air Commando, Stinger, Spooky, Shadow, and Spectre patches and insignia.

Any donations would be greatly appreciated. I am willing to trade or buy any of the aforementioned items.

James Mastoris
1625 S. Limestone St.
Springfield, Ohio 45505

I am a World War II veteran who served with the 8th Infantry Division, combat engineers, and transportation corps. I have compiled a personal collection of memorabilia regarding the dropping of the first atomic bomb at Hiroshima.

One item I am desirous of obtaining is a shoulder patch (original or reproduction) of the 509th Bombardment Group. I would consider a litho reproduction in color if that is available.

Please contact me at the address below.

E. E. Weatherson
3609 Bryn Mawr Dr.
Irving, Tex. 75062

I am interested in collecting any patches from the World War II era (1939–45).

If you have any patches that you would not mind parting with, please contact me at the address below.

Joseph D. McLain
4159 Constellation Rd.
Lompoc, Calif. 93436

I am a collector who is looking for USAF security police K-9 patches. I have security police K-9 patches to trade.

Please contact me at the address below.

Edward Russell
7 Liberty Place
South Boston, Mass. 02127

Roll Call

I am trying to locate an old flying buddy, Elmer J. Perry. We graduated from Class 44-G at Moore Field, Tex., and trained in P-47s at Camp Springs, Md., and Dover, Del. His hometown was Pine Village, Ind.

Any information would be greatly appreciated.

Edward P. Poole
303 N. 90th St.
Milwaukee, Wis. 53226

I am trying to locate three members of our B-26 bomber crew. We flew together in 1944 and 1945 out of Roye, France, with the 391st Bomb Group, Ninth Air Force. The crew was led by Lt. Clarence R. Martin.

The missing members are James C. Mosier, Herman M. Rovelli, and Herbert S. Stewart.

I would appreciate hearing from anyone who can put me in touch with any of these men.

William I. Phillips
3523 W. 229th St.
Torrance, Calif. 90505
Phone: (213) 325-3404

I am desperately trying to locate a long-lost relative, A1C Charles H. Reed. He served in an aerial refueling squadron and was stationed in Salina, Kan., around November 1956.

Anyone knowing his whereabouts is asked to contact me at the address below.

Elizabeth Etemadi
1702 E. 57th Ave.
Hobart, Ind. 46342

I am trying to locate anyone who knew Capt. Thomas Gardner Archibald. Captain Archibald served in Italy with the 526th Fighter-Bomber Squadron, 86th Fighter-Bomber Group, from April 1944 to March 1945.

Any information about Captain Archibald would be greatly appreciated.

David H. Onkst
F-207 University Village
Athens, Ga. 30605
Phone: (404) 353-8292

Blain Burton was my radio operator on a mission over western China on December 28, 1944, when we were forced to bail out. We were members of the 4th Combat Cargo Squadron, 1st Combat Cargo Group. I believe he was from Washington or Oregon.

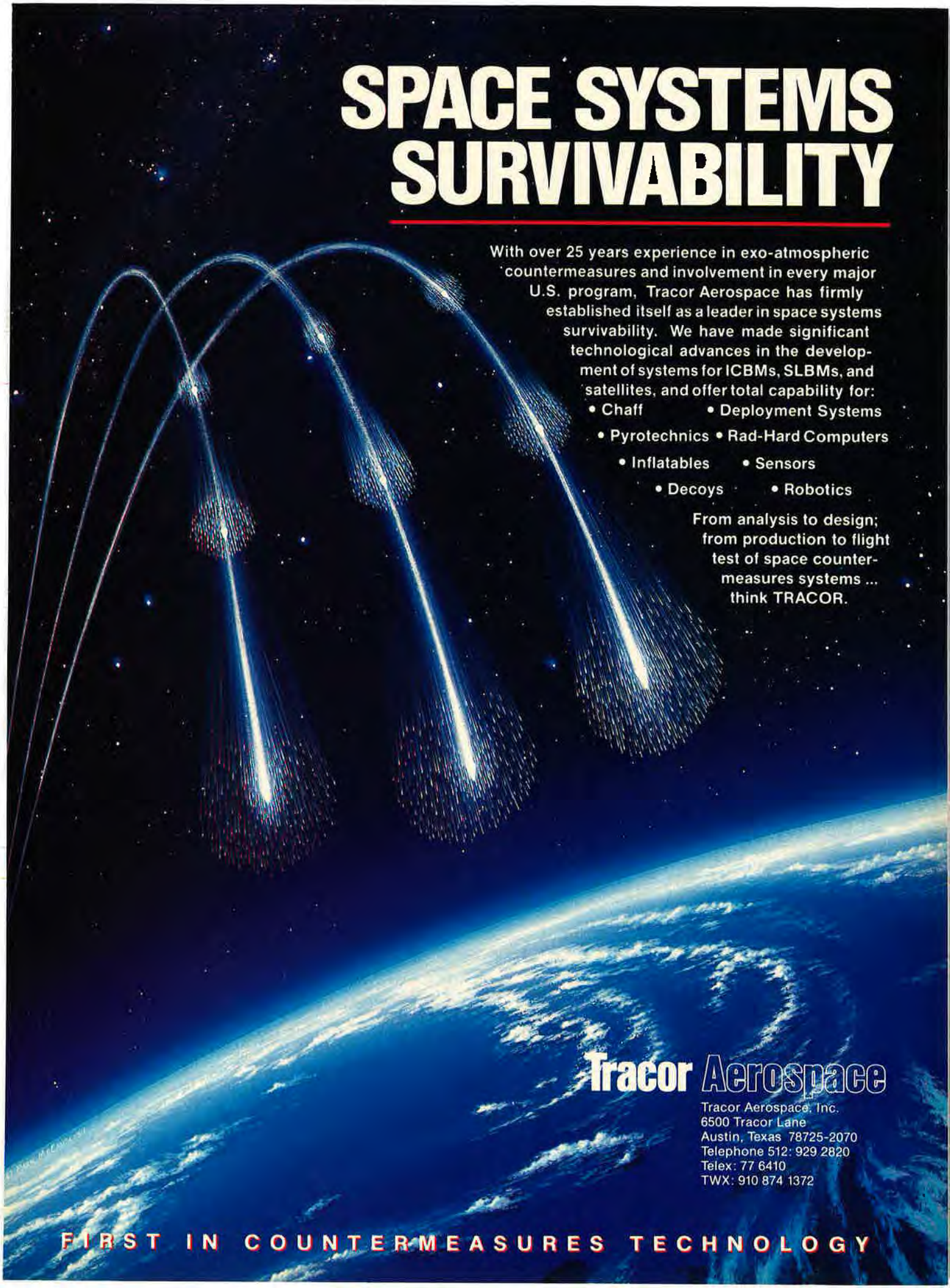
I would like to determine his whereabouts. If anyone knows where I might find him, I would like to hear about it.

Walt Glover
711 18th St.
Manhattan Beach, Calif.
90266

I urgently need any information pertaining to my father, Robert Harris, a private first class or corporal who was stationed at Kirtland Field, N. M., in March 1945.

Please contact me at the address below.

R. B. Piña
433 Simpson Dr.
Redstone Arsenal, Ala.
35808
Phone: (205) 837-1536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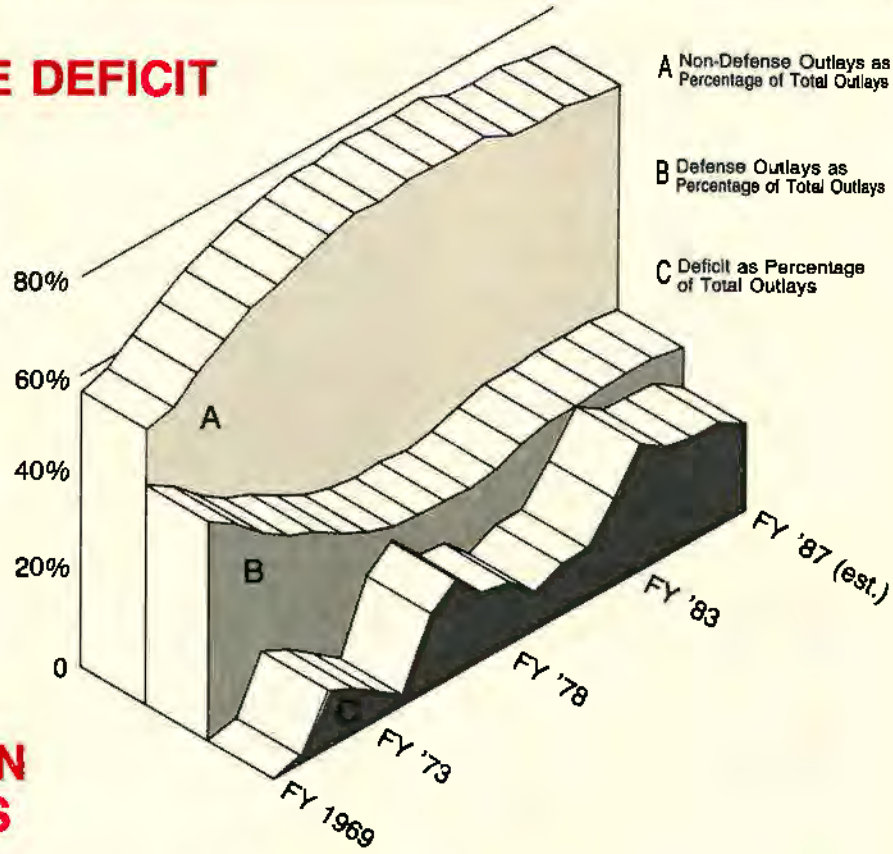
The Chart Page

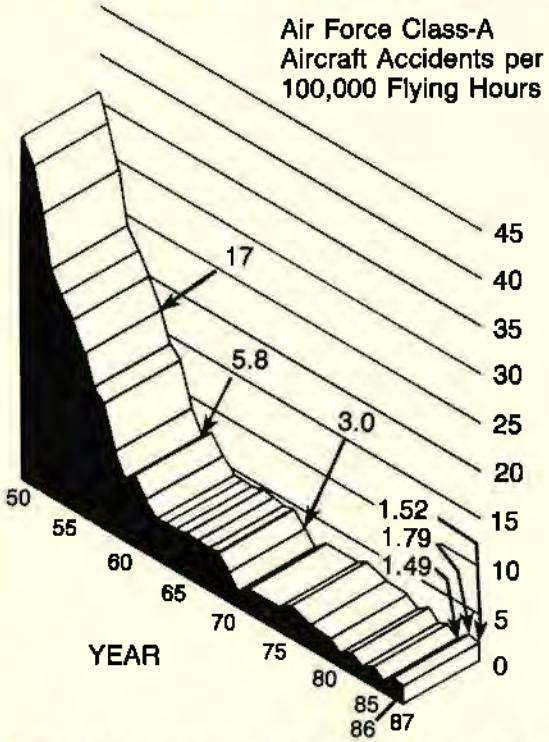
THE RISE OF THE DEFICIT

Can the deficit be blamed on defense spending? The deficit is the gap between federal revenues and outlays. This chart begins in 1969—the last year when the budget was balanced and when no deficit existed—and traces what has happened since. As the deficit grew from zero to alarming levels (expressed here, for purposes of comparison, by its equivalent as a percentage of all federal outlays), defense spending generally declined rather than increased. The evidence of two decades says that defense did not cause the deficit.

SOURCE: Office of Management and Budget



FALLING RATE ON FLYING MISHAPS



Class-A mishaps are accidents involving the loss of an aircraft, a fatality, or more than $500,000 worth of damage. Although the Air Force is flying more technologically advanced aircraft for more hours under more demanding and realistic training conditions, the flying safety record has dramatically improved.

SOURCE: USAF Report to Congress and the Air Force Inspection and Safety Center

THE SLIDE IN PILOT RETENTION

Retention Percentages by Command and System

	FY '83	FY '84	FY '85	FY '86	FY '87
By Major Command					
ATC	70	61	47	40	37
MAC	79	66	49	48	39
PACAF	91	86	86	89	80
SAC	76	77	60	55	46
TAC	80	73	59	54	43
USAFE	88	87	87	72	74
Air Force Total	**78**	**72**	**59**	**56**	**48**
By Weapon System					
Fighter	80	79	68	63	55
Trainer	65	46	36	66	31
Bomber	76	79	72	51	58
Tanker	76	74	56	50	36
Strategic Airlift	73	63	41	41	32
Tactical Airlift	82	71	53	52	46
Helicopter	82	68	81	82	69
Pilot Total	**76**	**72**	**59**	**56**	**48**

These are cumulative continuation rates (CCR) for USAF pilots with between six and eleven years of service. The CCR percentage is regarded as the best index of retention. To maintain the pilot force, USAF needs a CCR of about sixty percent—and the overall rate is running lower than that.

SOURCE: Air Force Military Personnel Center

The Five-Year Drought

By John T. Correll, EDITOR IN CHIEF

The Pentagon has reduced its long-range spending plans by more than ten percent. This means loss of people, force structure, and weapon systems—and perhaps the end of Midgetman.

Washington, D. C. Defense Secretary Frank C. Carlucci will be testing a bold theory when he takes his budget request to Congress this month. His predecessor, Caspar W. Weinberger, was faulted by many on Capitol Hill for his unyielding stance on funding requests. This, it is said, hurt Mr. Weinberger's credibility with Congress and ensured a frosty reaction to the programs he proposed.

Secretary Carlucci says that while he does not disagree that much with Mr. Weinberger on defense requirements, "we have to recognize reality" about how much money the Department is likely to get in the present climate of anguish about the federal deficit.

In an extraordinary concession, the Defense Department is voluntarily "reshaping" its FY '89 budget request downward by $33 billion. It has further told the services to assume a "five-year drought" in which their funding will be ten to twelve percent lower than projected by the old, now-defunct Five-Year Defense Plan.

The "realistic" budget that goes to the Hill in February will seek $299 billion for FY '89—or $13 billion less than the Defense Department had asked for in its FY '88 submission. The question is whether Congress will receive Secretary Carlucci's realism in a reciprocal spirit or simply leap on it as a lower opening bid from the Pentagon—with the usual reduction exercises to begin from there.

Defense planners spent the Christmas holidays behind closed doors struggling over what they could cut or cancel to meet the new fiscal guidance. The total impact will probably mean a loss of $150 billion to defense over the five years, with a reduction of about 100,000 in military personnel strength, deactivation of units, and elimination of some major weapon systems.

This move comes after three lean years in which defense budget authority declined, after inflation, to ten percent below the level of 1985. The easy choices for savings are all gone. When Deputy Defense Secretary William H. Taft IV met with reporters in December, he acknowledged that the prospect is for "a smaller, less capable force than we would like to see and certainly than we had programmed."

Secretary Taft said the reductions will be made at some risk because "our forces are programmed to certain contingencies. If you don't have the forces, the contingencies to which they were assigned are less capably dealt with. . . . If you kill a weapon system, the threat to which that system was directed is unanswered."

Secretary Taft acknowledges that the prospect is for "a smaller, less capable force than we would like to see and . . . had programmed."

• *People.* The Administration protected the military personnel account from the $20 billion budget cut this year, diverting the reduction to other spending categories. It has now run out of maneuver room. The Air Force share of the decrease in military manpower will probably be 21,000. There will be cutbacks in civilian personnel strength as well.

According to Secretary Taft, people are and will continue to be the Department's top priority. With budgets going down by at least a tenth, though, it is probable that pay, benefits, and quality of life will take a beating anyway. This year again, Congress held the military pay raise to less than a full cost-of-living increase. This was the fifth such pay cap in a row, and as measured by the Employment Cost Index (ECI), military pay now trails the private sector by eleven percent.

• *Force structure.* Secretary Taft predicts a decline of four to five percent in force structure. Depending on how the percentage is allocated, the Air Force could lose two combat-coded tactical wings. It was only a year ago that the goal was reduced from forty wings to thirty-seven as an economy measure. It may now drop to thirty-five. Another possibility is that the Air Force will end strategic reconnaissance operations with the SR-71 Blackbird and put more reliance on space-based assets.

• *Weapon system cancellations.* Among those likely to go are the Navy's A-6F medium attack aircraft and the Army's LHX multipurpose helicopter. The Air Force's anti-satellite (ASAT) program is also reported to be on the termination list. The most controversial cancellation to be proposed, however, is the Small ICBM, or Midgetman.

The road-mobile Midgetman offers a number of advantages, but since each missile carries only one warhead, it is a comparatively expensive way to field strategic firepower. Suddenly confronted with a directive to take big billions out of its long-range plan, the Air Force identified Midgetman as a candidate for cancellation.

There will be a blistering battle about this on Capitol Hill, where Midgetman has many supporters. "There is no way that a Democratic Congress will deny this option to a Democratic President," a spokesman for an influential senator, looking ahead to the election, told AIR FORCE Magazine.

CBO's Strategic Options

A study of strategic modernization alternatives, published December 3

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by the Congressional Budget Office, also points to Midgetman cancellation as one of the options that would substantially reduce defense spending.

"Reductions in the defense budget over the past two years have been accommodated without any fundamental change in planned strategic programs," CBO says. "If the budget trend continues, however, Congress may be faced with more difficult choices, possibly affecting the structure of US strategic forces for many years." The study explores four options.

• *No Trident backfit.* The first eight Trident submarines, procured in the 1970s, are equipped with Trident I missiles. The last twelve submarines in the series will have the larger, more accurate Trident II missile. The plan has been to backfit the older submarines with the newer missile in the 1990s. CBO says that cancellation of this backfit would take away a significant percentage of the US hard-target warheads that are likely to survive a Soviet attack and that the savings would amount to $5.8 billion.

• *Cancel a land-based ICBM.* The Administration built its ICBM modernization plan on the recommendations of the 1983 Scowcroft Commission. That panel called for 100 MX Peacekeepers to provide capability against hardened Soviet targets, followed in the 1990s by 500 mobile Midgetman ICBMs to reduce the vulnerability of the missile fleet. The Air Force is well along with putting the first fifty Peacekeepers into silos and plans to deploy the second fifty on trains in a "rail-garrison" mode. Midgetman is in full-scale development.

The arguments on behalf of the two missiles are familiar. Midgetman needs less than half an hour's warning to begin dispersal by highway. Peacekeeper requires several hours' notice to move out of garrison and onto the railroads. Advocates of Peacekeeper contend that a "bolt-out-of-the-blue" attack is highly improbable and that Peacekeeper can be put on the rails as a precaution in any time of crisis. Small ICBM proponents say that a surprise attack cannot be ruled out and that the awesome power of the ten-warhead Peacekeeper makes it a provocative target as well as a destabilizing threat to the enemy.

Midgetman and the rail-garrison half of Peacekeeper would each add 500 warheads to the US arsenal. Before the budget crisis, the two systems had been seen as a mutually reinforcing combination, with Peacekeeper supplying efficient strategic punch and Midgetman providing flexibility and survivability.

Under budget pressure, though, the two-missile consensus has come unstuck. CBO sets the cost for rail-garrison Peacekeeper at $8.4 billion and for Midgetman at $37.4 billion. Should the Pentagon be forced into retreat on the proposed cancellation of Midgetman, it will have to dig hard to find other cutbacks that lead to a similar cost reduction. The Air Force hopes to preserve the Peacekeeper program intact, but will offer to scale down production from twenty-one missiles per year to twelve.

• *Cancel the Stealth bomber.* Details about the B-2 Advanced Technology Bomber to be deployed in the early 1990s are classified, but it is clearly an expensive program. GAO estimates that by canceling Stealth, keeping the B-52G bombers in service longer than planned, and adding 1,200 advanced cruise missiles, it would be possible to save more than $40 billion. This, however, would bring the day closer when US bombers could no longer penetrate deep into Soviet airspace to chase down relocatable targets, such as mobile ICBMs. The top-of-the-line B-1B would eventually fall back to firing missiles from an increasing distance away.

CBO warns that "Congress may be faced with more difficult choices, possibly affecting the structure of US strategic forces for many years."

• *Stretch-outs.* Finally, CBO says, the US might save $17.9 billion between now and 1992 without canceling any strategic program if it stretched out all of them over time. Secretary Carlucci has often expressed his distaste for stretch-outs, which lead to higher unit costs, inefficient rates of production, and less defense for the dollar in the long run. On the other hand, the stretch-out has always been a favorite tool of government when it is in search of a compromise, and the odds are against its going unused this time.

Preview of the Battle

The Senate in mid-December provided a preview of the coming ICBM clash when the Appropriations Committee tried to kill Midgetman by deleting all money for it in the FY '88 budget. The attempt was unsuccessful, but the floor debate demonstrated the intensity of opinion on the missile issue.

Sen. J. Bennett Johnston (D-La.) led the charge, declaring that "to continue to fund both the MX rail-mobile and the Midgetman at this time seems to me a waste of money." He recognized that the warheads and megatonnage of the two systems are comparable, but said the small missile is not worth the difference in cost. He cited Defense Department figures showing that "you can maintain the MX with 3,667 people. The Small ICBM takes between 8,300 and 10,300 to maintain."

Beyond that, Senator Johnston said that "the MX rail-mobile can carry many more penetration aids, chaff, decoys, those kinds of things that are necessary or will be necessary in tomorrow's battle. . . . To be sure, they have increased the size and weight of the Midgetman, but not to the extent and with the capacity that the rail-mobile MX has."

Joining in the attack on Midgetman was Sen. Pete Wilson (R-Calif.), who said that "the staggering consideration here is the enormous cost of this weapon system. . . . So I think we really have to ask ourselves what it is that justifies this outlandish cost to achieve a minimal capability when there are available to us so many other ways to achieve mobility and survivability. You get survivability with the mobility from a rail-mobile MX. You get survivability in a much more effective way when you combine not only the mobility of the submarine but the concealment that is available to it."

Foremost among those blocking the attempt to kill Midgetman was Sen. Sam Nunn (D-Ga.), who said he may end up as an enthusiastic supporter of rail-garrison MX, but that the time has not come to terminate Midgetman and "commit ourselves to the rail-mobile in an unalterable fashion." Nor is he ready to forget about a "bolt-out-of-the-blue" attack: "I cannot help but think that sometime in 1941 there must have been an admiral somewhere who said: 'Yes, it is true that most of our battleships are lined up in Pearl Harbor, but, by golly, we can disperse them out to sea within six hours.'"

The consensus on strategic mod-

ernization forged around the Scowcroft Commission report has always been fragile, especially the part of it dealing with ICBMs. Each of the missiles has taken on a political coloration. Peacekeeper is seen as a Republican-Conservative system, while Midgetman is identified with the Democrats. Midgetman advocates have long believed that Administration and Air Force support for the small missile is lukewarm at best. Congress, for its part, has been reluctant to proceed with the second fifty Peacekeepers. A year ago, the Administration squelched an internal faction that wanted to terminate Midgetman, believing that the future of MX depended on a two-missile package deal. Backing for the small missile is particularly strong in the House of Representatives.

In the December debate, Senator Nunn warned that a showdown between the missiles might bring on "an act of political fratricide" in which "we could end up with the Senate killing Midgetman and the House of Representatives next year killing rail-mobile MX."

Sen. Albert Gore, Jr. (D-Tenn.), a steady champion of the small missile, said the rail-garrison Peacekeeper idea is workable only if its need for warning time is offset by capabilities elsewhere in the missile force: "Deploying Midgetman in conjunction with rail-mobile MX might, therefore, help eliminate concerns about the latter. . . . Without Midgetman, however, rail-mobile MX is not the answer to any problem."

Underscoring his point, Senator Gore added that "the Small ICBM concept, if it dies, would bring down with it any remaining chance for success for the MX missiles in any guise. Make no mistake about that."

Senator Nunn read into the record a letter from Lt. Gen. Brent Scowcroft, chairman of the 1983 commission, that strongly urged continuation of the Small ICBM program. Cosigners included four former Secretaries of Defense—Harold Brown, James Schlesinger, Donald Rumsfeld, and Melvin Laird—and two former Secretaries of State, Henry Kissinger and Alexander Haig.

Manpower Problems

The announced reduction in military manpower gives personnel managers more problems to worry about. The current active-duty strength of the Air Force is 606,000, not as low as during the "hollow force" years of the 1970s but still about three percent short of validated requirements for manpower. That gap is about to widen considerably.

It will be difficult to absorb a strength reduction in the 20,000 range without impact on mission performance. There is not much fat left in the force structure. USAF has been allowed some additional manning to go along with new taskings, but between 1979 and 1986 had to meet 11,600 of its manpower requirements by internal reallocations, reorganization, and the contracting-out of functions. The Air Staff has taken a fifteen percent reduction, and most major command headquarters have been cut by ten percent. Operational units are already working long duty days. This loss is going to hurt.

Apart from the matter of manpower totals, there are force configuration problems to reckon with. Congress remains insistent that the services reduce their officer strength by six percent in order to achieve a "correct" ratio of officers to enlisted personnel. The logic of this legislation begins—and pretty much ends—with the observation that the Marine Corps held steadily to its 1:8.9 officer-to-enlisted ratio since World War II, while the other services evolved to richer mixes. The Air Force, with a ratio of 1:4.5, was criticized as the most officer-intensive of them all.

Oddly enough, Congress admits that its ratio target is arbitrary and possibly wrong, but sticks to it anyway because it says the Defense Department has not proved adequately that all of its officers are needed.

It will be difficult for the Air Force to absorb a strength reduction in the 20,000 range without impact on mission performance.

AIR FORCE Magazine asked to see some of the proof that had been offered and was shown a sample of detailed, line-by-line justification for Air Force manpower growth. One entry describes the requirement for pilots and navigators to man 282 aircraft that were added to the fleet. Another segment breaks out the combat support personnel who were required at Misawa AB, Japan, when fighter operations began there. There are explanatory footnotes for line items that might raise questions about the officer ratio in particular instances.

The services cut their officer strength by one percent in 1987 and will spread out the remainder of the reduction over the next three years. The Air Force met most of its quota last year by taking in fewer new lieutenants and by allowing older and midcareer officers to leave service early if they wanted to do so. It says, however, that it cannot carry out the entire six percent reduction without forcing the separation of some officers whom it needs and who wish to stay.

Twenty-Year Pilots

At the direction of the Defense Resources Board, the Air Force is evaluating an alternate career path for pilots. It would give flyers an option to the traditional track in which they rotate between the cockpit and staff duties. The new path would allow pilots to choose a twenty-year career, with eighty to 100 percent of their service in flying assignments.

This is a variation of an old idea that surfaces periodically. The Air Force has rejected it in the past, feeling that except for doctors, chaplains, and others in nonline categories, an officer must be an officer first and a specialist after that. Although several factors complicate the issue this time, the Air Staff does not think that creating a limited-duty pilot corps is the solution to its problems.

The emphasis in recent years on career-broadening assignments and additional duties for pilots has bothered the Air Force leadership, which has revised internal policies to make such "ticket punching" less important for promotion. In addition, pilot-retention rates are running too low to sustain the force *(see "The Chart Page," p. 15 of this issue).*

Pilot hiring by the airlines is at a twenty-year high. The major carriers recruit a fourth of their pilots from the Air Force, and with demand up, the salaries are attractive. But the lure of the airlines does not explain the whole retention problem. Surveys find the length of the duty day and the extent of nonflying duties as major irritants for pilots.

A number of initiatives to improve pilot retention are in progress. The Air Force would also like to increase the number of pilots it trains annually by 125, beginning in 1989, but that, like much else, depends on where the budgets go. ■

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GENERAL DYNAMICS

A Strong Company For A Strong Country

Capitol Hill

By Brian Green, CONGRESSIONAL EDITOR

Washington, D. C.

FY '88 Funding Approved

Congress, almost three months after the start of the new fiscal year, approved a $604 billion omnibus continuing resolution (CR) that provides funding for the government in FY 1988. The bill includes $291.5 billion in defense budget authority (BA, the total amount that the Pentagon and other defense agencies can obligate) and $285.0 billion in outlays (the amount that is actually to be spent in FY '88).

Adjusted for inflation, the new budget is three percent below the FY '87 level and ten percent less than the budget for FY '85.

The bill actually provides $294.0 billion in new BA. However, it meets the target of $292 billion, the compromise figure agreed to for defense by White House and congressional leaders, by rescinding $3.5 billion in prior-year budget authority. Conferees managed to push up the budget authority figure while still meeting their outlay goals in part by fully authorizing two new aircraft carriers at $6.3 billion. FY '88 outlays associated with the carriers total only about $6 million.

Adding to public confusion in this matter has been the often-repeated but erroneous assertion in political speeches and press reports that the FY '88 defense cut was only $5 billion. That "reduction" is not from any real budget, but rather from an inflation-adjusted statement of last year's defense outlays, calculated by the Congressional Budget Office as a starting point for deficit debate. The Administration defense request of $312 billion actually was chopped by $20 billion in BA.

The spending-package compromise came after arduous negotiations that resulted in agreement on additional aid for the Nicaraguan contras. Congress passed four temporary CRs to cover the funding deadlines it missed. The new bill will supersede the Gramm-Rudman-Hollings sequestration cuts, technically in force (though with little impact) since November 20.

Air Force Cut

The Air Force budget will be $89.4 billion rather than the $97.2 billion USAF had sought. This compares with approved budget authority of $91.3 billion last year. The measure provides $13.0 billion ($14.2 billion requested) for aircraft procurement, $7.3 billion ($9.8 billion requested) for missile procurement, $8.0 billion ($8.6 billion requested) for "other" procurement, $19.7 billion ($21.3 billion requested) for operations and maintenance, and $15.0 billion ($18.6 billion requested) for Air Force R&D.

Compared to FY '87 (adjusted for inflation), aircraft procurement fell twenty-seven percent, missile procurement fell by five percent, "other" procurement lost eighteen percent, and R&D dropped by five percent. O&M was up two percent—a gain attributed mostly to the addition of about $1 billion in programs not previously in the O&M account. The Air Force estimates that O&M will decline six percent.

According to Air Force Comptroller Lt. Gen. Claudius E. "Bud" Watts III, "core Air Force programs" survived the slashing orgy more or less intact. The most damaging cuts to the Air Force request were imposed in O&M funding. He noted particularly the $600 million cut in the Air Force aircraft spares request.

"Other" procurement, which includes munitions and support materiel that affect readiness and sustainability, was also cut by $500 million this year. He also argued that the Air Force was "at best treading water" in maintaining its physical plant, much of which is approaching forty years of age and will require substantial refurbishing.

Small ICBM Controversy

The Small ICBM (SICBM, or Midgetman) survived an attempt to cancel the program in the Senate and was ultimately funded in the House-Senate conference at $700 million.

The Air Force, in light of extraordinary fiscal constraints it will face for the foreseeable future, favors the termination of the SICBM.

Program Actions

- *Personnel:* The bill provides $875 million to "fully fund the cost of the military pay raise, with any remaining balance to partially fund civilian pay costs." Only $152.3 million of the $223.1 million requested for family housing was approved.
- *Strategic:* Twelve of twenty-one Peacekeeper ICBMs requested were funded, and $350 million of $451 million in the President's budget for R&D on the rail-garrison basing mode was approved. The Strategic Defense Initiative was funded at $3.9 billion of the $5.7 billion requested.
- *Tactical:* Procurement for 384 Advanced Medium-Range Air-to-Air Missiles (AMRAAM) was set at $670 million. The Air Force had asked for 630 missiles at $833 million. $348 million was earmarked for the Joint Surveillance and Target Attack Radar System (Joint STARS), $10 million more than was requested. The increase was attributed to concern over conventional force effectiveness in light of the arms-control agreement banning intermediate-range nuclear weapons. $500 million of the $537 million requested was approved for the Advanced Tactical Fighter. The bill added $2 million to the $83.3 million requested for the Integrated Electronic Warfare System and the Integrated Communications Navigation Identification Avionics system (INEWS/ICNIA). Procurement of forty-two F-15Es and 180 F-16s—the numbers requested—was approved, though each program was reduced by $75 million. $589 million for procurement of the first two C-17 airlifters was approved, along with $1.1 billion for continued C-17 R&D. $618 million and $1.2 billion respectively were requested.
- *Space:* $183 million of $236 million requested was approved for the National Aerospace Plane (NASP). The Senate had slashed funding to $114 million. The approved bill allows the transfer of $316 million to "activities related to the spacelaunch recovery program," contingent upon receipt of the Advanced Launch System (ALS) Plan. ■

Aerospace World

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Washington, D. C.

★ Aerospace Industries Association of America Inc. has issued a national call to arms to defend against foreign assaults on the long-standing US leadership in aerospace technologies.

To fortify that leadership, which it claims is slipping sharply, AIA is proposing that the aerospace industry, the government, and the academic community team up in a nationwide program called "Key Technologies for the 1990s" to be supported and furthered by the White House itself.

The program was announced in Washington by Don Fuqua, President of AIA, near the end of last year at the annual aerospace review-and-forecast luncheon sponsored by AIA and the Aviation/Space Writers Association. It is pegged to eight key technologies chosen by senior technologists of AIA member companies as meriting special consideration and concentrated attention in the years ahead.

The technologies deemed crucial by AIA for the continuance of US leadership are those of composite structural materials, very-large-scale integrated circuits, software, propulsion, advanced sensors, optical information processing, artificial intelligence, and ultrareliable electronic systems.

Mr. Fuqua reported that 1987 was a banner year for the US aerospace industry in world markets, with the value of its exported products reaching the record-breaking level of $112 billion. But he warned that many of those products, notably military and civilian aircraft, were "based on technologies developed ten to twenty-five years ago" when the US was by far the world's foremost nation in their development.

The AIA President also noted that "the global market is expanding rapidly, and even though our export volume is increasing, we are in fact losing ground in terms of the US share of foreign markets. We have been drawing heavily on the technology bank, and we have inadequately replenished our bank account."

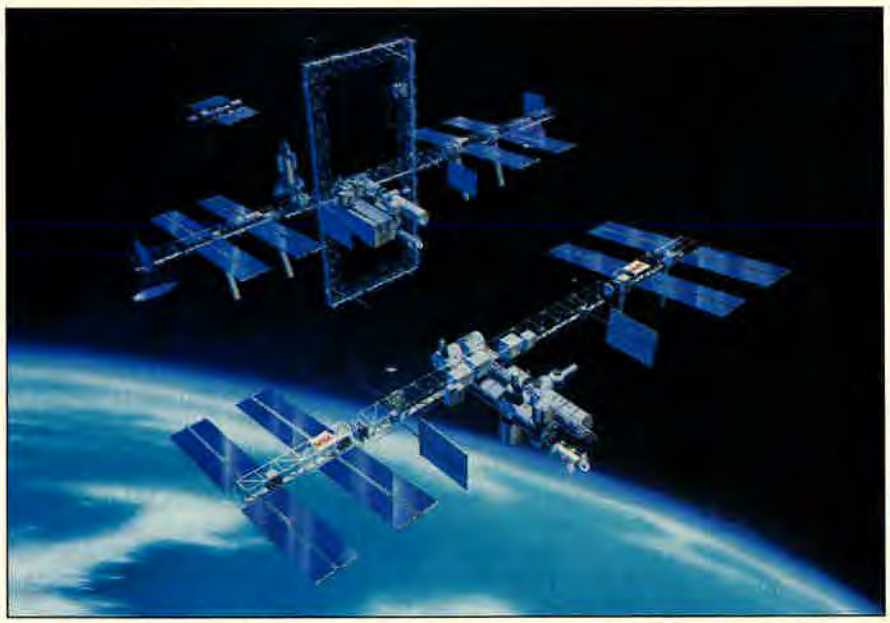
Mr. Fuqua made the corollary point that foreign aerospace products imported by the US reached "an all-time high" in 1986 and were "only slightly less" in 1987.

The harsh fact underlying the urgent need for the US to reestablish its aerospace technology leadership is that "the aerospace products of foreign competitors now equal or exceed ours in several important fields," Mr. Fuqua declared.

★ America's space program for the 1990s took a giant step toward fulfillment on December 1 when National Aeronautics and Space Administration (NASA) Administrator James Fletcher announced four winning contractor teams to build the permanently manned space station. Assembly of the station in orbit is scheduled to begin in 1994, and completion is expected in 1995.

Construction of the station is divided into four distinct "work packages" that are expected to create some 12,000 jobs in California, Texas, Alabama, Pennsylvania, and eight to twelve more states over a ten-year period. The work packages, contractor teams, and proposed costs for Phase I (the basic space station) and Phase II (an option for additional structures) are as follows:

- Work Package 1: Fabrication of two modules to be used as a laboratory and crew quarters, along with environmental and life support systems. Boeing Aerospace of Huntsville, Ala., leads a team of partners composed of Lockheed Missiles and Space Co., Teledyne-Brown Engineering, Hamilton Standard, Fairchild-Weston Systems, Garrett AiResearch, Grumman Aerospace, and ILC Space Systems. Proposed costs are $750 million in Phase I and $25 million in Phase II. NASA's George C. Marshall Space Flight Center in Huntsville is managing this portion of the program.
- Work Package 2: Construction of the structural framework plus propulsion, navigation, communication, and airlock equipment. The contractor team leader is the McDonnell Douglas Astronautics Co. of Huntington Beach, Calif., and Houston, Tex.,



Boeing Aerospace, McDonnell Douglas Astronautics Co., General Electric, and Rocketdyne are the leading contractor teams that will build America's permanently manned space station. The Phase I space station (foreground) is to be completed in 1995; in the background is what the station will look like when Phase II is finished.

while IBM, Lockheed Missiles and Space Co., General Electric, Honeywell, and Astro Aerospace are the team members. Proposed costs are $1.9 billion for the basic space station and $140 million if the Phase II option is exercised. The Lyndon B. Johnson Space Center is the program manager for this work package.

• Work Package 3: Assembly of a free-flying platform for carrying scientific instruments and a robotic satellite-servicing system. General Electric's Astro Space Div. of Valley Forge, Pa., and East Windsor, N. J., is the prime contractor and is teamed with TRW. Phase I proposed costs are $800 million, with $570 million being projected for Phase II. This portion of the work will be managed by the Goddard Space Flight Center in Greenbelt, Md.

• Work Package 4: Design and fabrication of electric power generation and storage equipment and management and distribution of electrical power. Rockwell's Rocketdyne Div. of Canoga Park, Calif., is leading the effort, with Ford Aerospace and Communications, Garrett, General Dynamics, Harris, and Lockheed Missiles and Space Co. as teammates. Proposed costs are $1.6 billion in Phase I and $750 million in Phase II. NASA's Lewis Research Center in Cleveland, Ohio, is managing the work package.

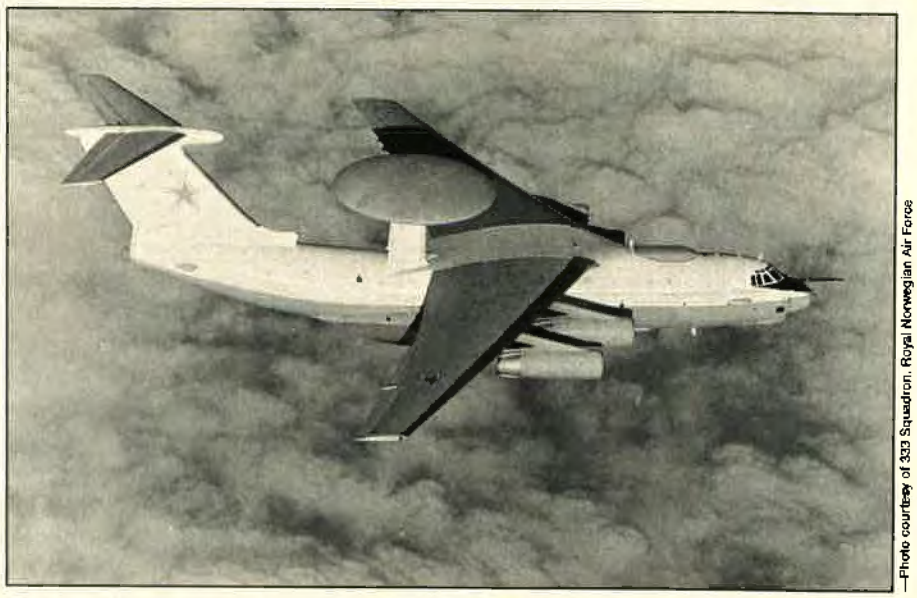
The finished space station is also expected to include two habitable modules, one made in Japan and the other provided by the European Space Agency (ESA), as well as a robot manipulator arm made in Canada.

No specific contracts were awarded because of congressional funding uncertainties at the time of the announcement.

★ The Air Force Reserve's Individual Mobilization Augmentee Task Force recently submitted its final report, and except for the need for a "little fine tuning" in the program, the committee concluded that the Air Force IMA program is making a significant contribution to the regular Air Force.

The task force was formed last June at the request of Maj. Gen. Roger P. Scheer, the Chief of the Air Force Reserve. Its charter was to review the IMA program completely and to recommend specific ways to correct problems and initiate improvements.

Based on surveys sent to IMAs, supervisors, commanders, base IMA administrators, and personnel office chiefs, the task force determined that the current IMA program is liked, is understood, and is being properly utilized.



—Photo courtesy of 333 Squadron, Royal Norwegian Air Force

This is the first picture of the new Soviet Airborne Warning and Control System (AWACS) aircraft, the Ilyushin Il-76 Mainstay. Designed to operate with the new-generation Russian fighters, Mainstay's rotodome is also believed to be capable of detecting cruise-missile-size targets. A Norwegian Air Force P-3 crew photographed this Mainstay in international airspace over the Barents Sea.

Four areas—overall organizational structure, assignments and utilization, readiness, and administrative and support areas—were targeted for upgrading and clarification.

Some of the recommendations the task force made to address these areas were:

• The establishment of a special staff office at the Air Reserve Personnel Center (ARPC) in Denver, Colo., to serve as "focal point" for IMA management. This would eliminate what were called "disconnected policies and programming, fragmented responsibilities among various commands and agencies, and no training for new managers."

• Development of a civilian skills bank at ARPC. This action would take into account the specific skills of IMAs when making assignment and utilization decisions. This data bank will be tested on colonels and general officers this year, and a decision will be made in 1989 whether to expand this system to include all IMAs.

• Under the area of readiness, giving all present and future IMAs mobilization orders and travel warrants that could be activated on mobilization. Also, the committee urged that regulations be changed to require notification by phone on mobilization day rather than by means of Mailgrams.

• Revise the pay process. Implementation of recommendations to update and streamline current pay processing will, it is hoped, reduce the current twenty-one-day cycle to five to ten days by late 1988.

★ After six months of comprehensive evaluations, the US Army selected the team of Martin Marietta and the Swiss firm Oerlikon Bührle on November 30 as the winner of the Line of Sight Forward-Heavy (LOS-F-H) portion of the new five-part Forward Area Air Defense System (FAADS). This missile/armored-vehicle combination will replace the canceled Sgt. York Division Air Defense (DIVAD) mobile antiaircraft gun.

The Martin Marietta/Oerlikon Air Defense Anti-Tank System (ADATS) beat out three other competing teams for the LOS-F-H award. The other competitors were the LTV/Thomson-CSF Liberty, a version of the Shahine missile system; the United Technologies/FMC/British Aerospace tracked Rapier vehicle; and the Hughes/MBB/Aérospatiale Paladin, a version of the Roland missile system.

All of the competitors went through a two-part evaluation at the White Sands Missile Range in New Mexico. In the first phase, soldiers operated each of the systems in numerous nonfiring engagements that evaluated how well the weapons could find and track low-level attacking airplanes and helicopters that employ countermeasures. In the second phase, each of the competitors fired ten missiles in engagements against drones.

ADATS is capable of tracking up to ten targets simultaneously, and it uses beamrider missiles that are less prone to jamming and countermeasures than those of the other competitors. ADATS is equipped with a forward-looking infrared thermal

The 310th Tactical Fighter Training Squadron at Luke AFB, Ariz., recently reprised its original "top hat and skull" insignia, which dates back to 1942. Shown with the emblem are Lt. Col. John B. Gibbs (center), the unit's current commander, and two previous commanders, retired Col. "Mac" MaCurdy and retired Lt. Col. Howard Tuman.

imager, TV camera, laser rangefinder, and a carbon dioxide laser for missile tracking.

The Army will award a contract to Martin Marietta for four ADATS fire units as soon as FY '88 funds become available. Operational testing will begin late this year at Fort Hunter, Calif., with a production decision to be made in 1989. The Army hopes eventually to procure up to 562 ADATS units. ADATS was also recently ordered by the government of Canada for its air defense requirements.

In a related note, Vega Precision Laboratories of Vienna, Va., and the Army's Missile Command developed the hardware to hover a full-scale helicopter at low altitude during the LOS-F-H candidate evaluations. For the tests, Missile Command wanted a QUH-1 helicopter to be able to pop up and hover at an altitude of twenty feet in order to provide as realistic a target as possible. Vega Laboratories says that this was the first time a full-scale helicopter drone had been held in a low-altitude hover.

★ The trend to contract training in the Air Force is continuing. Three companies have recently been awarded contracts for ground training of pilots in seven aircraft types.

In late November, Singer's SimuFlite Training International Div. was given a five-year $1.7 million contract for academic instruction for RF-4 pilots and weapon system officers (WSOs) at Bergstrom AFB, Tex. Training will expand to both academic and simulator instruction at Bergstrom and at Shaw AFB, S. C., in the second and in the later years of the contract.

Earlier in the month, McDonnell Douglas Training Systems Inc. (MDTSI) was given a five-year, $5.85 million contract for academic and simulator training for F-15 pilots at Luke AFB, Ariz., and Tyndall AFB, Fla. Later this year, MDTSI will assign additional instructors to Langley AFB, Va., Eglin AFB, Fla., Holloman AFB, N. M., and McChord AFB, Wash. MDTSI was also awarded a $591,000 contract for academic and simulator training for OV-10 pilots at Patrick AFB, Fla.

Both SimuFlite and MDTSI will employ retired military instructor pilots as the simulator instructors. This will allow operational experience to be passed on to the trainees.

The final major contract award went to FlightSafety International, which will provide academic and simulator training to pilots of the Air Force's C-9, C-21, C-12F, and C-140B aircraft. Training will take place at the company's DC-9/MD-80 Learning Center in St. Louis, Mo. (C-9), the Learjet and King Air Learning Centers in Wichita, Kan. (C-21 and C-12F), and the JetStar Learning Center in Marietta, Ga. (C-140B).

★ There were all kinds of missiles flying through the air during November and early December. AMRAAM recorded two more successes in its development program, a cruise missile was launched from a B-1B, and two Sidewinder missiles were fired from a helicopter.

February Anniversaries

- *February 18, 1918:* The first American fighter unit proper, the 95th Aero Squadron, arrives in France during World War I.
- *February 28, 1918:* Regulation of the airways begins when an order by President Woodrow Wilson requires licenses for civilian pilots or owners. More than 800 licenses are issued after this order takes effect.
- *February 15, 1928:* President Calvin Coolidge signs a bill authorizing acceptance of a new site near San Antonio, Tex., to become the Army Air Corps training center. This center is now called Randolph AFB.
- *February 17, 1938:* Six Boeing B-17 Flying Fortresses, under the command of Lt. Col. Robert Olds, leave Miami, Fla., on a goodwill flight to Buenos Aires, Argentina. The return trip to Langley Field, Va., would be the longest nonstop flight in Air Corps history up to that time.
- *February 15, 1943:* It is announced that Maj. Gen. Ira C. Eaker will succeed Maj. Gen. Carl A. "Tooey" Spaatz as Commander of the USAAF Eighth Air Force.
- *February 27, 1943:* RAF Bomber Command announces that the Allied air forces have made 2,000 sorties over the past forty-eight hours.
- *February 20, 1948:* The first Boeing B-50 Superfortress is delivered to Strategic Air Command.
- *February 4, 1958:* The keel of the world's first nuclear-powered aircraft carrier, the USS *Enterprise* (CVN-65), is laid at the Newport News Shipbuilding and Drydock Co. yards in Virginia.
- *February 27, 1958:* Approval is given to the Air Force to start research and development on a solid-propelled intercontinental ballistic missile program that would later be called "Minuteman." The first Minuteman squadron, the 10th SMS at Malmstrom AFB, Mont., is declared operational on February 28, 1963.
- *February 12, 1973:* "Operation Homecoming" begins. Military Airlift Command crews would repatriate 591 American prisoners of war during the operation, which saw MAC crews flying missions into North Vietnam.
- *February 9, 1983:* At Lockheed's plant in Marietta, Ga., the first rewinged C-5A makes its first flight. It would be delivered to the Air Force at the end of the month.
- *February 10, 1983:* The Cruise Pact is signed by the US and Canada. This treaty allows testing of US cruise missiles in northern Canada.

Hughes Aircraft Company has designed and built a common set of core modules to reduce cost and increase reliability in U.S. military aircraft radar systems. Instead of using unique modules for each aircraft, a Standard Avionic Module (SAM) format is used, permitting the core modules to be interchanged in Programmable Signal Processors (PSPs) for the U.S. Air Force F-15's APG-70 radar and the Navy F-14D's APG-71. A SAM consists of two printed circuit boards mounted on both sides of a flow-through heat exchanger, with VHSIC-level integrated circuits in rows on either side of the SAM. Significantly fewer module types need be created and debugged, resulting in a more mature design and production base.

A system for night reconnaissance, border surveillance, and specialized military applications has recently completed 150 successful cross-country demonstration flights. The approach utilizes a Hughes Night Vision System (HNVS) aboard Schweizer Aircraft Corporation's new SA 2-37A Special Purpose Aircraft. The HNVS is a forward-looking infrared (FLIR) system that lets crew members see at night and in poor visibility conditions. Unlike radar, the FLIR emits no energy of its own that can be detected during operations. It can locate and track vehicles and, at its maximum magnification setting, can even delineate individual tree limbs and branches. HNVS is in use by the U.S. Army and the U.S. Customs Service, and was selected for use on the proposed V-22 Osprey tilt-rotor aircraft.

The United Kingdom Infrared Telescope (UKIRT) in Hawaii was the first to use a new infrared focal plane array, which has caused a technological revolution in infrared astronomy. The Hughes-built microchip "sandwich" provides sharp, fast infrared images of our solar system and the galaxies. Astronomers can now obtain a better look inside mysterious clouds of dust and gas, known as nebulae, to learn more about the life cycle of stars. The array also produces, for the first time, fine-grain infrared images of objects within nebulae that were previously hidden.

A newly developed system significantly speeds up the measurement of digital data generated by modern radars. The Automated Radar Monitor (ARM) system uses a computer and special interface hardware. It replaces expensive, time-consuming manual special test equipment (STE) hardware panels currently used. ARM can collect high-speed digital radar data, analyze it, and display it on several computer terminals simultaneously. The cost of the ARM system, developed by Hughes, is approximately one-third that of the STE it replaces.

A high-performance instrumentation radar establishes state-of-the-art fast and sensitive microwave and millimeter-wave measurements. Developed by Hughes, the fully programmable, broadband, frequency- and polarization-agile radar provides the flexibility to make radar cross section and antenna pattern measurements, EW simulation testing, and more. Utilizing Inverse Synthetic Aperture Radar imaging, modular design, and automatic diagnostics, the radar achieves reliable, accurate measurements from 100 MHz to more than 100 GHz. The system can be tailored for indoor or outdoor ranges or in natural environments for measurements of ships at sea or aircraft in flight.

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

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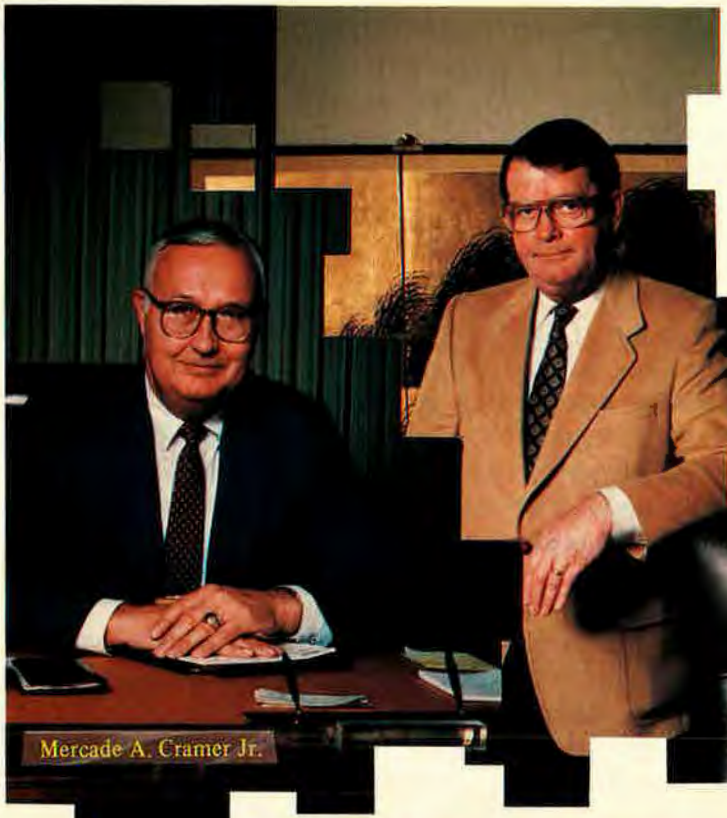

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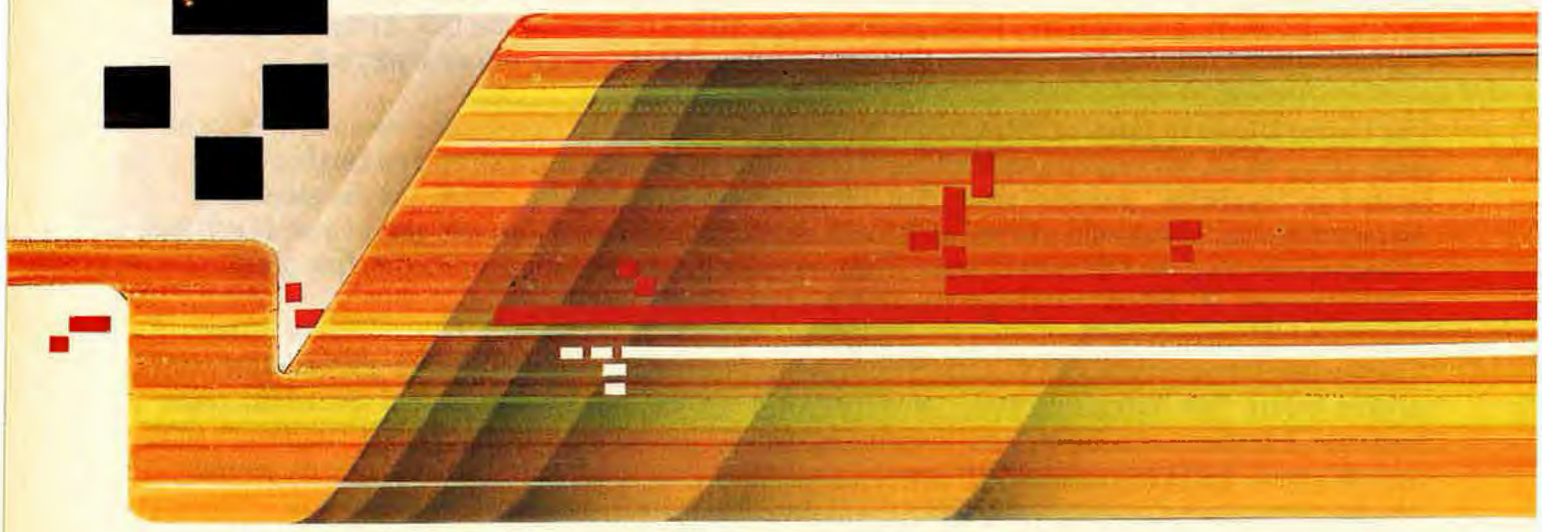

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Two AIM-120A Advanced Medium-Range Air-to-Air Missiles were launched in separate tests in different locations on November 18 and 22.

The first trial tested the AIM-120's ability to discriminate between two targets in a cluster formation. The 335-pound missile passed within lethal range of the correct QF-100 drone. This test was conducted over the Gulf Test Range near Eglin AFB, Fla., and the launching aircraft was an F-16.

In the second test, an AMRAAM was fired from an F-15 in a nearly head-on, high-speed and high-altitude shot against a QF-4 over the Pacific Missile Test Center at Point Mugu, Calif. The F-15 was traveling at Mach 1.5 at 45,000 feet, while the drone was flying at a higher speed and altitude. The test missile passed within lethal range of the target.

These latest successes bring the AMRAAM test program scoreboard to forty successes in forty-eight attempts. That is a success rate of eighty-three percent in almost two years of testing.

The Rockwell B-1B recorded another milestone in its ongoing operational flight test program last November 24 when an AGM-86B Air-Launched Cruise Missile was successfully launched from the bomber for the first time. The test took place over the Utah Test and Training Range west of Salt Lake City.

The ALCM's warhead was replaced by an instrument package for the test. The AGM-86 was launched at low altitude from a Common Strategic Rotary Launcher (CSRL) in the B-1B's bomb bay.

McDonnell Douglas recently leased an AH-64A Apache attack helicopter from the Army, and in late November, the company conducted from it two firings of AIM-9 Sidewinder air-to-air missiles over the White Sands Missile Range in New Mexico. This company-funded test was designed to evaluate the Apache's air-to-air capability.

The missiles were unarmed and were not aimed at any specific targets, but were launched to test missile separation and how well the missile's seeker interfaced with the AH-64's weapons control system. One shot was made while the helicopter was hovering, and the other was carried out while the Apache was flying at a speed of ninety-three miles per hour.

McDonnell Douglas Helicopter Co., maker of the AH-64, is also under Army contract for a test program to adapt the FIM-92 Stinger shoulder-launched surface-to-air missile to the AH-64 as an air-to-air missile. Up to four Stingers can be mounted on the Apache.

★ **AWARDED—Chad Hennings,** a senior defensive tackle on the Air Force Academy football team, was named **winner of the Outland Trophy** on December 9. The prestigious award, presented annually since 1946 by the Football Writers Association of America, is given to the nation's top interior lineman. Cadet Hennings, who recorded eighty-seven tackles and twenty-four quarterback sacks during the regular season, is the first Air Force Academy player to win one of college football's major trophies. In a related note, the Air Force Academy claimed the 1987 Commander in Chief's Trophy by beating both Army and Navy on the gridiron last fall.

★ **MILESTONES—The NASA X-Wing Rotor Systems Research Aircraft** (RSRA), after a series of delays, finally **flew for the first time** on December 2. The forty-minute flight was accomplished without the RSRA's distinctive X-shaped rotor/wing. The RSRA X-Wing will undergo a three-stage test program in 1988. After a

Senior Staff Changes

PROMOTIONS: To be **Major General:** Edward P. **Barry,** Jr.; James W. **Hopp**; James F. **Record**; Dale W. **Thompson,** Jr.

To be **Brigadier General:** Harold B. **Adams;** Dennis C. **Beasley**; Lawrence E. **Boese;** Ralph T. **Browning;** Richard A. **Browning;** Edward N. **Brya;** Frank **Cardile**; William E. **Collins;** Lewis E. **Curtis** III; Stancil L. **Dilda,** Jr.; Francis R. **Dillon;** John W. **Douglass;** Brett M. **Dula.**

Albert J. **Edmonds;** Marvin S. **Ervin**; James A. **Faln,** Jr.; John L. **Finan;** Bruce L. **Fister;** Charles E. **Franklin**; Benard W. **Gann;** Timothy D. **Gill**; James F. **Grant**; Kenneth L. **Hagemann,** Sr.; Milton L. **Haines;** Larry L. **Henry;** Walter C. **Hersman.**

Ellwood P. **Hinman** III; James M. **Hurley;** Ronald W. **Iverson;** Arthur E. **Johnson;** Roger A. **Jones;** John P. **Jumper;** Kenneth F. **Keller**; Jean E. **Kilck**; Owen W. **Lentz**; Antonio **Maldonado;** James W. **McIntyre;** Ben **Nelson,** Jr.; Philip W. **Nuber.**

Raymund E. **O'Mara;** Robert W. **Parker;** John F. **Phillips**; Robert W. **Poel;** Joseph J. **Redden;** Ronald N. **Running;** John J. **Salvadore;** Garry A. **Schnelzer;** Graham E. **Shirley;** Nolan **Sklute;** Lester J. **Weber;** Thad A. **Wolfe;** Walter A. **Worthington.**

To be **ANG Major General:** Thomas R. **Elliott,** Jr.; Timothy T. **Flaherty**; John R. **Layman.**

To be **ANG Brigadier General:** Paul L. **Carroll,** Jr.; Edward R. **Clark;** Joe H. **Engle;** Michael S. **Hall**; Wallace D. **Hegg;** Richard J. **Idzkowski;** Philip G. **Killey;** Stephen M. **Korcheck;** Charles R. **Linz;** Ralph J. **Melancon,** Sr.; William D. **Neville;** Donald J. **Ryan;** James H. **Tuten**; Thomas R. **Webb**; James T. **Whitehead.**

RETIREMENTS: M/G Clarence R. **Autery**; B/G Philip M. **Drew;** L/G James E. **Light,** Jr.; L/G Edward L. **Tixier.**

CHANGES: B/G James S. Allen, from Mil. Ass't to Sec'y of the Air Force, OSAF, Washington, D. C., to Cmdr., 833d AD, TAC, Holloman AFB, N. M., replacing B/G (M/G selectee) James F. Record . . . **B/G John P. Dickey,** from Dep. Cmdr., 5ATAF, Vicenza, Itely, to Cmdr., Field Command, DNA, Kirtland AFB, N. M. . . . **Col. (B/G selectee) Francis R. Dillon,** from Vice Cmdr., Hq. AFOSI, Bolling AFB, D. C., to Cmdr., Hq. AFOSI, and Ass't IG for Spec. Investigations, Bolling AFB, D. C., replacing retiring B/G Richard S. Beyea, Jr. . . . **Col. (B/G selectee) Brett M. Dula,** from Cmdr., 2d Bomb Wing, SAC, Barksdale AFB, La., to IG, Hq. SAC, Offutt AFB, Neb., replacing B/G Eugene E. Habiger . . . **B/G Joel T. Hall,** from Cmdr., 57th FWW, TAC, Nellis AFB, Nev., to Dep. Cmdr., 5ATAF, Vicenza, Italy, replacing B/G John P. Dickey . . . **M/G Wayne O. Jefferson, Jr.,** from Ass't Dir., Communications and Info. Sys. Div., Int'l Mil. Staff, NATO, Brussels, Belgium, to Dep. Dir., Defense-Wide C^3 Support, J-61, OJCS, Washington, D. C., replacing retiring M/G John P. Hyde.

Col. (B/G selectee) John P. Jumper, from Cmdr., 33d TFW, TAC, Eglin AFB, Fla., to Cmdr., 57th FWW, TAC, Nellis AFB, Nev., replacing B/G Joel T. Hall . . . **B/G Orthus K. Lewis, Jr.,** from Cmdr., 40th AD, SAC, Wurtsmith AFB, Mich., to Ass't DCS/Tech. Training for Resource Sys. and Policy Integration, Hq. ATC, Randolph AFB, Tex., replacing Col. James M. Middleton . . . **Col. (B/G selectee) Raymund E. O'Mara,** from Dep. Dir., Ops. and Training, Dir. of Ops., DCS/P&O, Hq. USAF, Washington, D. C., to Cmdr., 40th AD, and ECM Consultant to CINCSAC, SAC, Wurtsmith AFB, Mich., replacing B/G Orthus K. Lewis, Jr. . . . **B/G (M/G selectee) James F. Record,** from Cmdr., 833d AD, TAC, Holloman AFB, N. M., to Dir., Ops. (J-3), Hq. USCENTCOM, MacDill AFB, Fla., replacing M/G Samuel H. Swart, Jr. . . . **M/G Samuel H. Swart, Jr.,** from Dir., Ops. (J-3), Hq. USCENTCOM, MacDill AFB, Fla., to C/S, AFSOUTH, Neples, Italy, replacing M/G James P. Smothermon. ■

series of flights without the X-Wing, the aircraft will be flown with two rotor/wing blades, and then late this year, the RSRA will fly with all four blades. The RSRA will take off and land vertically, but once airborne, the X-Wing will be locked down, and the vehicle will fly like a conventional aircraft.

Many people have plastic surgery done to shorten their nose. In a sort of reverse aviation equivalent, **the last "Roman nose" Lockheed C-130A** recently went in for some plastic surgery to have its "nose" (radome) lengthened. The modification was done to **install a new solid-state radar** in the thirty-year-old airplane. The C-130A (serial number 54-1631) began life in 1957 with the 61st Troop Carrier Squadron at Dyess AFB, Tex., and is now assigned to the 143d Tactical Airlift Group, the Air National Guard unit based at Quonset Point State Airport near Providence, R. I.

The last of the "Roman nose" Lockheed C-130As recently had some "surgery" to lengthen its radome in order to accommodate a new solid-state radar. The C-130 is assigned to the Rhode Island Air National Guard.

The **8th Tactical Fighter Squadron** of the 49th Tactical Fighter Wing at Holloman AFB, N. M., has **flown more than 70,000 hours without a major accident,** which is the longest safety record of any F-15 squadron in the world. The "Black Sheep," as the unit is known, passed the plateau on November 20. The milestone sortie was flown by Lt. Col. Jerry Coy, the squadron commander. The 70,000-hour mark represents more than 26,000,000 miles and took eleven years to achieve.

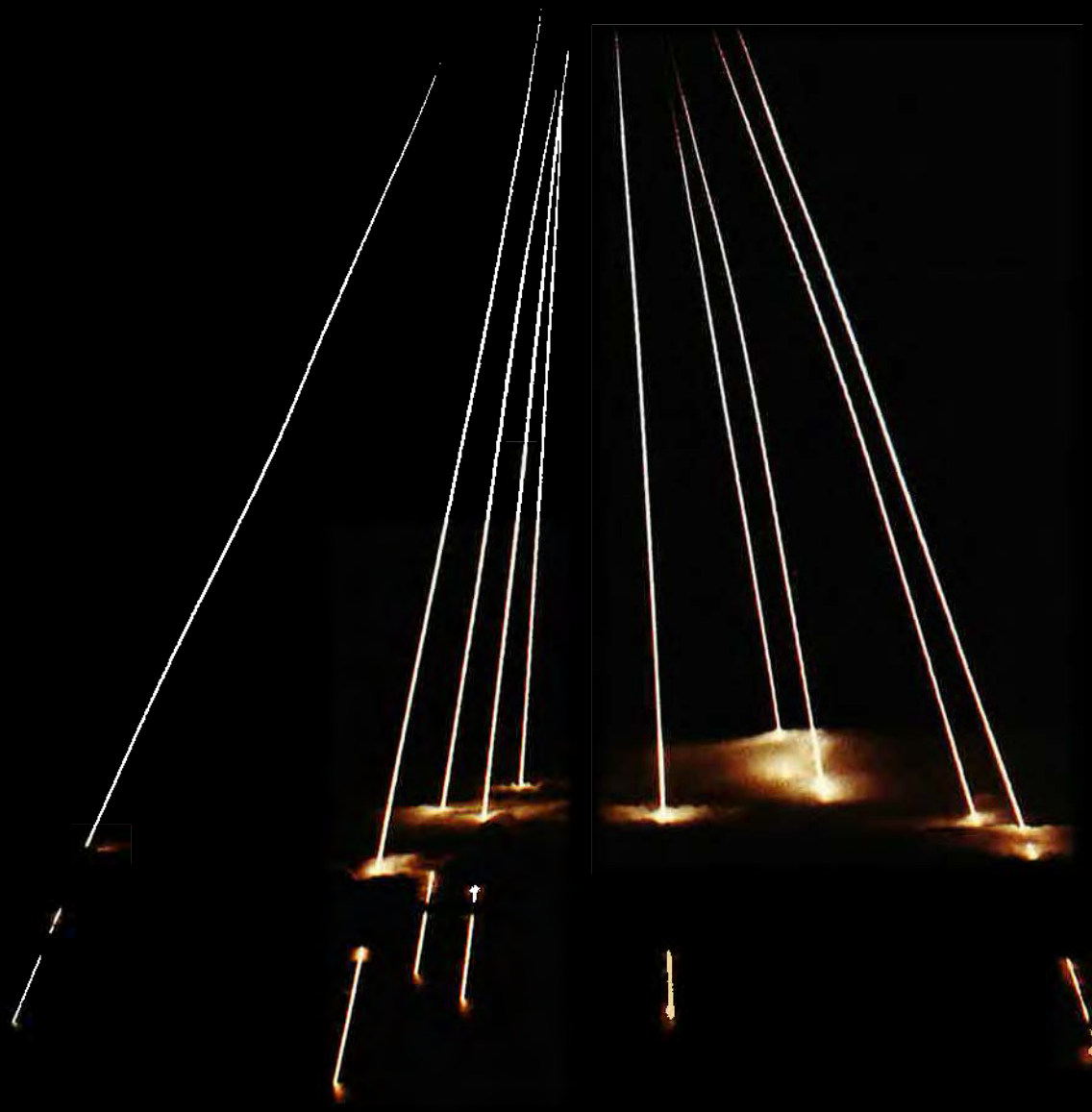
Texas Instruments completed its **fifth year of on-time deliveries of the AGM-88A high-speed antiradiation missile** (HARM) in November. The latest deliveries completed the FY '85 contract, which called for 1,684 missiles. TI reached a monthly delivery rate of 166 HARMs during the year.

The **first F-16C assembled in Turkey** was delivered to the Turkish Air Force on November 30. Tusas Aerospace Industries (TAI) will coproduce 152 F-16C and D aircraft with General Dynamics. The milestone aircraft was built by GD in Fort Worth, Tex., and was disassembled and shipped along with another disassembled F-16 to Turkey by an Air Force C-5A. The second aircraft was expected to be delivered to the Turkish Air Force in January.

★ **NEWS NOTES**—On December 23, the Navy chose the **McDonnell Douglas/General Dynamics** team over the Grumman/Northrop team to develop and produce its **Advanced Tactical Aircraft** (ATA) and awarded the winner a $241,000 interim contract in advance of a much more lucrative contract for full-scale development. The Navy plans to build more than 500 ATAs well into the twenty-first century at a cost of more than $35 billion. McDonnell Douglas and General Dynamics are also members of industrial teams, headed by Northrop and Lockheed respectively, in competition to develop and build the Air Force's Advanced Tactical Fighter (ATF).

After the fleet was grounded for eighteen months, **the Air Force successfully launched its second Titan 34D rocket** on November 28. The Titan 34D was carrying a classified payload believed to be an early warning satellite. Unlike the first Titan launch on October 27, which lifted off from Vandenberg AFB, Calif., this rocket was launched from Cape Canaveral AFS, Fla., to demonstrate the Air Force's ability to launch from both coasts. In a related note, the Air Force recently awarded Martin Marietta a $1.558 billion contract for an additional thirteen new-generation Titan IV launch vehicles. Martin Marietta is currently under contract for ten Titan IVs.

Index to Advertisers



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In an exercise conducted over Alaska in November, **Air Force F-15 Eagles had the opportunity to "mix it up" with Navy F-14 Tomcats** in simulated air combat. The US Third Fleet exercise, called NORPACEX, allowed the F-15s to participate in a variety of scenarios. The Eagles, from the 21st Tactical Fighter Wing at Elmendorf AFB, Alaska, also had to "defend" the ranges near Eielson AFB, Alaska, from aircraft of the USS *Enterprise* (CVN-65). The exercise also successfully demonstrated the ability of the Air Force and Navy to work together in Alaska. There was no word on whether the Eagles or Tomcats "won" the aerial altercations between the two air-superiority fighters.

Rockwell International's North American Aircraft Operations Div. recently awarded **two major subcontracts for the AC-130U gunship development effort.** Ball Corp.'s Aerospace Systems Div. was awarded a $14 million contract in November for **construction of an All-Light-Level TV subsystem.** This system will contain a thirteen-inch telescope, a low-light-level TV camera, a cryogenically cooled gallium arsenide laser illuminator, a laser rangefinder, a video target tracker, a control panel, and a stabilizing mechanism.

Hughes Aircraft Co., meanwhile, was awarded a $58 million contract in early December for the **fire control radar system for the new gunships.** The radar will be a modified APG-70, the same radar operational on F-15C/D aircraft and in flight test on F-15E aircraft. The radar will have new modes that will include fixed target tracking and projectile impact point prediction.

Lt. Gen. (Gen. selectee) James A. Abrahamson, head of the Strategic Defense Initiative Organization (SDIO), directed in mid-November that **the metric system be the official measurement standard** for all newly designed and developed **elements of SDI.** General Abrahamson said that making the move to metrics now would facilitate production programs if SDI systems are deployed, and it would make it easier for allied nations, which are already using the metric system, to participate in SDI development.

★ **DIED—Donn F. Eisele,** command module pilot on the Apollo-7 mission in October 1968, of a heart attack December 2 while on business to Tokyo, Japan. He was fifty-seven.

Then Air Force Major Eisele, along with astronauts Wally Schirra and Walter Cunningham, spent nearly eleven days in space completely checking out the onboard systems of the Apollo command and service modules. The tests, performed by the first successful three-man US crew, were very important not only for system shakedown but also for restoring confidence in the US manned space program after the disastrous Apollo-1 fire of January 1967. Major Eisele gained a measure of fame on what was to be his only spaceflight when he became the first person to catch a head cold while in orbit.

Mr. Eisele retired from the Air Force as a colonel in 1972. He was a graduate of the US Naval Academy, the Air Force Test Pilot's School, and the Air Force Institute of Technology. After retiring, he headed the Peace Corps in Thailand. For the last few years, he worked as a financial consultant and in advertising. ■

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As the superpowers explore deep reductions in nuclear weaponry, the US strategic modernization program is more important than ever.

Strategic Forces at the Brink of START

BY ROBERT S. DUDNEY, SENIOR EDITOR

AMERICA's strategic nuclear deterrent, though a prime target for Geneva arms negotiators, appears headed toward a strengthening.

Such is the prospect, even should President Reagan succeed in his campaign to achieve epic cuts in superpower nuclear arsenals at the Strategic Arms Reduction Talks (START) in Geneva.

Already, the new and more potent forms of offensive strategic arms that had been integrated on a large scale into US plans tended to make the debate over the overall size of the force almost academic.

Technically, the US armory may decline in "strength"—as it is defined numerically. In fact, if current weapons procurement plans hold up over the long term, US land, sea, and air elements would be recast in ways that will bolster their deterrent power.

The force, even if cut fifty percent as Reagan hopes, would have a larger proportion of newer arms because older weapons are being replaced with more modern ones—ICBMs, submarine-launched missiles, bombers, and cruise missiles.

It's not just a matter of newer arms. The planned US strategic weaponry of the future would possess properties that would provide major gains in effectiveness relative to predecessor arms.

The strengthening, say experts, would occur in three major ways:

- *Survivability.* No longer would any of the three legs of the strategic "triad"—land-based missiles, submarine-launched missiles, and bombers—be clearly exposed to a devastating Soviet knockout attack. Mobile basing and deception promise to lend far greater protection.
- *Capability.* Weapons will be equipped with superaccurate warheads capable of threatening the hardest Soviet targets. Less accurate arms that constrain US planning today will decline in number.
- *Versatility.* Today's practice of assigning each type of weapon to a single overriding mission will be modified. Forces will be capable of more rapid retargeting and thus be more responsive to change.

Though due for replacement, the Minuteman ICBM remains the backbone of the nation's land-based missile force and will serve as such for years to come. Sgt. Randy Womack of the 341st Strategic Missile Wing, Malmstrom AFB, Mont., is one of the thousands who keep the venerable ICBMs in top condition. Now under way is an upgrade program that will keep Minuteman effective through the rest of the century, by which time plans call for newer, more powerful, and less vulnerable weapons to take over its mission.

—Photo by SrA. Carrie Heatherly, USAF

—Staff photo by Guy Aceto

SAC bombers and crews continue to provide a high proportion of US nuclear punch and remain the most flexible of all strategic weapons. SAC's fleet of B-52s (left), thoroughly modified and modernized through the years, will play a critical role in the 1990s as SAC's principal cruise missile carrier. Meanwhile, the last of SAC's planned 100 B-1B bombers is scheduled to be delivered this year and will take over the prime penetrating bomber role. Work is continuing on a radar-evading "Stealth" bomber, designated B-2, for initial operating capability in the mid-1990s.

As a result, new US strategic forces—even at reduced levels—would provide a measurable improvement in the nation's ability to meet the specific requirements of strategic deterrence.

These requirements entail being able to survive a Soviet attack, credibly threaten a retaliatory second strike against assets valued the most by Moscow, and cope with an increasingly complex set of Soviet targets over a prolonged period. Why is this the case?

Destructiveness Not Enough

The simple answer, according to defense officials: With major changes taking place in Soviet nuclear strategy, deterrence depends far less on the overwhelming size of the American force than it does on the force's power to perform specific military missions.

The situation is summed up this way by former Defense Secretary Caspar W. Weinberger: "The sheer destructiveness of nuclear forces does not by itself guarantee deterrence. Our forces must be survivable, capable, flexible, and discriminative."

To be sure, the ongoing Geneva negotiations to achieve a superpower arms agreement that would eliminate large numbers of nuclear warheads and launchers presented certain problems and perils.

For one thing, say experts, the Pentagon's projected strategic scenario could be upset by an inequitable agreement that permits Moscow to retain a significant advantage in one or more measures of strategic power—particularly its massive edge in heavy, accurate, multiwarhead missiles based in silos.

The Kremlin had already agreed, under START, to halve its force of "heavy" SS-18 missiles from 308 today to 154 and to cut drastically the lifting power of its force. Still in dispute, however, was a US demand for tight overall limits on the total Soviet ICBM force.

The US had been insisting that the Soviet Union accept a limit of 3,300 on its number of ICBM warheads. Soviet officials had countered by saying that Moscow would accept this stricture if Washington agreed to a limit of 3,300 on sea-based missile warheads.

Both sides had balked, and there the matter lay after the latest superpower summit in Washington. The thorny problem was passed off to Geneva negotiators for another try.

Among some strategic planners, there was also concern that such a treaty might sap political support for the President's ongoing strategic arms-modernization programs. They warn that the program might falter if the public perceives that new arms have been made unnecessary by a treaty that would make drastic reductions.

This danger had been seen as being particularly acute in view of harsh federal budget austerity that lies ahead in Washington.

In fact, it is sharp domestic political pressures on defense spending, rather than arms control, that is seen as posing the greater threat to strategic revitalization. As 1987 ended, that was made clear when the Senate came close to killing a key US strategic program, the so-called Small ICBM.

While congressional negotiators eventually revived the fledgling missile—at least through 1988—the issue was volatile. It, along with other key strategic issues, could be reopened at any time, either by Congress or by Administration actions. Air Force officials had worried that the mobile Peacekeeper missile program could ultimately become a victim of the same pressures.

Reductions and Modernization Are Compatible

Whatever the momentary ups and downs of such controversial programs, however, they are certain to remain at the forefront of debate in 1988, undergoing fitful starts and stops but with no final conclusions reached until year's end—if then.

Whatever the indirect effects, however, there is a consensus that today's strategic weapons programs would be no more than marginally affected by an arms deal of the kind under consideration, in and of itself.

In fact, the Air Force Chief of Staff, Gen. Larry Welch, notes that Washington's "deep reduction" plan was crafted with modernization programs uppermost in everyone's mind—particularly those programs

aimed at strengthening the land-based missile force.

"All those [programs] fit within the deep reduction numbers," says he. "There is no basic restructuring . . . required" in the current modernization program.

What is perhaps the most important facet of that program, say military analysts, is the contribution it promises to make toward the restoration of a relatively less vulnerable strategic arsenal in the 1990s.

No one expects to return America to the comfortable and secure environment of the 1950s and 1960s. Those times are gone forever unless active defenses are built.

But the Pentagon was embarked on a range of weapons initiatives that, taken together, would go far toward addressing what was once referred to as a "window of vulnerability" that may have left US strategic forces exposed to the Soviet Union's force of increasingly destructive and accurate intercontinental ballistic missiles.

Experts maintain that the subject of vulnerability can be looked at in two different ways. One concerns the broad sense of the vulnerability of the strategic forces as a whole—which is not today, and is not likely to be, a problem.

Even so, the Reagan Administration is moving on that front with strengthening programs embracing all elements of the triad—bombers and submarines as well as the ICBM leg. Limited results are already apparent.

There is a strong case to be made that the B-1B bomber, with its greater dash speed for escape, shapes up as being far less vulnerable to a Soviet attack on US bases than the B-52 that it replaces. The same holds true for the Advanced Technology Bomber, now known officially as B-2.

Current plans call for deploying 231 B-1Bs and B-2s over the next decade. In strategic agreements now being discussed, the equivalent of around 1,200 warheads would be reserved for bombers.

The Navy's strategic-missile-firing submarines, armed with long-range weaponry, already provide the most survivable portion of the nation's triad of strategic forces. Introduction of Trident submarines of the *Ohio* class, far quieter than earlier subs, will only add to the undersea deterrent's security.

Quieter submarines combined with longer-legged missiles mean that the boats are able to hide in a far greater volume of ocean.

Securing the Land-Based Force

The other way to look at vulnerability, however, is in the more narrow sense of the exposure of land-based ICBMs to a Soviet attack.

There is widespread belief that the most critical strategic problem facing the US is the vulnerability of the nearly 1,000 missiles based in silos. Theoretically, at least, these silos appear to be vulnerable to an attack with the Soviet Union's accurate, powerful, long-range SS-18 multiwarhead missiles.

It is the attempt to secure this land-based force that holds the greatest problems, and promise, for the United States.

At the core of Washington's effort today is the proposed deployment of 100 mammoth, ten-warhead Peacekeeper ICBMs, some twenty-seven of which are in the inventory at this writing. Plans call for making half of the total force secure by virtue of mobility.

The current Peacekeeper plan was born of tactical retreat. From the outset, Mr. Reagan rejected a Carter Administration plan to shuttle 200 of the supermissiles among 4,600 shelters in Nevada and Utah.

Then, he proposed to cut the number of Peacekeepers from the 200 planned by the Air Force to 100 and to deploy them in the Minuteman's already-vulnerable silos. He then changed his mind, deciding to pursue another basing scheme called "dense pack"—officially, "Closely Spaced Basing." When that fight was lost in Congress, he went back to a Minuteman silo variation, which received provisional approval on Capitol Hill.

The first fifty Peacekeepers now are being deployed at F. E. Warren AFB, Wyo., with completion due in late 1988.

Congress, however, authorized the deployment of only fifty of the weapons in fixed, land-based silos. It has been withholding approval for

Out on the western Great Plains, ICBM modernization is becoming a reality. Pictured here is installation of a canister containing an LGM-118 Peacekeeper component at F. E. Warren AFB, Wyo. The first fifty Peacekeepers will be in place this year.

deployment of the second fifty pending Administration creation of a more survivable basing system for them.

Now, USAF is convinced that it has found one. Strategic Air Command is pursuing deployment of the second fifty missiles in a scheme to make them mobile by putting them aboard rail cars. The Administration is also seeking political approval for this so-called "rail-garrison" system.

Essentially, the scheme is this: Peacekeeper missiles would be deployed aboard trains—two per train—at up to seven garrisons spread across the continental US. Each garrison would contain three or four missile trains designed to look similar to civilian versions.

On receipt of strategic warning, say planners, Strategic Air Command would set the trains rolling onto the nation's railway system, creating a virtually impossible targeting task for Soviet planners attempting to destroy these high-quality weapons.

The attack problem flows from the arithmetic of a strike: By assuming that approximately 200,000 miles of commercial track will be available for dispersing them, says a recent analysis by the staff of the International Institute for Strategic Studies in London, it would take 10,000 one-megaton Soviet warheads to destroy the 500 Peacekeeper warheads in the system—an unfavorable exchange ratio of twenty to one against the Soviet Union.

Concludes one SAC planner: "The combination of all that rail, with only twenty-five cars, makes a Soviet attack not feasible. It would cost him too many weapons to try to attack all of the places where they could be."

To avoid provoking public opposition to nuclear weapons traveling around the nation's rails, the trains would be garrisoned on USAF bases during peacetime and dispersed onto civilian rails only in a major international crisis.

Currently in design development, the rail-garrison basing system will face a critical test in March, when the Pentagon will take up the decision of whether or not to go into full-scale development. Official approval seems likely. The first major vote in Congress on funding a full-scale program is scheduled for late 1988.

The Small ICBM

It is not only the mobile Peacekeeper that was being contemplated in an effort to enhance the survivability of the ICBM force. Also being worked on was another mobile missile that, experts say, would confront the Soviet Union with another massive targeting problem—the Small ICBM.

Proposed by the so-called Scowcroft Commission in 1983, SICBM since that time had been officially accepted by the Air Force and the White House. By late last year, it had been taken well along in full-scale engineering development.

First deployment of the 37,000-pound, single-warhead weapon had been set for 1992. All told, the Air Force had originally proposed to build up to 500 of them to complement the Peacekeeper's awesome attack capabilities.

It is the SICBM's basing system, however, that would provide the true justification for its future existence.

That system was centered on the Hard Mobile Launcher—a specially hardened offroad mobile vehicle that could carry one SICBM. The deployment concept called for 500 of the missile/HML systems to be housed on military bases either in the southwest US or in Minuteman fields, or both.

On tactical warning, the missiles would be moved off base as rapidly as possible—up to fifty-five miles per hour on paved roads and at around fifteen miles per hour on unimproved surfaces. Within thirty minutes, say officials, the HMLs with their SICBM cargoes would be able to be dispersed over 28,000 square miles of desolate western territory.

Again, the arithmetic that would confront an attack planner is daunting.

How many weapons would it take to barrage such a vast area and destroy the force? In the view of the IISS staff's study, the attacker would be forced to expend 9,500 half-megaton weapons to catch a mere 500 American warheads—an unfavorable nineteen-to-one ratio.

SICBM gains a measure of protection by virtue of its relatively low value. Armed with only a single warhead, the smaller missile will be a less lucrative target than MIRVed forces.

In that circumstance, the Soviets might well choose to strike elsewhere. But the SICBM force would remain a threat.

Far from endangering this missile system, an arms-reduction agreement would probably enhance it by limiting the Soviet offensive threat that could be thrown against it.

The US would not be able to build the thousands of SICBMs that would be needed in the face of unconstrained Soviet building programs. It would be too expensive. Arms reductions would make that problem far more manageable.

Even so, a 500-strong SICBM force would not come cheap. The cost of building, deploying, and operating a force of this size is put by

Characteristics of US Ballistic Missile Forces

System	Number of Reentry Vehicles	Yield per RV (Kilotons)	CEP (Nautical miles)	Throw-weight (in thousands of pounds)	System Availability (Day-to-day)
Minuteman II	1	1,200	0.34	1.6	0.95
Minuteman III					
Mk 12	3	170	0.10	2.4	0.95
Mk 12A	3	335	0.10	2.4	0.95
MX (Peacekeeper)	10	300	0.05	7.9	0.95
SICBM	1	475	0.07	1.3	0.90
Poseidon (C-3)	10	40	0.25	3.3	0.66
Trident I (C-4)	8	100	0.15	3.0+	0.66
Trident II					
Mk 4	12	100	0.08	5.3	0.66
Mk 5	8	475	0.08	5.3	0.66

SOURCE: Congressional Budget Office

The Navy's fleet of thirty-six strategic-missile-firing submarines is viewed as the most secure leg of the nation's "triad" of long-range nuclear forces. Eight of the Ohio-class Trident boats (one of which is pictured at right) are now at sea. Twenty of the mammoth "boomers" are planned by the mid-1990s. The deployment of a new, more accurate D5 multiwarhead missile is expected to give the Navy's big boats a greatly expanded warfighting capability.

Air Force officials at $40 billion over the next fifteen years. This is roughly three times the cost of an identical number of mobile Peacekeeper warheads. Cost is one reason that the Air Force and the Administration, while fully aware of the SICBM's benefits, have equivocated over the years on this program. While there is some DoD sentiment for scrapping the program to save money, such a move could derail the modernization plans for ICBMs.

The Bottom Line

The bottom line of these two important mobile missile systems is this: If fully deployed, the Peacekeeper in the rail-garrison system and the mobile SICBM would provide the US deterrent with large numbers of warheads with much reduced vulnerability to attack.

This, say most strategic experts, would more than compensate for the possible loss of vulnerable Minuteman missiles in an arms treaty, if it comes to that. True, there would be fewer aimpoints—only 600 compared to 1,000 today. But 550 of those 600—the mobile SICBMs and Peacekeepers—would be far more difficult to locate and target.

In light of the central importance of these programs, the President's previous proposal at Geneva to ban mobile ICBMs, first put forth in 1985 and not officially withdrawn, was seen as being moot.

This conclusion was supported by the words of no less an authority than Secretary of State George Shultz, who publicly acknowledged that "mobile missiles have a lot to be said for them from the standpoint of their survivability." Mr. Shultz added late last year that "we have said to the Soviet Union that we don't have an objection in principle to mobile missiles."

Equally critical to the strengthening of the American nuclear deterrent is what shapes up as a far-reaching expansion of the nation's strategic "warfighting" capabilities in coming years.

In simplest terms: Under plans that existed, the Pentagon would increasingly acquire and deploy nuclear weapons with sufficient power, accuracy, and numbers to be able to threaten the most heavily fortified, highest value targets within the control of the Soviet leadership.

Today, because of Soviet advances in "hardening" their critical control centers, central strategic weapons, and warfighting facilities, the current US weapons can no longer rapidly perform this task.

Part of the problem can be put down to the sheer size of the Soviet target base. Pentagon officials say they have identified more than 1,500 buried command bunkers designated for Party and military leaders, and that is only a fraction of protected Soviet targets.

More important, however, is the relative paucity of hard-target killer warheads in the US inventory. In fact, say SAC officers, the US today has less than half the number of high-quality warheads it needs to be able to hold at risk these classes of Soviet targets.

Three Weapon Systems

Rectifying this situation had been assigned the highest priority by Washington. Helping to achieve the Administration's goals would be three principal weapon systems. They are:

- *Peacekeeper.* The addition of 1,000 superaccurate warheads would result from full deployment of 100 of these ten-warhead ICBMs by 1993 if the program is not sidetracked along the way.

Special advantages of this ICBM would he high alert rates and rapid strike against the most difficult targets. It shaped up as the premier weapon for threatening certain and accurate retaliation against the Soviet Union.

Officials say that the accuracy of the Peacekeeper warheads would represent a striking improvement over that of earlier ICBM warheads. Precise figures are classified. However, a recent Congressional Budget Office study maintains that the warhead could be expected to land within 300 feet of its target after a flight of some 6,000 miles—nearly twice the accuracy of the Minuteman weapon.

So accurate has the Peacekeeper been during flight tests, says SAC

Commander in Chief Gen. John Chain, that "it would make your eyes water."

• *Small ICBM.* The SICBM had been planned to carry the same type warhead as Peacekeper and a modified version of the guidance system found on the larger missile.

This program would add another 500 weapons with pinpoint accuracy to the US arsenal by the mid-1990s.

• *Trident II* (D5). A modernized and highly accurate submarine-launched ballistic missile (SLBM) force was in the works to complement the attack capabilities of the land-based weapons. An addition of as many as 3,000 silo-busting warheads could result. Some officers say D5 accuracies could approach those of the Peacekeeper.

The D5 missile, which underwent its first flight tests throughout 1987, was planned to become operational aboard *Ohio*-class SSBNs in December 1989. It had been anticipated that the D5 would carry eight nuclear warheads.

From their inception, SLBM warheads have been inherently less accurate than their land-based counterparts because their firing locations at sea could never be determined with precision.

Now, however, the D5 is proving to have far better accuracy and a larger payload than present SLBMs and is billed as being effective against most of the hardened military targets in the Soviet Union—including missile silos and launch-control centers.

All told, the count of prompt, hard-target-kill warheads in the American force might top 4,000 when, and if, the building program is complete in the 1990s. That compares to a total today estimated at no more than 1,000.

If Trident II, Peacekeeper, and SICBM are actually procured in substantial quantities and perform as advertised, the US would attain for the first time, in the early 1990s, the theoretical ability to destroy most Soviet ICBM silos simultaneously.

Turning the Tables?

Some analysts assert that the current US military buildup, if fully implemented, could turn the tables on Russia in the decade ahead. The Peacekeeper, SICBM, and an expanding force of D5 submarine-launched missiles, they say, may confront the Soviets with a threat to their fixed ICBM force, which represents roughly sixty-five percent of their strategic striking power compared to twenty percent for the US.

Why would the United States desire such a capability—even though the first strike is not an option?

The answer, analysts maintain, has a political, psychological, and military dimension.

In political terms, the US had concluded that it would have to give overriding priority to building a force that could visibly threaten the Kremlin's land-based missiles in the same fashion that Moscow now can threaten US ICBMs.

Without that capability, defense officials fear, this country could be perceived by its adversaries and allies as being inferior in strategic arms.

In this view, 100 Peacekeepers with a total of 1,000 silo-busting warheads, augmented by SICBM and the D5, would go far to close such a "perception gap."

In psychological terms, the very presence of such weapons would help deter any Soviet attack, some backers of the program argued. This view holds that the existence of large numbers of superaccurate arms in the US force would drive home to the Soviet Union the dangers of any nuclear bullying on Moscow's part.

Doomsday Conflict?

Finally, the military argument held that such a capability is required to support the strategy of deterrence and to conduct damage limitation should a doomsday conflict break out.

As defense experts see it, deterrence is strengthened if the Kremlin's leaders are forced to contemplate, in advance of an attack, the fact that the US has the capability to extract a high price indeed from the aggressor.

In the words of former Defense Secretary Harold Brown, the principal goal of US nuclear forces should be "to threaten retaliation against assets that the Soviet leaders appear to prize—their urban-industrial society, their nuclear and conventional military forces, and the hardened shelters that protect their political and military control centers as well as their own lives."

On the second score, Air Force leaders had maintained that the essence of deterrence is to be able to endanger those very military assets the Soviets must have in order to succeed in an attack. This, they say, requires warfighting forces.

The thinking was summarized in this fashion by a SAC officer: "We think that the Soviet attack plan would unfold over a period of time. We're not talking about just a few hours here; we're talking long range—perhaps a week or two. And they would hold back weapons to use later on, after the initial exchange.

"The purpose of the Peacekeeper and other weapons that are hard-target killers is to take out that [strategic] reserve force. . . . The Peacekeeper [would be] targeted at what the Soviets hold most dear."

A More Versatile Force

Apart from major increases in survivability and fighting power, the US strategic program, as it was planned, would be certain to provide a more versatile overall force—one that stands a better chance of coping with Russia's rapidly shifting military posture than do the one-dimensional arms of today.

Cast in a starring role would be Strategic Air Command's long-range bomber force—100 B-1Bs that will be fully operational by the end of this year and, some years later, the planned force of 132 "stealthy" B-2 bombers that is being developed.

As the Air Force sees it, the manned bomber is an essential factor in the struggle to stay abreast of worrisome new Soviet arms moves.

The concerns stem from the growing numbers of what are termed "relocatable targets" (RTs). These are Soviet warfighting assets that could rapidly disperse and relocate, primarily to avoid detection and thus destruction by American long-range missiles.

The intensifying Soviet shift toward mobile ICBMs, for example, has heightened concern over how to deter strategic forces composed of weapons that are now exceedingly hard to find.

Already deployed in substantial numbers is the SS-25, a one-war-

—Photo by Nigel Dickson

"Positive control" governs SAC weapons employment. A member of an ICBM launch crew, such as 1st Lt. John Mitchell of SAC's 341st SMW at Malmstrom AFB, Mont. (pictured above), would have to work in tandem with a partner in order to launch a weapon.

head, reasonably accurate Soviet ICBM mounted on special missile-carrying vehicles. US officials view this launcher as part of the Soviet reserve force that could be held back to threaten American targets in a Soviet second strike.

Soon to become fully operational, say officials, is another mobile Soviet missile, the SS-X-24. This ten-warhead ICBM, believed to be of moderate accuracy, was to be based on railroad cars and shuttled around the Siberian wastes.

These are certain to be only the beginning. Officials expect hundreds of these missiles to be deployed eventually.

In slating the strategic bomber force for this mission, the Pentagon is turning to what is already the most versatile and flexible element of the triad.

This force's ability to launch quickly on warning, combined with its ability to be recalled or redirected after launch, is nowhere found in the rest of the strategic triad.

Now assuming central significance, however, is the bomber's ability to make on-the-spot damage assessments during an attack and to be reconstituted for other missions.

What's more, the aircraft carry a large variety of nuclear arms—ranging from air-launched cruise missiles to short-range attack missiles to gravity bombs—that permit them to pursue even the most widely separated targets.

The Air Force has long had an RT Capability Program that pursues upgrades of sensors and avionics for strategic bombers to help locate and target such RTs.

Air Force officials have high hopes in this regard for the radar-evading B-2 bomber. With its projected capability to dash into the Soviet Union undetected, they say, the B-2 would be able to roam the strongholds of the mobile Soviet missiles and look for targets.

It is just as well that the B-2 has the job. Air Force officers say they would confront severe difficulties in being able to locate and attack relocatable targets with standard ICBMs or SLBMs. Even so, this is getting a large share of attention within the Air Force.

New Strategic Options

Overall, the American strategic arsenal has expanded beyond the traditional elements of the triad. A kind of fourth leg of the force is emerging in the form of cruise missiles deployed on aircraft, surface ships, and submarines. The growing diversity of strategic systems and their increased capability has created new strategic options that never existed before for the United States. This will remain the case even if the force is limited numerically by an arms agreement.

Even the SICBM, though simple in concept, would be a more versatile weapon. Compared to the ten-warhead Peacekeeper, the small launcher would provide great flexibility to US attack planners because using one weapon at a time is easier than planning to use ten at a time.

Unless and until the details of a START agreement are nailed down, there can be no way to determine with certainty the precise outline of the residual US strategic force.

At their recently concluded Washington summit, the President and Soviet leader Mikhail Gorbachev made what appeared to be only modest progress on arms-control matters. The summit outcome left in doubt whether the two next year can achieve the "deep reductions" agreement they both want.

One major impediment to the agreement—Soviet demands that the US Strategic Defense Initiative be tethered in advance—appeared on first analysis to have been sidestepped at the summit. The issue was finessed in a way that permitted both sides to claim victory. This action was the kind of glossing-over operation that both sides needed if they wished to get on with their main objective of a treaty.

Equally important, however, is the question of whether or not the strategic program survives the domestic political process. ■

The US cannot see what the Soviets have up in critical sectors of deep space. Now that the USSR has spacelaunch capability from its mobile ICBMs and is about to begin shuttle flights, the problem is becoming worse.

Our Blind Spots in Space

US Space Command advocates deploying space-based radars, such as this lightweight antenna array designed by Grumman, to spot bombers and cruise missiles.

—Photo courtesy of Grumman Corp.

BY JAMES W. CANAN, SENIOR EDITOR

For US space-watching sentries, the Soviet Space Shuttle soon to be flying has sinister implications. From low-earth orbit, it will be capable of launching satellites into deep space on the sly.

The ground-based US space surveillance and tracking system would be hard pressed to detect such surreptitiously launched satellites or identify their payloads, and this is much on the mind of Air Force Gen. John L. Piotrowski, Commander in Chief of US Space Command and Commander in Chief of North American Aerospace Defense Command.

"There is a critical void," he explains, "in our ability to observe deep space over one part of the world. This gap in coverage will become even more critical when the Soviets begin operating their Shuttle.

"If they fly it in a high inclination—say, sixty or seventy degrees to the equator—we will have no ability to see anything that it launches as it goes over the Antarctic and up over the Indian Ocean. With the right kind of technology, the Soviets could place satellites in geosynchronous orbit that we would never know about. They could fill up deep space with things we never knew existed."

So the US must deploy more and better deep-space sensors on land or in space itself, General Piotrowski claims.

He conveys this message just as space takes on greater meaning as a military realm for both superpowers.

The US Strategic Defense Initiative program for defense against ballistic missiles is oriented to space weaponry and to satellites for surveillance and command control and communications. Now Soviet General Secretary Mikhail Gorbachev has conceded that the Soviets, as the Pentagon had long contended, are working on an SDI-type system of their own.

This makes it increasingly urgent for the US to know at all times what is out there in space and for what purpose.

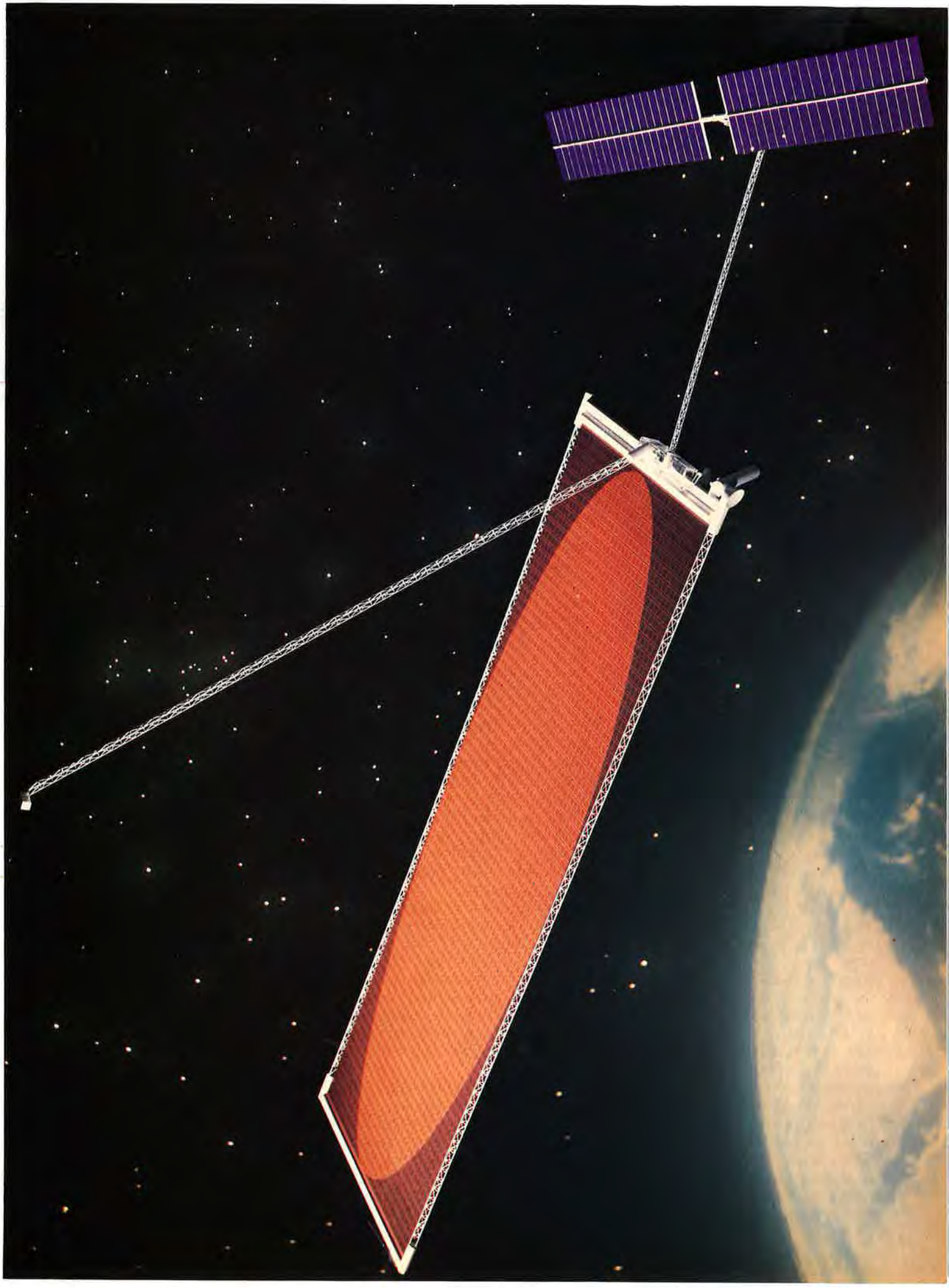
Such knowledge has always been imperative. The USSR, like the US, depends more and more on satellites of all varieties—those for communications, navigation, surveillance, reconnaissance, and early warning—to enable air, sea, and land forces to fight with maximum efficiency and firepower.

Moreover, the Soviet Union, unlike the United States, has had operational antisatellite weapons—in the form of hunter-killer satellites—for many years.

Late last year, as the US and the USSR moved to draw down their nuclear missile forces, it came to light that the threat to the US in space may be even greater than formerly imagined. The Soviet Union is apparently capable of launching satellites—possibly including ASAT satellites—atop its covertly mobile SS-20 and SS-25 ballistic missile boosters.

Caspar W. Weinberger went public with this information before a Washington audience only a few days after having resigned as Secretary of Defense.

The Soviets, he said, "have developed mobile ICBMs with a very clear potential for spacelaunch." Given the Soviets' great emphasis on military space operations and on being able to launch satellites rapidly and profusely, "it would be



foolish," Mr. Weinberger said, "not to assume that they have a covert, mobile spacelaunch capability."

On that same occasion, Air Force Lt. Gen. Leonard H. Perroots, Director of the Defense Intelligence Agency, said that the Soviets could launch a spaceplane, the likes of which they have tested a dozen times in space as a subscale model, aboard their newly operational SL-16 medium-lift rocket booster.

These revelations exacerbate the concerns about US space surveillance capability expressed by General Piotrowski. His concerns extend to looking down from space as well.

In the General's opinion, the US should deploy radars in space to scan the sky below for the increasingly threatening "low flyers"—Soviet Bear and Backfire bombers now in operation and Blackjack bombers in the offing that could attack North America and US warships at sea with long-range cruise missiles.

US Over-the-Horizon Backscatter (OTH-B) radars are expected to be able to catch sight of bombers and cruise missiles out to 1,800 miles. Airborne Warning and Control System (AWACS) aircraft would also do this job, but at much shorter ranges and with questionable capability for collaring relatively small cruise missiles in their radars. The Navy has worked up a multilayered set of surveillance systems and defensive aircraft and missile systems to protect its carrier battle groups.

Help Needed

These systems are worthwhile and necessary, but all need help from space-based radars, General Piotrowski claims, saying: "OTH radar can only tell you that something is out there. We'd still have to fly out a thousand miles to find out what it is and if it's hostile. That's a lot different from having detected it and watched it from space and knowing that it's hostile-by-origin.

"We'd know it was a Bear, for example, because it took off from a Bear base and has Bear characteristics. If the bombers were numerous, we'd know it long before OTH radar picked them up, and we'd have plenty of time to tell the Soviets that we know they're coming and that we'll take action unless they're turned around."

Space-based radars could serve the Navy, which has become extremely wary of air-launched missile attacks against warships, as in the Persian Gulf, in the same long-range fashion and would alert battle groups to movements of enemy ships too.

General Piotrowski's advocacy of space-based radars (SBRs) apparently runs against the tide. It comes at a time when their prospective cost has caused the Air Force to put their development on hold. He insists that those costs would be reasonable and worth paying, however, and he will continue to make the case for the SBRs. He will also press for different ways of doing things in space—all in keeping with his view that US Space Command must fulfill its obligations and exercise its operational prerogatives if it is to come of age as a full-fledged warfighting command.

General Piotrowski took command of US Space Command a year ago, five months after its second anniversary. He praises his predecessor, Air Force Gen. Robert T. Herres, now Vice Chairman of the Joint Chiefs of Staff, for having done "a terrific job" of organizing the command and getting it rolling. This involved meshing Air Force Space Command, now in its fifth year and commanded by Lt. Gen. Donald Kutyna, with Naval Space Command, which includes the Marine Corps and is in its fourth year, and with the Army Space Agency, which was formed in August 1986 and is soon to be renamed Army Space Command.

What US Space Command must now do is "demonstrate our intellectual and operational maturity," its commander says. How? "By coming up with sound requirements for operational systems to do our missions and by arguing convincingly for getting them. Just flailing our arms and banging on tables isn't going to do it."

He believes that making his command fully capable of doing all that it is supposed to do—broadly, operating military satellites, seeing to space surveillance, tending to the early warning system in concert with NORAD, and planning for operational ballistic missile defense—will entail big changes in the structure, readiness, and sustainability of US space forces and resources.

In his mind, such changes come under the heading of "normalizing US military space operations," and this means, for openers, giving US Space Command the same authority over its systems and operations that Strategic Air Command, Tactical Air Command, and all other combat commands in all the services have over theirs.

He is pushing for his command to be put in charge of launching all operational military satellites, an exercise that is now carried out in the main by Air Force Systems Command's Space Division, their developer and producer.

"Space Control"

He also believes that the US must:

- Make much better use of its launchpads at Cape Canaveral, Fla., and at Vandenberg AFB, Calif., in order to be able to launch satellites on shorter notice and, if necessary, in profusion, much as the Soviets have shown that they can do.
- Deploy greater numbers of satellites as on-orbit spares to take over if those in operation fail or are destroyed.
- Build up and maintain "war reserve" stocks of spare satellites on earth.
- Complete the testing and get cracking on the production and deployment of fighter-launched ASAT missiles to protect US satellites against attackers in space and to destroy enemy satellites that abet attacks on US air, land, and sea forces.

All such requirements are germane to US Space Command's ability to do its job of "space control," which its leader defines as "similar to sea control" in "ensuring that hostile forces can't prevent our access to space and our use of space."

"The exercise of space control is US Space Command's warfighting responsibility," General Piotrowski asserts. And so is the command's stewardship of its space systems in support of the other US warfighting commands.

It all begins with surveillance. "Before we can undertake operations in space, we must be able to

see and evaluate all activity in that medium," General Piotrowski declares. And this is precisely why he is in pursuit of new land-based or space-based sensors, to sweep the sky above for Soviet satellites in deep-space sectors not presently fathomable.

To him, though, it is even more urgent that the US deploy radars in space to look down and all around for Soviet bombers bearing cruise missiles bent on savaging the US fleet or such US mainland targets as strategic command control and communications centers.

He has come out strongly for such radars in several forums in recent months, including an Air Force Association symposium last October in Los Angeles, Calif. On that occasion, Air Force Secretary Edward C. Aldridge, Jr., who preceded him at the podium, had bad news.

Taking note of the defense budget drawdown, Secretary Aldridge declared that "the country cannot afford a space-based radar now."

He continued: "I've ridden the space-based radar white horse for five or six years, and I'm probably the strongest advocate [for it] in the Department of Defense. We will continue to study it, because it will have application sometime in the future, when and if we can afford it. But right now, it is delegated to a lower priority. It is not in the cards for another several years."

In an interview following the symposium, General Piotrowski said that he and the Secretary had no quarrel about the operational value of space-based radar. He made it clear, however, that he was approaching the matter from the standpoint of US Space Command's operational requirements and that these could very well necessitate overriding the fiscal constraints that Secretary Aldridge had addressed.

A great deal may depend on analyses of space-based radar now under way. Last July, Space Division awarded contracts of $1 million apiece to General Electric, Grumman, Lockheed, Martin Marietta, and TRW to size up the state of the art in such radars and to determine just what they would be capable of doing and of withstanding while in orbit.

To clinch his case for space-based radars, those studies will have to show, says General Piotrowski, that the radars will be capable of picking out their low-flying targets amid ground-clutter return signals and that they will also be "relatively jam-resistant."

"I think the technologies for doing all that are in hand and can be demonstrated," he asserts. "I also think that the space-based systems would be much more survivable than ground-based [radar] systems. Constellations of space-based radars would do surveillance of air-breathing threats and maritime threats much better than anything else we have now or will have in the foreseeable future."

Protective Panoply

At the same time, land-based radars and AWACS aircraft will always have a place in the protective panoply of surveillance systems, General Piotrowski says, and would be needed to complement and confirm the sightings of the SBRs.

Should the SBRs surmount the fiscal resistance to them, the Air Force would develop and build the satellites, and the Navy would do the same with the terrestrial terminals. In his efforts to persuade the powers-that-be to approve the radars, General Piotrowski is counting on strong support from theater and fleet commanders in chief and on the greater leverage that such CINCs, including himself, have been given in the defense acquisition process.

"I can see all the CINCs favoring space-based radar to give them a clearer picture, a god's-eye view, of the threats," he says. "Over-the-Horizon radar is primarily a North American surveillance system. Space-based radars would serve all the theater and fleet commands. The system would be an AWACS, in effect, everywhere they wanted it to be. In deploying their forces, they would have instant knowledge at all times of what the Soviet air picture was."

What about the price tag? "It would be an expensive program, but not much more expensive, in terms of constant dollars, than the AWACS program. It would cost between $5 billion and $10 billion to put up a constellation of space-based radars that would give us global coverage."

An SBR constellation would comprise as many as nine satellites, or as few as three, in orbits up to 1,000 miles from earth. Ideally, each satellite would be designed to survive attacks from Soviet co-orbital and direct-ascent ASAT satellites by means of shielding and/or maneuvering and from Soviet laser weapons—although this might be much more difficult to achieve.

Soviet land-based lasers at Sary Shagan have been tested and are said to be capable of damaging the structures of satellites up to 300 nautical miles and the power-generating solar panels of satellites up to 1,500 miles.

Soviet lasers can also blind the electro-optical systems of satellites in deep space, including those in geosynchronous orbits where US early warning satellites and communications satellites are stationed.

The possibility that the Soviets may covertly deploy weaponry satellites in space greatly concerns US Space Command. This would daunt its space surveillance network, which is charged with detecting, identifying, and tracking all man-made objects in near-earth orbits and in deep-space orbits—those beyond 15,000 nautical miles. The command relies on this network to keep US satellites from colliding with any of the nearly 6,000 objects now in space, to warn of satellite attacks, and to determine the payloads of "unknown or unfriendly" orbiters.

Spot-Checking in Space

Perhaps contrary to popular belief, the US space surveillance network of ground-based radars and electro-optical sensors does not constantly keep track of all satellites in space. Instead, it spot-checks them, using what is called a "predictive" technique.

The sensors search limited sectors of space to confirm, at any given time, that certain satellites are orbiting through those areas in keeping with computer predictions that they will indeed be doing so. If they are detected, data on their positioning is fed back into a computer, which then updates its mathematical calculations of the satellites' orbital parameters. If they are not detected, which happens, the search pattern is adjusted to try to

catch them the next time around or in some other sector of the sky.

This technique applies in the main to satellites in near-earth orbits—those lower than 3,000 nautical miles—where most Soviet satellites are to be found. These include the Soviet electronic intelligence, photoreconnaissance, and radar ocean reconnaissance satellites (RORSATs) that would be high among the targeting priorities of US ASAT weapons—if they are ever deployed—should war break out. Many Soviet satellites can maneuver, too, which compounds the problem for US space trackers.

US surveillance of low-orbiting satellites is being upgraded mostly by means of computer hardware and software improvements in such sensor systems as the Pave Paws radar at Robins AFB, Ga., and the radar at Kaena Point, Hawaii. The network is being expanded too. For example, a new radar site is in the works for the western Pacific Ocean, where coverage is considered to be critical. Sensors out that way detect Soviet spacelaunches, get a handle on what's aboard and why it's there, and cue other space-tracking sensors elsewhere to keep watch on the payload once it's in space.

Even with upgrading, US surveillance of satellites orbiting relatively close to the planet will still have "significant coverage gaps that could be exploited by a determined adversary," General Piotrowski asserts.

Deep-space surveillance, also deficient, could become downright dismal once the Soviets begin flying their Shuttles on operational, satellite-deployment missions.

They are already depositing more and more of their satellites, most notably those for communications purposes, into geosynchronous orbits. US space trackers have little problem tracking them if they are spotted. Their orbital speeds are the same as the speed of the earth's rotation, and they appear, in consequence, to be stationary in space. But it greatly helps the trackers to know that they are out there in the first place. There are means of "hiding" them from ground-based sensors, should the Soviets decide to build them for such deception. And if they are poised over the eastern hemisphere, such sensors may not pick them out in any event.

"Currently, in order to put anything into geosynchronous orbit, the Soviets throw up the satellite, put it into a parking orbit, and then boost it from there into deep space," General Piotrowski explains. "With our satellite early-warning system, we see that satellite launched. Our surveillance sensors track it. We recognize the activity for what it is."

This would not always be possible, however, in the case of a satellite launched from a Shuttle into geosynchronous orbit over the eastern hemisphere that could, by some means, escape the surveillance of current US systems.

To solve this problem, the US ground-based deep-space surveillance would have to be greatly expanded or a space-based surveillance system would have to be deployed.

It was once believed that a network of five electro-optical sensors positioned equidistantly around the equator would take care of the deep-space surveillance problem. Thus was born the ground-based electro-optical deep-space surveillance system (GEODSS) to detect objects far out in space by spotting their reflections of sunlight.

Four GEODSS sites are operational. The fourth went into action a year ago at Diego Garcia in the Indian Ocean. The fifth is planned for Portugal, but its construction has been deferred for eight years as a result of unresolved negotiations with the government in Lisbon and the rising costs associated with the delay. The protracted Portugal experience is taken by USAF as evidence that expansion of the GEODSS network to more than five sites on foreign territory would be impractical.

Such expansion might not do much good. "Even with the site at Diego Garcia," says General Piotrowski, "there is a critical real-time coverage gap. A number of the Soviet geosynchronous satellites are in this gap, and there are many critical US satellites in the same region."

Sharpening Deep-Space Vision

Some steps have been taken to sharpen US Space Command's deep-space vision. For example, the command now has the part-time use of the National Science Foundation's ultrahigh frequency radar at the Massachusetts Institute of Technology's Lincoln Laboratory and of EO sensors at a military test site at Socorro, N. M.

US Space Command and Air Force Space Division are also looking into developing a land-based deep-space radar that would embody the latest wideband radar technologies best exemplified by MIT's Haystack radar. Other candidates to fulfill Space Command's space-peering requirements are an orbital optical system and the space-based radar being developed for the Strategic Defense Initiative's Space Surveillance and Tracking System to catch Soviet ballistic missiles and reentry vehicles in their midcourse stage of flight.

A champion of the SDI program, General Piotrowski hails it for its potential as a defensive system—one that US Space Command almost surely would have a major or exclusive role in operating—and for its technologies, such as space-based sensors, that dovetail nicely with the command's own requirements for space-control systems in the broader sense.

General Piotrowski finds no fault with space systems now at his disposal. Having been developed by Space Division, they are "very capable, very reliable" systems, and "I'm convinced that the R&D community is putting all the technological capability that this nation can muster into our satellites."

He declares, however: "We've got to step up to some problems. I don't believe we have the space force structure, the combat readiness, and the sustainability that's necessary."

For example: "We've backed away from providing sufficient numbers of on-orbit spares [satellites] and of spares on earth that are ready to be launched—and that can be launched—if we need them. If we put into space a constellation that's important to the National Command Authority, then we should be willing to spend the extra dollars to make sure that we have sufficient spares on orbit so that we won't lose that capability in a conflict. So one of my top goals is to

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improve the readiness and sustainability of space systems."

Launching readiness is a big part of that. The US spacelaunch program is showing vigor again following two years of near-dormancy in the aftermath of the *Challenger* disaster and the failures of a few unmanned launch vehicles, most notably the big Titan 34D boosters that boom fairly heavy military payloads into orbits. Now the Titan 34Ds are back in business with a bang, having carried vital classified payloads into space on two recent occasions.

But only a half-dozen or so Titan 34Ds remain in USAF's inventory, and other needed boosters of variegated thrust and purpose are still in development. Moreover, the Space Shuttles, grounded since *Challenger* went down, are not expected to resume flying until late this year—and then only tentatively in terms of operational missions.

Even when the US spacelaunch program is once again a going concern, it will need work, in General Piotrowski's opinion. Noting that the Soviets have twice as many launchpads as the US and can use them for hurry-up launches, he says that the US must figure out how to make the most of its own launchpads in order to shorten its too-lengthy launch-turnaround intervals and to launch, on demand, whichever satellites its warfighting commanders need, whenever they need them.

He explains: "Once we start to prepare for a launch on a given booster, we move it to the pad and tie up that pad for a considerable time. If we need to change direction and launch a different satellite from the pad, we have to move the first booster off and download the whole system.

"We need to find a better way of doing that. We have to build an infrastructure that supports more rapid launching. Perhaps we have to get away from using the launchpads to stack satellites and test systems out. We would have to do that off the pads so that the pads are available.

"We also have to get away from the scientific approach to launching satellites and go to the SAC or the TAC or the MAC approach—and that is, when the need arises for a satellite, we put our act together and go launch it."

Step in the Right Direction

General Piotrowski makes it clear that giving US Space Command control of the launching of all operational military satellites, as opposed to developmental satellites, would be a big step in the right direction—away from such control by "the R&D community" as represented by Space Division, NASA, and their booster and satellite contractors in attendance. He notes that the operational military community has had considerable experience in launching ballistic-missile boosters and others of filial relationship to space boosters, and he claims that it could handle spacelaunches quite handily.

"I see space boosters like I see C-5s," he says. "They're the means of carrying something to a location—in this case, space. And I see more involvement for US Space Command in the entire process, not as hewers of wood and carriers of water, but as true operators."

The space R&D community should transfer control of space launchers to the space operational community just as the aircraft R&D community does with bombers to SAC, fighters to TAC, and airlifters to MAC, General Piotrowski insists.

Within US Space Command, Air Force Space Command has begun working with Air Force Logistics Command on a program aimed at enhancing the maintainability and sustainability of operational satellites. It is likely that Naval Space Command and Army Space Command will team up with those services' logistics commands to do the same with space systems under their purviews, once the two Air Force commands have established a model for doing so.

The Air Force and Navy components of US Space Command ride herd on their respective satellite systems, such as those for communications and navigation. A major role planned for the Army component of the unified command is the operation of the entire Defense Satellite Communications System (DSCS) network for all the services.

In effect, the Army already does this—but under the control of the Defense Communications Agency. The passage of control from DCA to US Space Command, probably later this year, will mark a milestone in the unified command's coming of age.

Air Force Space Command will continue to be US Space Command's agent for controlling all DSCS II and DSCS III spacecraft from operations centers at Falcon AFS, Colo., and Onizuka AFB, Calif.

Just how the Air Force, the Navy, the Army, and the Marine Corps components of US Space Command will continue to work together and at what is being explored in the "Space Campaign Plan" that the unified command is devising. In the process, it has been working for more than a year with all other US unified and specified warfighting commands to identify the capabilities that they require of space systems.

"It is a pioneering effort," General Piotrowski says. "What is beginning to emerge is a picture of all that a space campaign must encompass to support terrestrial and maritime campaigns."

The plan will be, he says, "an essential element of normalizing military space operations and of integrating space capability into combined-arms warfighting plans, just as the Soviets have done."

In this connection, General Piotrowski comes down hard on what he sees as a glaring deficiency in his command's capability for controlling space—the lack of antisatellite weapons. Without them, he says, "our space forces constitute a critical military system that lacks the means to defend its assets," and the Soviets would be "undeterred" in using their electronic intelligence satellites, radar reconnaissance satellites, and photoreconnaissance satellites "to seriously jeopardize our ability to project and sustain US forces and to fight once engaged."

As he summed it up at the Air Force Association symposium in Los Angeles: "Our space forces are not sustainable except in peacetime. If space were to be contested or if our space forces were disturbed by hostile action, they could easily be lost—even in the best of circumstances—at a rate far greater than the rate at which we could replenish them.

"And with their loss would be the loss of critical support to our terrestrial and maritime forces." ■

SAC's bombing accuracy, crew proficiency, and aircraft reliability were impressive in the Proud Shield competition.

Up to the Test

BY JEFFREY P. RHODES
AERONAUTICS EDITOR

ONE need look no further than Strategic Air Command's latest precision bombing competition to see why SAC's leaders have such high confidence in their warfighting prowess.

In the fiercely waged contest, top honors fell to the 379th Bomb Wing from Wurtsmith AFB, Mich., whose B-52G aircraft and KC-135 tankers repeatedly demonstrated their ability to put ordnance on target and on time.

The significance, however, goes far beyond the achievement of a specific unit. The overall conclusion to be drawn from the 1987 meet is that SAC units, on the whole, are ready and able to perform the daunting military mission that is assigned to them.

That mission entails flying through the teeth of Soviet air defenses to deliver nuclear weapons with pinpoint accuracy almost to the second—and then surviving. Similar demands are placed on crews who will take part in conventional operations.

What emerges from a close look at the details of SAC's thirty-first Bombing and Navigation Competition, spanning October, is that the units appear to be better qualified than ever to meet the test of battle—despite obvious problems stemming from the use of aging aircraft and a relative lack of sophisticated weapons.

Three critical factors support this assessment:

- *Bombing Accuracy.* SAC analysts report that the crews have been steadily sharpening their aim. This year's contestants, on average, scored higher than ever in this vital measure of bomber capability.

This is true of both nuclear and conventional bomb runs. So accurate were some low-level conventional attacks, in fact, that the target building took direct hits.

- *Crew Proficiency.* The evasion of "enemy" air defense weapons and interceptors, the location and identification of small, hard-to-see targets, and the maneuvering of the lumbering B-52s at treetop level all showed the result of intense training and high motivation on the part of flying crews.
- *Aircraft Reliability.* None of the more than 160 competing aircraft suffered major malfunctions or had to abort their missions. All airplanes were available on short notice and ready to fly—a significant achievement in light of the age of the B-52 bombers, KC-135 tankers, and other aircraft.

Up to the Test

These factors, taken together, give SAC officials high confidence that the airborne leg of the nation's strategic triad is up to the test of combat.

"The competition is like SAC saying, 'We are going to war today, and we want to see how you perform,'" asserts Capt. Dan "Dano" Novak, a B-52G aircraft commander. "SAC wants to see how well the wings can fight a war."

The competition saw twenty-four SAC bombing and refueling wings, six Air National Guard and three Air Force Reserve tanker units, and the 27th Tactical Fighter Wing from Cannon AFB, N. M., battle it out for eighteen trophies in fourteen categories *(see accompanying compilation of results)* covering all areas of tanker and bomber operations.

The actual competition broke down into two distinct phases.

- Phase I, October 2–4 for tankers and October 4–7 for bombers, involved a basic skills test for the tankers and testing of capability to perform high-altitude bombing, low-level bombing, and low-level launches of AGM-69 Short-Range Attack Missiles (SRAMs) in support of the Single Integrated Operational Plan (SIOP). Each "base

team" was scored on the basis of how close it came to performing a perfect mission as defined by SAC regulations.

• Phase II took place on October 21 and 23 for selected KC-135 tankers and all KC-10 aircraft. The bombers, meanwhile, took part in this second portion of the competition over October 19–22. In this phase, these aircraft performed low-level conventional bombing runs complete with "attacks" by First Air Force F-15s playing the role of Soviet interceptors.

There was much that was new in the latest competition, renamed "Proud Shield" in 1987.

Overall, this year's event placed a far higher degree of emphasis on creating a realistic atmosphere in which the crews would participate. Simply put, SAC officials believe that their crews and weapons should be measured against the actual standard of wartime operations.

The SAC competition has always been considerably different in style and substance from some of the other command-wide competitions, such as Airlift Rodeo or Gunsmoke. Proud Shield '87, however, was a radical departure even from past Bomb Comps.

—USAF photo by Maj. Ken St. John

Proud Shield '87 was a true measure of the skills all SAC bomber and tanker crews need to have. Here, crew chief SSgt. Tony Berwager and assistant crew chief A1C Mary Jo Spaulding stand in front of their aircraft, the FB-111 from Pease AFB, N. H., that was named the FB-111 "Glossy Eagle" restoration program winner.

Sweeping Changes

The most sweeping changes came in crew selection. Every crew in SAC got a shot to "try out" for the competition during normal training sorties last summer.

However, the four crews from each bomber and tanker unit who actually participated in the meet (having four crews was also a change) were selected by SAC's 1st Combat Evaluation Group (1st CEVG, the unit responsible for scoring the meet) rather than by the units themselves.

Furthermore, the competition crews were not told that they would be participating until five days before the flights began, and most of the crews who flew the sorties were not their units' highest scorers.

"The top-scoring crew from each unit participated in the competition, but the other three were taken from a random percentile in the top fifty percent, and that was held uniform for all units," says Maj. Wayne Dickey, one of the chief judges of the competition. "This gets more crews involved, and it reflects more of SAC capability. There is a larger cross section."

SAC has a key reason for following this procedure. Because the crews were not notified until a week before the show started, the units did not have a chance to develop what amounted to professional competition teams as had some units in the past.

"They took an average crew off the shelf and said, 'See what you can do,'" added Capt. Randy "Rando" Rose, a competition pilot from the 2d BMW at Barksdale AFB, La. "It's pretty much how it would be in real life."

Perhaps the most unusual new wrinkle in the Bomb Comp was that the bomber crews, upon completion of their low-level bombing runs, and even the tanker crews were required to regenerate their own aircraft—possibly a wartime necessity, given the likelihood that support aircraft and facilities would be destroyed.

Flying crews would land at an un-

A new element in the 1987 competition was that the crews had to land at a strange base, regenerate their aircraft without the aid of any ground crew, and then take off again. This crew from the 2d Bomb Wing at Barksdale AFB, La., is moving an auxiliary power unit while at Fairchild AFB, Wash.

—USAF photo by Maj. Ken St. John

Although AGM-86B Air-Launched Cruise Missiles (ALCMs) (as shown here) were not a part of the competition, simulated high-altitude bombing and launchings of Short-Range Attack Missiles (SRAMs) as well as actual low-level conventional bombing were. This ultra-clean B-52G is the "Glossy Eagle" restoration program winner, and it is from the 2d Bomb Wing at Barksdale AFB, La.

familiar base, deplane, check the oil and hydraulics, fuel the aircraft themselves, and depart for their home bases. Normally, this is done by ground crews and is a highly specialized task. Each unit, nonetheless, was scored according to the standard of the specific aircraft's technical orders.

The point of all these measures boils down to this: The crews involved in the competition represent a true cross section of SAC as a whole—rather than "contest" crews—and the activities they were engaged in reflects the demands of wartime—a fact openly acknowledged by SAC's senior commander.

"It is an absolute sampling of what the troops do on a regular basis," says Gen. John T. Chain, SAC's Commander in Chief. "The troops all get an opportunity to go against the same standard. There is a common denominator." *(For General Chain's thoughts on other topics, see the accompanying box.)*

The competition, though more realistic, has not changed in its basic purpose.

Particulars have changed. For instance, low-altitude bombing (1976) and electronic-countermeasures employment (1978) were added to reflect the changing threat conditions the crews must face.

The crux of the matter, though, remains the measurement of just how well B-52, FB-111, and Tactical Air Command F-111 crews can attack a target and how capable KC-135 and KC-10 crews are in getting them there.

In fact, the contest was conceived in 1948 when Gen. George C. Kenney, the first CINCSAC, set out to determine if bombing proficiency was as high as it was at the end of World War II. The crews were given the task of simulating bomb runs on Dayton, Ohio, and legend has it that no one was able to find the city. How times have changed.

Improving Accuracy

Nowhere was the increasing capability of SAC more apparent than in the sharpshooting skills on display in the various bombing runs.

The results of the Bomb Comp demonstrate that the trend toward increasingly pinpoint bombing is continuing. Training, new equipment, and improved procedures and tactics (often given their initial tryouts at Bomb Comp) have brought about a precipitous decline in the targeting error rate for bombers.

That reality is demonstrated in the continuously falling "Circular Error Average," or CEA, which measures the average distance from the actual target that the weapon strikes during any single bombing run.

Once that figure was calculated in terms of thousands of feet. Today, based on the results of the latest competition, the CEA extends less than 300 feet—even for bombs dropped from an altitude of more than four miles.

This kind of accuracy, while extraordinary, is not out of the ordinary—not for today's SAC crews. Indeed, each and every bomber crew that took part in Proud Shield came within this same general range of accuracy.

What accounts for this continuing improvement in a critical measurement of bomber capability?

A prime reason is greatly improved technology for targeting and launching—particularly the improved Offensive Avionics System (OAS) installed in the B-52 fleet.

First deployed in 1982, OAS replaces all the last-generation analog computers and rangefinding radars that limited the accuracy of bomber weapons. Completely digital with greatly reduced numbers of unreliable "black boxes," containing an inertial guidance system, and capable of terrain-contour matching, the OAS represents a quantum leap in bomber technology.

Crews are now able to locate and identify the target with a much clearer image. What's more, OAS provides far sharper information on the ever-shifting distance from aircraft to target and the trajectory that the weapons must take to score a direct hit on the target.

The beneficial impact of this system is spelled out in this fashion by a Proud Shield competitor: "With the

OAS, you're talking [of being able to hit] within twenty or thirty feet [of the target]. Now that every one of the B-52s has this system, the difference between first and last places has shrunk to only feet, rather than hundreds of feet."

Steadily improving bomber accuracies are important if SAC is to be able to meet its wartime requirements. The Soviet Union has been steadily strengthening critical targets so that they can survive attacks from all but the most precise blasts from nuclear weapons.

These "hardened" facilities, such as missile silos and underground command bunkers, are critical targets for SAC. Bomber crews are not likely to get more than one shot at such a target. Thus, a premium is placed on every shot.

The problem is equally critical with respect to bombing by conven-

Chain on the Mission

Gen. John T. Chain, Jr., is SAC's Commander in Chief and Director of the Joint Strategic Target Planning Staff. A command pilot and master parachutist, he served two tours in Vietnam flying A-1s and F-4s and has since held a number of positions in TAC and on the Air Staff. A man given to saying exactly what he thinks, he said some of it to AIR FORCE Magazine during a free moment at the Bombing and Navigation Symposium. The following are his views on several subjects.

• *On SAC's increasing conventional role:* "SAC has been in the conventional business since SAC has been SAC. In the past year and a half, we have tried to expand that capability. Starting last January, we dual-docked our bomber squadrons, meaning all our flying units were tasked to be both conventional and nuclear trained. All our troops have gone through that training and will continue to enhance it [by] working very hard on improving their techniques and procedures.

"What we need is standoff weapons. We don't want to have to overfly a conventional target. We want to be able to get in the general vicinity of the terget and then be able to fire a . . . precision weapon into the target area. Whether that means that we have to be in the next county or two countries over [depends] on the types of targets we're going after.

"Our long-term game plan . . . is to retain all B-52Gs, of which there are 150, and put them into the conventional role only. In the early 1990s, when we have all of our B-1Bs, the B-2 starts coming into the inventory, and with the B-52H, those aircraft will be able to perform the nuclear mission. We are working very hard with OSD [Office of the Secretary of Defense], the Air Staff, end the theater commanders to retain the B-52G, so this country can have an enhanced conventional capability. With the INF [Intermediate-range Nuclear Forces] Treaty, it is going to make it an even higher requirement to improve our conventional capability."

• *On basing bombers in Europe as a result of the INF Treaty:* "I don't envision the bombers being stationed in Europe. I envision the bombers participating in European exercises and exercises in the Far East and exercises anywhere else . . . where we need the conventional force of the bomber.

"[The bombers] can respond quickly, but they'll need to know what bases they are going to, and the bases will have to be prepared to accept them. Munitions will have to be prepositioned, but there is no need to forward-base the bombers in peacetime, because of their long-distance capability."

• *On taking care of SAC's people, especially the pilots:* "We are not taking sufficient care of our pilots. The people on Capitol Hill have allowed flight pay to erode. They have allowed military salaries to erode. That's got to be fixed. Our people don't expect to be rich in the military, but they expect to have [the] standard of living [that] they had been promised when they volunteered to come into the Air Force.

"I'm very disappointed that the citizens . . . who have been elected and charged by the Constitution to raise and support armies, navies, and air forces have not supported our people at the level at which they should be supported, and I think the American people ought to demand that our people [be] taken care of better. That's not just for the Air Force and not just for pilots.

"Seven years ago . . . the new Administration—with the support of Congress—brought the salaries back to parity. Subsequent to that time, flight pay has not changed, so it has eroded in purchasing power. Basic salaries have eroded to where they are about nine percent below parity. That's not right, that's not fair, that's a breach of contract, and it . . . should be fixed now."

• *On SAC's "Wellness" Program:* "I've been very pleased with the positive response. There was a little bit [of resistance to the no-smoking-on-aircraft directive], but not very much. There was a little resistance to no smoking in the headquarters, but there is a designated area called 'outside.' Most of the responses have been from the nonsmokers who have said thank you . . . for cleaning up the building.

"A brigadier general came up to me recently and said, 'Thank you. My father died of emphysema, my mother has emphysema. I was a smoker. When I came into SAC, I recognized you had a program encouraging general officers not to smoke, so I gave it up. I feel better, and I'm going to live a much nicer life than my parents did, but it took an outside stimulus to cause it to happen. I wouldn't have quit on my own.' I think that's a beautiful testimonial.

"The Wellness Program, [which also includes such things as twenty-four-hour, on-base gymnasiums and more nutritious food in cafeterias], helps the mission. The end goal is to improve combat capability. There are two elements in combat capability—weapon systems and people. If we can have a healthy and well command, the troops are going to feel better as individuals, and they are not going to get ill as often. Statistically, that happens to be a fact.

"We are working really hard, not through coercion, but hopefully through positive leadership. We are demonstrating to the other troops . . . a lifestyle that's going to be good for everyone."

• *On media treatment of the B-1B and Peacekeeper ICBM:* "It's been very unfair. But it's only been unfair by a very few reporters, and that's the tragedy of it. It's just been a few loudmouths who either haven't done their homework so they don't understand what they are writing about, or they aren't bright enough to understand what they are writing about, or they are purposely deceiving the American public. I don't know which category some of these people fit in to, but they have to fit into one of those.

"There are some stories, obviously negative stories, about weapon systems that are true, but some reporters have just gone out of their way to tell just plain lies about those two weapon systems, and that is very unfortunate for the American people.

"I think the great majority of people in the media . . . are honest . . . and try to get the truth out. But there has been a disproportionate share of muteness on one side and dishonesty on the vocal side."

• *On the renewed sense of pride SAC people are showing:* "Pride is an intangible item, but it's critically important . . . to a military organization. I think that anything we can do to allow people to increase their pride in what they do and how they do it [is] to our advantage. When I say 'our advantage,' I'm talking about the country.

"We've got wonderful people in Strategic Air Command. They do a terrific job. When we allow them to personalize the types of things they do, that enhances their pride.

"[Nose art on aircraft] is symbolic that that is their aircraft. They take care of it—they maintain it. If that's what they want on it, then I think that's terrific."

Proud Shield '87 Award Winners

AWARD	GIVEN FOR	WINNER AND SCORE (POSSIBLE POINTS OR %)
Gen. James H. Doolittle Trophy	Numbered Air Force whose B-52 units achieve the highest percentage of possible points for low-level bombing, low-level time control, and SRAM launches.	Eighth Air Force—31,335 (62.17% of all total points)
Richard H. Ellis Trophy	Unit whose KC-10 team achieves the most points for all competition activity.	2d BMW, Barksdale AFB, La. 7,991 (8,400)
Brig. Gen. Donald W. Saunders Trophy	Unit whose KC-135 team achieves the most points for all competition activity.	AFRES Team* 4,598 (6,400)
Lt. Jack Mathis Trophy	B-52 or F/FB-111 unit achieving the most points for low-level bombing, including time control.	379th BMW, Wurtsmith AFB, Mich. 3,950 (4,800)
Gen. John D. Ryan B-52 Trophy	B-52 unit achieving the most points for low-level bombing, including time control.	379th BMW, Wurtsmith AFB, Mich. 4,663 (5,600)
Gen. John C. Meyer Memorial Trophy	F/FB-111 unit with the highest damage expectancy.	27th TFW, Cannon AFB, N. M. .7079 (1.0)
Gen. Russell E. Dougherty SRAM Trophy	B-52 or FB-111 unit achieving the most points for Short-Range Attack Missile activities.	5th BMW, Minot AFB, N. D. 1,583 (2,400)
William J. Crumm Linebacker Memorial Trophy	B-52 unit achieving the most points for high-altitude bombing and time control.	379th BMW, Wurtsmith AFB, Mich. 713 (800)
Maj. James F. Bartsch ECM Trophy	B-52 unit achieving the most points for electronic countermeasures employment.	97th BMW, Blytheville AFB, Ark. 3,165 (3,480)
Bruce K. Holloway Trophy	KC-135 unit achieving the most points in celestial navigation.	ANG White Team* 2,967 (4,200)
Gen. Curtis E. LeMay Bombing Trophy	B-52 or F/FB-111 crew achieving the most points in low-level bombing and time control.	Crew R-33, 379th BMW, Wurtsmith AFB, Mich. 1,162 (1,200)
Gen. Bennie L. Davis Most Improved Unit Trophy	Awarded to the unit with the highest percentage of improvement in the Fairchild or Saunders results over the previous year.	509th BMW, Pease AFB, N. H. (from last place in 1986 to second place in 1987)
Best B-52 Crew	Crew achieving the highest percentage points for all activity.	Crew E-41, 5th BMW, Minot AFB, N. D. .7943 (1.0)
Best FB-111 Crew	Crew achieving the highest percentage points for all activity.	Crew R-43, 509th BMW, Pease AFB, N. H. .7384 (1.0)
Best TAC F-111 Crew	Crew achieving the highest percentage points for all activity.	Crew R-01, 27th TFW, Cannon AFB, N. M. .7903 (1.0)
Best KC-10 Crew	Crew achieving the highest percentage points for all activity.	Crew R-016, 2d BMW, Barksdale AFB, La. .9762 (1.0)
Best KC-135 Crew	Crew achieving the highest percentage points for all activity.	Crew R-015, 452d ARW, March AFB, Calif. .8524 (1.0)

*Comprised of several AFRES or ANG units, but competing as one team.

tional means. This would entail use of free-falling gravity bombs, which are at least as difficult to place on a small target as are the more advanced, nuclear-armed attack missiles that would be used in strategic nuclear conflict. And a target would have to take a direct hit for the conventional explosive to achieve maximum destructiveness.

Scoring the Meet

In the competition at hand, scoring individual bomber accuracies amounts to a high-tech operation in itself.

The core of the scoring system in use is the AN/TPQ-43 Seek Score computerized radar and optical tracking system, which in effect does a complex arithmetic calculation to determine where actual attack missiles and bombs would fall under various circumstances.

The system plots when the simulated bomb is released and then factors in weight, speed, trajectory, winds, altitude of the aircraft, and other variables to arrive at a determination of the specific impact point. The distance of this impact point from the target becomes the basis for scoring.

In the future, say experts, accuracies will improve even more. One major reason is the planned introduction of the advanced SRAM II weapon, now scheduled for deployment aboard SAC bombers in the early 1990s.

Not represented in the competition, but also a prime factor in SAC calculations, is the emergence of the cruise missile as a weapon of high accuracy.

Equally encouraging to SAC leaders is the high professionalism, much in evidence in the competition, of the individuals who fly, navigate, supply, and maintain the nation's force of long-range bombers and their associated tanker aircraft.

The people are the heart of bomber and tanker forces. In virtually every operation undertaken during the contest, the flight crews and their ground-support compatriots carried out complex tasks without noticeable glitches or shortcomings.

One example is the Phase I flights for the KC-135 tankers. Crews were given the task of carrying out a demanding, night celestial-navigation

—USAF photo by Maj. Ken St. John

Normally one of the grimiest places on a B-52, this bomb bay may not be clean enough to eat off of, but it's close. This picture graphically shows the amount of work it takes to bring an aircraft up to "Glossy Eagle" standards.

Better Than Brand New

Most of the trophies handed out at the SAC Bombing and Navigation Competition went to the crews who flew the aircraft. However, four new awards were presented to the keepers of those aircraft—the crew chiefs—who painstakingly restored "their" aircraft to a pristine form under SAC's "Glossy Eagle" program.

"We wanted to get the crew chiefs out of the mold of spray-can maintenance," said Lt. Col. Vern Meyers, Chief of the Eighth Air Force Systems Division, on the origins of the program. "This is meant to be restorative type work."

The aircraft were not just cleaned and repainted. They were scrubbed to a gleam. They were cleaned in places that haven't been clean since the aircraft were built fourteen to thirty-plus years ago. Instead of painting over old paint, the crew chiefs and the "Glossy Eagle" work teams at each of the bases stripped to bare metal such things as the interiors of crew access door frames, which were then repainted.

No detail was too small. "We used 000 steel wool to take the scratches out of the Plexiglas on the cockpit instruments," said SSgt. Charles E. Winne, the crew chief of the B-52G based at Barksdale AFB, La., that won an award. The position notches on the throttle quadrant were also touched up on this B-52.

As can be imagined, getting the aircraft restored (and that is the only word that can be used to describe these airplanes) takes an unbelievable amount of hard, dirty work. The "Glossy Eagle" FB-111 from Pease AFB, N. H., took roughly 150 hours to complete, while the much larger EC-135 winner from Ellsworth AFB, S. D., took nearly three weeks to finish.

Several benefits come from this program. Physical appearance is one, but improved maintenance is the main one. "While the aircraft was stripped down, we were able to check things like mounting brackets for corrosion and cracks," said A1C Joey L. Steinbeck, the keeper of the 28th BMW's EC-135. Added TSgt. Peter P. Kabelka, the 509th BMW's "Glossy Eagle" project manager, "It's a lot easier to keep the aircraft this way than to get them like this."

Morale and personal pride are some other reasons crew chiefs and project teams take on such tasks as redoing circuit breaker panel decals. "Crews fight to get on the aircraft that have been done," noted Sergeant Winne. "The pilots feel better about flying these aircraft because they know everything is completely fixed. I'm convinced they fly better."

Added Capt. Mark Ritzloff, the pilot of Ellsworth's EC-135, "Some aircraft look like garbage trucks inside, but being in one of these planes is like a cool breeze in the desert."

The four winning crew chiefs all get a trophy, and each of the aircraft (a KC-135 from the 9th Strategic Reconnaissance Wing at Beale AFB, Calif., was the other winner) gets a small plaque to be mounted on one of their bulkheads. The winning aircraft were displayed at the three-day Bomb Comp Symposium held at Barksdale in late November.

Fairchild Trophy Standings

Unit	Aircraft	Base	Competition Effectiveness
1. 379th BMW	B-52G	Wurtsmith AFB, Mich.	.6434
2. 509th BMW	FB-111A	Pease AFB, N. H.	.6377
3. 92d BMW	B-52H	Fairchild AFB, Wash.	.6117
4. 5th BMW	B-52H	Minot AFB, N. D.	.6016
5. 42d BMW	B-52G	Loring AFB, Me.	.5995
6. 410th BMW	B-52H	K. I. Sawyer AFB, Mich.	.5886
7. 7th BMW	B-52H	Carswell AFB, Tex.	.5862
8. 2d BMW	B-52G	Barksdale AFB, La.	.5783
9. 97th BMW	B-52G	Blytheville AFB, Ark.	.5773
10. 416th BMW	B-52G	Griffiss AFB, N. Y.	.5458
11. 320th BMW	B-52G	Mather AFB, Calif.	.5326
12. 43d BMW	B-52G	Andersen AFB, Guam	.5033
13. 380th BMW	FB-111A	Plattsburgh AFB, N. Y.	.4990

The Gen. Muir S. Fairchild Trophy is awarded to the SAC bomber-tanker wing with the highest competition effectiveness (1.0 being the perfect score), excluding the fighter intercept exercise and high-altitude bombing.

and orbit mission. There was a new twist, though—crews were not permitted to make use of their inertial navigation system (INS) to help them know where their tanker was going. Nor were they allowed to use their programmable calculators or any other computer-generated information—a handicap for airmen who normally rely on such high-technology wares on a routine basis.

The result is that the crews had to make use of the most basic navigational tools—sextant, position of the stars, calculation of winds, and geometry itself—in order to find their way. Most of the crews used an old-fashioned stopwatch to gauge their turns in the orbit.

As Capt. Gary Finchum, SAC Proud Shield Project Officer, stated, "Despite all the handicaps we threw at them, the tanker crews' performance was outstanding. In fact, we had a tanker that was only 2,000 feet off after using only the stars to navigate 850 miles."

"Celestial navigation has always been in Bomb Comp," says Capt. Thomas E. Klipp, the navigator on one of Barksdale's KC-135s. "In normal training, we practice it a little less, but you had to know celestial [navigation] during training. If you didn't need the skills, you wouldn't have had to do it [in the competition]."

The KC-135 crews flew the same profile the following two nights, but rather than just orbiting, the tankers rendezvoused with another competition tanker.

The two-ship cell would then rendezvous with one of the competition bombers, and one of the KC-135s would offload 10,000 pounds of fuel in eight to ten minutes. Both the bomber and tanker were graded on "toggle time," or the amount of time the bomber stayed on the refueling boom without a disconnect.

Without a Hitch

Demands on the crews of the newer KC-10 cargo tankers were equally great—and different in their scope.

These aircraft, deployed in two-ship teams, had to conduct a refueling operation in flight. After that, the lead tanker would land at an unfamiliar air base, and its crew, while unloading the cargo, would also carry out all tasks required to get the airplane flying again. Meanwhile, the refueled tanker, having conducted a precision orbit exercise in a different area, would arrive on the ground to pick up the first aircraft's cargo. Roles were reversed in the second phase of the contest.

Again, these complex operations were carried off with no discernible hitches or unexpected events.

Likewise, SAC officials are well pleased with the performance of bomber aircraft crews as it unfolded in Proud Shield 1987.

Of greatest prominence in the minds of many was the skill with which the bomber crews were able to circumvent, elude, confuse, and thoroughly confound both land-based and airborne "defenders" of the target sites marked for "attack."

The bombers, without exception, were successful in utilizing the masking potential of mountains, valleys, and low-level approach to get to the target. Flying within designated boundaries along an approach corridor, they attempted to evade the "enemy" interceptors.

As Lt. Steve Cunico, a B-52 navigator, pointed out, "All the bombers had to enter [the attack route] at a common point so [that] the fighters would have a chance of finding us."

The learning factor in these exercises does not end when the aircraft land. Also contributing to greater crew proficiency in their missions is a one-of-a-kind classified symposium held at Barksdale in which all participants in the contest hash out the lessons that might be gleaned from the action in the air. Among the most enthusiastic players at this session are the erstwhile "enemy" fighter pilots, who bring a unique perspective to the discussion.

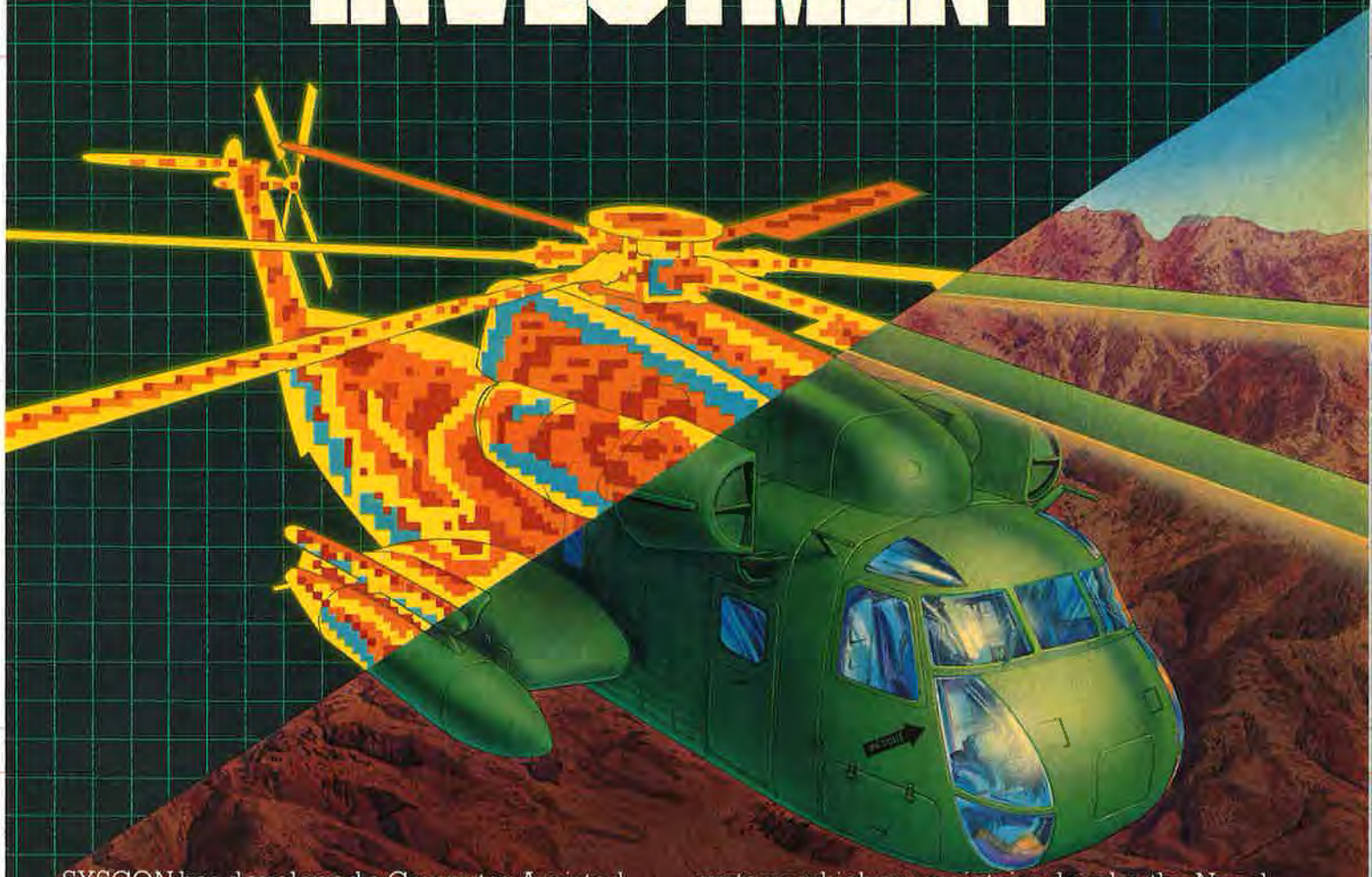
It was not only the people who performed with distinction throughout the competition. The aircraft—most of them with many years of prior service—flew more than 250 sorties without a single major mechanical failure that forced withdrawal from the contest.

Making this accomplishment even more striking was the fact the units did not have the opportunity to select their best-maintained aircraft and prepare them for the competition. The aircraft actually used in the meet were assigned at random by the logistics branch at Hq. SAC a mere six days before the flights began.

Thus, even though maintenance was not specifically graded in the competition, all of the jets had to be ready to fly at a moment's notice—this being yet another indication of the more realistic format of the Proud Shield event this time around.

Proud Shield '88 will present an even more formidable demonstration of the real-world capabilities of SAC's bomber and tanker force, given the planned debut of the B-1B in the forthcoming contest. Still, SAC officials have no complaints about the one just concluded. Says General Chain, "We will be a stronger command because of this exercise." ■

CAMMS/TOUCHTIME PROTECTS AIRCRAFT INVESTMENT



SYSCON has developed a Computer Assisted Maintenance Management System (CAMMS)™. This system is currently being used by Dynalectron to maintain T2 aircraft for the U.S. Navy.

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The Soviets have three times as many warheads as we have silos. They also have a monopoly on mobile missiles. We must put some of our ICBMs on roads and rails to make them moving targets.

The Case for Mobile ICBMs

BY BARRY R. SCHNEIDER

THE YEAR 1988 shapes up as a fateful time for the nation's plan to modernize its land-based missile force. Major decisions now are pending on two key elements—the deployment of multiwarhead Peacekeeper ICBMs on rail cars and the development of single-warhead "Midgetman" missiles aboard transporter vehicles. Both are controversial. Missile mobility appears to enjoy overall support. But tight defense budgets, arms-control considerations, strategic arguments, and politics raise concerns that the two-missile scheme could unravel.

ICBMs are at the heart of US deterrence strategy. They perform the prompt, hard-target retaliatory role that no other US strategic forces are capable of performing. For several years now, the US plan for ICBMs has pointed increasingly toward mobile systems, specifically the Peacekeeper (MX) deployed in a rail-mobile mode and the Small ICBM (also called Midgetman) carried on hardened mobile launchers.

Mobility would improve the prelaunch survivability of the US triad force in general and the ICBM force in particular in the face of the Soviet fourth- and fifth-generation missile threat. The combination of Peacekeeper missiles deployed on trains and Small ICBMs deployed on rugged wheeled vehicles capable of on-road and off-road mobility would enhance the overall survivability and effectiveness of each force and of US ICBMs overall.

Mobile ICBMs are difficult to track, target, and destroy. Mobiles, once dispersed, are more likely to survive a Soviet first-strike attack than are such fixed targets as silo-based ICBMs. Even superhard silos, twenty-five times more blast-resistant than present US ICBM silos, could not protect US ICBMs if Soviet missile accuracy continues to improve to current US accuracy levels. Mobile US ICBMs can be an effective means of ensuring that the Soviet Union could not shift the balance of military power decisively against us in the first hour of a conflict.

At present, the Soviet Union has three times as many SS-18 warheads as the United States has ICBM silos. Fratricide effects might limit the Soviet forces to two-on-one targeting, but even so, the currently deployed SS-18 Mod 4 force theoretically has the capability to destroy sixty-five percent to eighty percent of the US ICBM silos in an attack.

US mobile missiles would trump the Soviet ace by confronting them with moving targets traveling in unpredictable directions over a very large area. Even if the Soviet force had real-time intelligence of the locations of the US mobile missile force at the time of the launch of their own ICBMs, they would have no guarantee that the

The Air Force proposes to deploy the second fifty MX Peacekeepers in a "rail-garrison" mode. In time of crisis, this system could disperse by railroad. The original plan had been for a combination of rail-mobile Peacekeepers and road-mobile Small ICBMs, but budget reductions now make the future composition of the US missile fleet uncertain.

US mobiles would be at the point of impact thirty to forty minutes later.

Closing the Window of Vulnerability

US mobile missiles would help close the US ICBM "window of vulnerability," which has been of such concern to US officials, by neutralizing much of the strength of the Soviet ICBM force. US rail-garrison Peacekeepers and mobile Small ICBMs would alleviate the "use or lose" dilemma faced by US decision-makers now reliant on fixed silo-based ICBMs. Soviet warplanners faced with US mobiles would confront the daunting prospect of expending as many as nineteen warheads to knock out just one Small ICBM warhead.

Analysis done by Rep. Les Aspin (D-Wis.), the Chairman of the House Armed Services Committee, and his staff indicates that "to destroy ninety percent of a 500-Midgetman deployment (the damage level that it is believed the Soviets seek) would require 112 SS-18s if Midgetman were dispersed more than 4,000 square miles (a likely peacetime dispersal on government lands) or 787 SS-18s if Midgetman were dispersed more than 28,000 square miles (a likely dispersal with warning of an attack)." The Soviet inventory does not contain that many SS-18s (the current estimate is 308). Clearly, Soviet employment of their ICBMs in this manner would

force them to leave scores of other critical US targets untouched.

Peacekeeper ICBMs mounted on railway cars can also disperse beyond the limits of the Soviet ICBM threat if given any kind of warning time. Within three hours after dispersal has begun, the attack price to the USSR for destroying the Peacekeeper rail-mobile force would exceed the entire projected SS-18 warhead inventory. Trying to target US mobile ICBM forces as they dispersed—along with other triad elements and fixed US targets—would be a targeting nightmare for Soviet warplanners. Nor is a bolt-from-the-blue scenario considered likely. A Soviet first strike from ungenerated forces would not be capable of disarming US forces. Moreover, the process of generating their forces would give strategic warning to the US and time to disperse US forces.

Deployment of mobiles by the United States should sharply alter, in favor of the United States, the likely exchange rate of a Soviet attack. Soviet awareness of that fact should improve stability and US security in future crises and confrontations. Soviet decision-makers would be unlikely to enter a conflict in which they perceived at the outset that their forces would be depleted and exhausted before those of the United States. That would be a path to their own ruin and defeat.

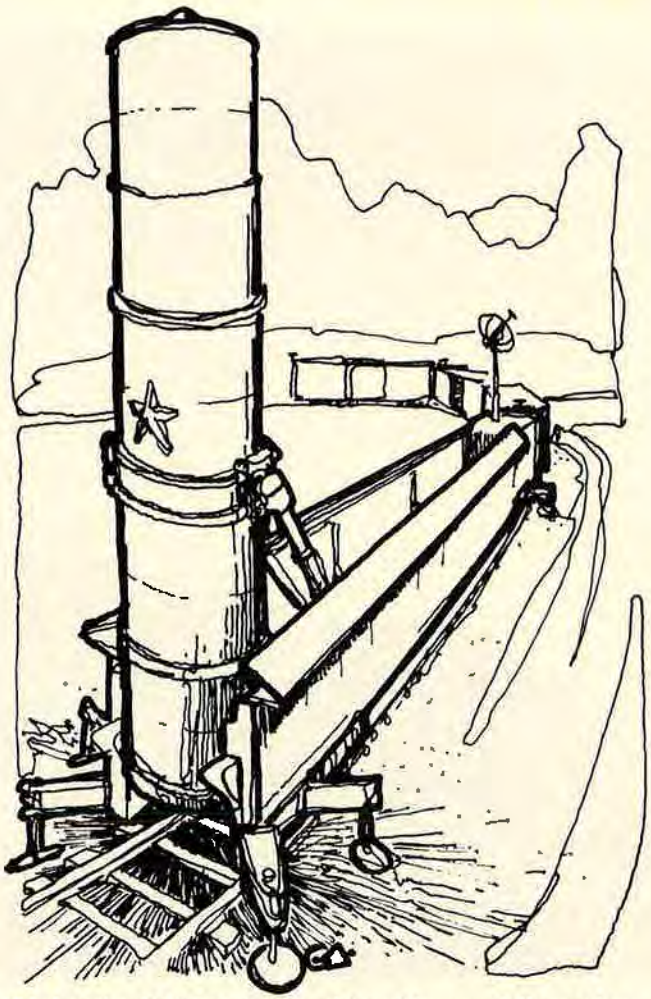
The Soviet Move to Mobiles

Clearly, the Soviet leadership has seen the value of mobile ICBMs. The USSR has tested the SS-X-24 ICBM, a ten-warhead, rail-mobile missile that will be deployed along the Soviet rail network. In August 1987, Viktor Karpov, head of the Disarmament Agency of the Foreign Ministry of the USSR, announced that the first SS-X-24s had been deployed, a claim initially confirmed by the White House but later disputed by the Defense Department and US intelligence agencies, which, nevertheless, had been predicting such a deployment for the past three years. All US sources agree that such SS-X-24 deployments are imminent if they have not yet happened. Since 1986, the USSR has deployed another mobile ICBM, the SS-25, a smaller, one-warhead ICBM that is about the size of a US Minuteman missile and can be mounted on a truck-launcher. Later models of the SS-25 could be developed in a three-warhead MIRVed version.

It is highly likely that the Soviet interest in mobility is a response to growing US counterforce capabilities and the corresponding vulnerability of their own silo-based intercontinental ballistic missile forces. Soviet leaders obviously believe that mobile land-based missiles enhance their prelaunch survivability.

This has led some to conclude that the world will be a safer place once both sides have secure second-strike ICBM forces since neither side would need to adopt a launch-on-warning, hair-trigger posture in an acute crisis. Soviet trigger fingers may be much less itchy when their own premier strategic force is mobile, hence survivable, against surprise attack.

Deployment of Soviet mobiles should not necessarily make US decision-makers sleep easier at night. If the Soviet Union keeps its large, silo-based ICBM force intact while adding mobile missiles as well, then they would possess both a missile force that can be used effectively in a first salvo (their silo-based SS-11s, SS-13s, SS-17s, SS-18s, and SS-19s) as well as a secure reserve force (their mobile SS-X-24s and SS-25s) useful for later stages of a conflict. It is for this reason that US arms-control negotiators must seek to limit the Soviet silo-based ICBM inventory as more Soviet mobile missiles are deployed. Their overall force structure affects strategic and crisis stability in a more fundamental way than any one component of it.



This looming SS-X-24 missile and its rail transportation system have been tested and will be deployed along the existing Soviet rail network in a program that may have already begun. The smaller Soviet SS-25 missile is operational on trucks.

Given the very heavy Soviet investments in the SS-X-24s and SS-25s, it was always unlikely that they would agree at the Strategic Arms Reduction Talks (START) to ban mobile ICBMs even if the United States began to build its own mobile force. Nor was it in the US interest to ban mobiles.

If the United States and Soviet governments were to reach a deep-cuts START agreement along the lines of what was discussed at the Reykjavik summit and at the Geneva negotiations, then the United States would need to field its most survivable, highest quality deterrent. Older systems should be scrapped first, as should systems that are incompatible with the countervailing strategy of deterrence. Forces that do not have good prospects for prelaunch survivability would need to give way to make room for those that do. Deployment of far fewer warheads and launchers would require that the remain-

ing retaliatory capability be the most effective that the United States can field.

Mobile ICBMs also are likely to be valuable tools for crisis signaling and warning. During a tense period of US-Soviet confrontation characterized by great danger, significant opportunity, surprise, and a short time for decision, the dispersal of mobile US missiles could send a "don't tread on me" signal to the enemy while simultaneously making the US ICBM retaliatory capability more secure. If war broke out, the greater survivability of US mobile ICBMs could make that force available for intrawar deterrence, for midconflict use, or for war termination leverage. Mobile ICBMs that can disappear from enemy view or reach, together with bombers and SLBM forces, could form part of the US strategic reserve force.

The Logic of Two Mobile Missiles

The US deployment of two types of mobile ICBMs makes good strategic sense, as the Soviet leaders themselves have decided with their rail-based SS-25s and road-mobile SS-X-24s. Enemy warplanners considering a surprise attack could not be certain whether or not the train-based Peacekeepers would be launched while in garrison when given confirmed warning of an attack-in-progress. The Small ICBM can also be based on a hardened mobile launcher (HML) capable of on-road and off-road travel. Small ICBMs on military reservations will be dispersed at all times, and the entire force would be able to spread very wide and far with only tactical warning of the impending attack.

The first fifty Peacekeeper ICBMs and their 500 warheads are now being deployed in silos at F. E. Warren AFB in Wyoming. Fifty more mobile Peacekeeper ICBMs, combined with 500 mobile Small ICBMs, would contribute another 1,000 warheads that could hold at prompt risk a total of 1,500 high-value, time-urgent, time-sensitive targets in the Soviet Union.

The combination of the two types of US mobile ICBMs would create a synergism resulting in enhanced survivability for each force when faced with an attack. Each mobile force would increase the problems facing a Soviet warplanner contemplating an attack on the United States and its strategic forces. Therefore, the Soviets would be forced into treating mobile ICBMs as relocatable targets requiring multiple warheads for multiple aimpoints. Each of the two US mobile ICBM forces, if deployed, would stretch and deplete the Soviet warhead inventory. Together, they would add considerable uncertainty to the thinking of Soviet warplanners as to the outcome of a simultaneous strike against them both. Soviet warheads assigned to cover the rail-garrison Peacekeeper force could not be used to target the mobile Small ICBM force, and vice versa.

The single-warhead Small ICBM would offer US military planners considerable targeting flexibility. A missile with multiple warheads must be painstakingly matched against a collection of targets equal in number and value to the warheads carried by that missile. Moreover, a MIRVed missile can only attack targets located within a certain geographic area, an area determined by the "footprint" of the missile.

A single-warhead ICBM, in contrast, could be fired against a target located virtually anywhere in enemy territory. Only one target would need to be allocated to each Small ICBM. This means isolated and widely dispersed targets could be assigned to the Small ICBM force. In addition, the single-warhead payload of the Small ICBM, combined with its high accuracy, makes it a useful weapon for selective strikes at the outset of any conflict begun by the adversary. During conflict, the highly survivable HML-mounted Small ICBMs could be readily reassigned to targets that escaped initial US retaliatory attacks or to newly discovered targets.

SLBMs vs. Mobile ICBMs

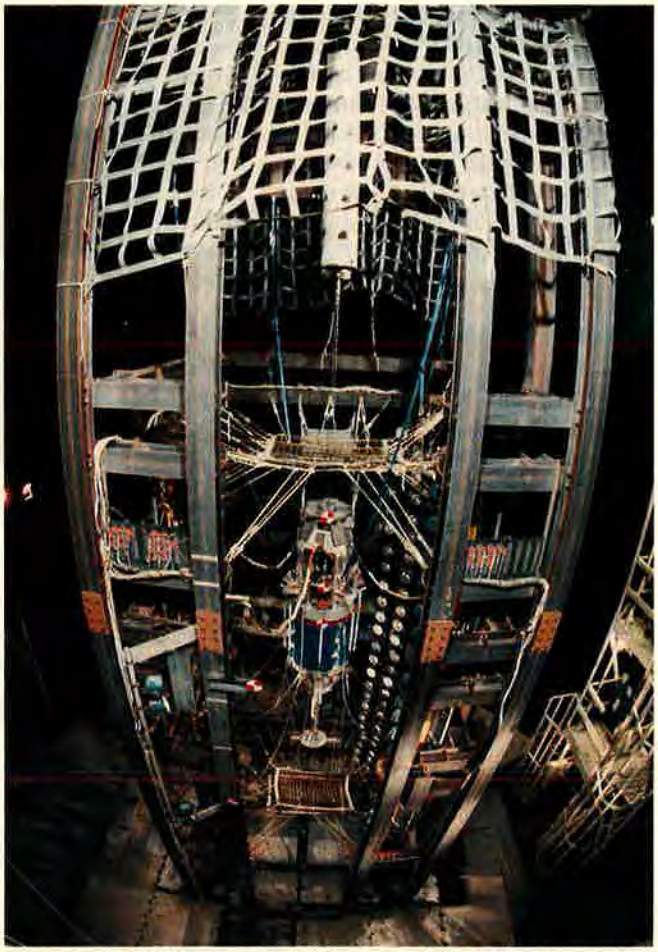
Some participants in the US strategic debate have suggested that the United States already has a survivable mobile ballistic missile in the works, the Trident II (D5) submarine-launched ballistic missile. Therefore, they argue, there is no need to deploy the Peacekeeper ICBMs on trains or Small ICBMs on hardened mobile launchers. They believe the D5 SLBM, when it is deployed, will be able to handle the entire deterrence and military missions currently assigned to ICBMs.

Unfortunately, life is not that simple. The D5 will not be capable of performing all the functions assigned to our ICBMs. The ICBM is the only US weapon capable of performing the *prompt* retaliatory role against Soviet high-value, hardened, and time-urgent or time-sensitive targets in the event of war. Only the ICBM force is capable of disorganiziug a Soviet missile attack-in-progress and of preventing a massive shift in the military balance of power in favor of the Soviet Union in the first minutes of a nuclear exchange. This is important because Soviet military doctrine states that victory is possible only when such a shift in the correlation of forces takes place at the inception of conflict. US bombers and SLBM forces are too slow to interrupt the adversary's attack-in-progress.

Today, US ICBMs alone have the needed combination of assured penetration to target, great accuracy, speed of delivery, force-wide alert status, rapid retargeting, and reliable and speedy command control and communications between the US leadership and the retaliatory forces. US submarine forces have their own advantages, but, today, their overall force reaction time may be too slow and their communications with the US National Command Authority are too uncertain to provide a high-confidence prompt-retaliation deterrent force.

Furthermore, even if command and control at sea were as fast and secure as that for ICBMs, the D5 SLBM will still lack some of the accuracy and hard-target capability being designed into the Peacekeeper and Midgetman ICBMs. Using D5 warheads to attack the hardest targets would lead to an inefficient allocation of the total US warhead inventory and would pose a less credible deterrent threat.

Nor is cost an argument for opting for SLBM or bomber weapons over ICBMs. If costs were computed on a realistic US capability to put a given type of nuclear warhead on an adversary target in a window of time and in the midst of a conflict started by the other side, then the projected cost per delivered warhead on destroyed targets for the Peacekeeper and Midgetman ICBMs is in the same general range as the projected cost per delivered warhead for those deployed by bombers or by SLBMs. Warheads on future mobile ICBMs will be just



This session of Congress will see a controversy over Midgetman (a half-scale model of which is seen here in simulation testing). Deep budget cuts have made the Small ICBM a candidate for cancellation.

as cheap because of their very high alert rates, high survivability and penetration capability, and their extreme accuracy when compared to the projected cost and performance of future bombers or SLBMs in these categories.

The 500/Fifty Mix

The pursuit of a single-RV ICBM is important to US interests. This is dictated by strategic logic and by the political need to maintain a bipartisan congressional consensus in support of US strategic goals and modernization programs.

In time of completely unconstrained defense budgets and in the absence of any new START agreement, the United States might wish to deploy 1,000 additional Small ICBMs and forgo the deployment of additional MIRVed ICBMs. There is obviously some benefit to be gained from dispersing US warheads in such a fashion that a single Soviet warhead can destroy no more than one US warhead in an attack. Preferably, many enemy warheads would be needed to cancel a single US warhead.

A very large Small ICBM force, however, makes no fiscal or arms-control sense from the US perspective. The Midgetman force would be too expensive for full deployment of 1,000 missiles, and 1,000 additional Small ICBM launchers would run in the opposite direction from our stated START goal of deep cuts in numbers of launchers.

For these reasons, it will also be necessary to deploy additional Peacekeeper ICBMs on a mobile launch platform rather than deploy an excess of Small ICBMs in order to give the United States the number of survivable yet accurate and prompt warheads it needs to deter the Soviet Union effectively while staying within economic and START constraints.

Most analysts believe it would be a mistake to put large numbers of additional warheads on ICBMs based in silos. Those warheads need to be placed on mobile platforms in order to frustrate any Soviet first-strike planning or execution. If the United States and the Soviet Union were to agree to a deep-cut START Treaty limiting each side to 1,600 launchers and 6,000 warheads, it would be unwise in the extreme to place most of those warheads on the Small ICBMs because the Small ICBM program would crowd out most of the rest of the US strategic triad. For example, a thousand Small ICBMs, combined with the fifty Peacekeeper ICBMs deployed in silos, would leave precious little room for either the strategic bomber component of the triad or for the fleet ballistic missile force.

The cost per warhead of the Midgetman program compared to the rail-garrison Peacekeeper also argues that the United States government ought to deploy a more cost-effective mix of Peacekeepers and Small ICBMs rather than opting solely for a Midgetman force. In an era of massive federal deficits, the United States ought to purchase the most efficient mix of ICBMs that can still do the deterrent job, perhaps something like a mix of 500 Small ICBMs on HMLs and fifty additional Peacekeepers on trains. This combination would fit more reasonably with any future START limits on launchers and warheads, would permit the deployment of a balanced US deterrent triad, and would be more affordable while still being able to threaten the Soviet target set in such an effective and timely way that it will maximize US war deterrence.

Such a mixed program of rail-mobile Peacekeepers and road-mobile Small ICBMs also makes more political sense than proposed alternatives, such as relying exclusively on Trident II D5s for counterforce capability. If any bipartisan consensus exists in the country and on Capitol Hill in support of US strategic policy, it includes support for both the Peacekeeper and the Small ICBM programs in the context of a strategic arms-control agreement reducing arms. This was the consensus reached by the President's Commission on Strategic Forces chaired by Lt. Gen. Brent Scowcroft, USAF (Ret.), and it remains the force mix and strategic modernization package that probably stands the best chance of meeting the tests of military utility and economic viability needed to carry out US strategic policy in a coherent manner. ■

Barry R. Schneider is a Senior Defense Analyst with National Security Research, Inc., in Fairfax, Va. He speaks and writes frequently on US defense and arms-control policy issues. He has taught at six universities, served both in the executive branch and on Capitol Hill, and has worked on national security issues for several Washington, D. C., think tanks.

Viewpoint

The Imbalance in Control

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

The USSR runs the Warsaw Pact and puts up with little back talk. NATO is democratic, almost to a fault. This makes quick, coordinated military response very difficult.

Peter the Great was no Communist, but then neither are the masters of present-day Russia Communists in the utopian sense. Like Peter, they rule forcibly a society composed of distinct classes. Only the names have changed; instead of the nobility of Peter's day, we have the *Nomenklatura;* serfs have disappeared in favor of workers. Anti-Semitism remains a constant, as does the Russian penchant for harsh punishment.

Most important for us is the fact that Moscow's basic aims have not changed. Insecurity has always played a part in Soviet foreign policy, or, more accurately, in Soviet policy toward foreigners. So has duplicity. Expansionism—putting a bit of room between the homeland and possibly hostile neighbors—is an ancient Russian antidote for insecurity.

In the early eighteenth century, there were internal problems to be solved before Peter the Great could undertake any foreign adventures. Accordingly, he disarmed Sweden's suspicions with that era's version of glasnost. The Swedes were captivated, ambassadors were exchanged, and Scandinavia relaxed. Soon after, without warning, Peter's army invaded Sweden.

This is not to say that the December summit was, like Peter's confidence game with the Swedes, simply a prelude to duplicity. Nevertheless, we would be very foolish to drop our guard, for Soviet long-range goals surely have not altered.

One of these goals has been on the books for decades: to pry Europe loose from its dependence on American protection. From the Soviet standpoint, the INF treaty is a step in that direction, or, at least, it can be if the NATO membership is content with its present-day *status quo.*

NATO, from the beginning, has been more of an imposing facade than a serious military coalition—grand headquarters with lots of flags, an impressive protocol. But the troops all march to their own national drumbeat. The Supreme Allied Commander Europe is invariably an American officer because of NATO's reliance on US strategic weaponry as the ultimate deterrent to Soviet adventurism. Remember, the Pershing IIs and GLCMs were introduced to counter a growing European suspicion that the US might be losing its will to use ICBMs in support of NATO.

Now, the INF will come out, assuming Senate ratification of the treaty. In fact, the INF will almost surely come out, ratification or no. So much emotional capital has been expended on the removal of the missiles that it is difficult to see how they could remain in Europe, especially if the Soviets remove their INF. Nonratification would, in that case, be an empty and divisive gesture.

Suddenly, the focus is on the imbalance of conventional forces. Nowadays, even the most uninformed are prattling about NATO's disadvantage.

In one of my Lucky Pierre moments, I was appointed chairman of the NATO Working Group on Mutual and Balanced Force Reduction. That was seventeen years ago, at the beginning of the seemingly endless rounds of discussions that have taken place in Vienna ever since. Maybe if these talks had been held in, say, Greenland or in northern Norway during the winter, they might have come to some conclusion. In Vienna, however, they have become a pleasant, if stultifying, way of life.

The game is fixed. Soviet troops withdrawn under an MBFR agreement would have a short ride back to Central Europe, while US troops would have to recross the Atlantic, assuming that they had not been demobilized long since.

One of these days, out of sheer frustration, the two sides might strike some sort of balanced-force agreement, but it will have little meaning in military terms. The real imbalance lies in the command and control machinery, the ability to mobilize into a cohesive force. The USSR runs the Warsaw Pact, and although the Soviets may have a few doubts about the reliability of their satellite forces, there is certainly no doubt about who gives the orders.

NATO, on the other hand, is democratic almost to a fault. Everyone has an equal voice, and unanimity is the rule for decisions. In the almost thirty-nine years since the North Atlantic Treaty was signed, NATO has never had to come to grips with the real-world problems of mobilization. It is a tribute to the soundness of the Alliance that it has accomplished its basic goal without going through the crisis of mobilization, but it is also NATO's principal weakness.

Although admittedly inferior in numbers to those of the Warsaw Pact, allied forces are of a generally high quality. The problem lies in getting them together in time and aimed in the right direction. A quiet simplification of NATO's alert procedures, with more peacetime authority granted to the Supreme Commanders, would be a positive substitute for the vanished INF. Or it may be that an even more thorough overhaul is in order.

When Charles de Gaulle booted NATO out of France, he very nearly withdrew entirely from the Alliance. He was persuaded to retain France's political membership while abstaining from the military organization, an arrangement that persists to this day.

A principal rationale behind the French aloofness was de Gaulle's assertion that the US would never risk its own nuclear destruction to defend Europe. That doubt will now be reinforced with the INF withdrawal. Clearly, some new initiative is needed to shore up NATO's flagging morale.

The very nature of the contented bureaucracy in Brussels, however, ensures that any such initiative will not originate there. ■

It had been almost forty years since a US combat aircraft flew over in peace and landed on Chinese soil.

Thunderbirds

Same show, very different location. Last September 24, the People's Republic of China became the fiftieth country in which the Thunderbirds have performed in the team's nearly thirty-five-year history. Here, one of the team's F-16s sits at the ready while a large number of Chinese military officials looks on prior to the start of the show.

THE six F-16s in the red, white, and blue show paint of the US Air Force Thunderbirds moved into position at Nanyuan Airfield, just outside of Beijing. Wang Hai, commander of the People's Liberation Army Air Force, stepped to the side of the lead aircraft and affixed to it a Chinese flag decal that joined the flags of forty-nine other nations where the Thunderbirds have performed.

The capacity crowd that filled the seats and lined the taxiways listened as the opening command crackled over the loudspeakers: "Thunderbirds—check in!" To great approval, the aerial demonstration team counted off in Chinese: *"E! Er! San! Sz! Wu! Liu!"*

From the lead fighter, Lt. Col. Roger Riggs called out a salute, *"Gan Bay"* ("Cheers to all"), and then they were rolling. With a stiff wind on their noses, the Thunderbirds lifted off, formed into their familiar diamond, and began the show with a maximum performance climbout.

None of the 25,000 spectators was more enthralled than Edward C. Aldridge, Jr., Secretary of the Air Force, who says he is the Thunderbirds' "number-one fan." He had pressed energetically for approval for the Thunderbirds to appear in Beijing. Finally, he secured an okay for the show, which was timed to coincide with his visit to the People's Republic of China last fall.

Even the weather cooperated.

Air Force Secretary Edward C. Aldridge, Jr., left, and the commander of the People's Liberation Army Air Force, Wang Hai, look on as the Thunderbird F-16s are put through their paces. Many high-ranking officials from the Chinese government and military were also on hand for the show.

Over Beijing

The previous day had been thick with clouds and haze, and it had rained heavily overnight. Show day, however, brought bright sunshine, cool temperatures, and clear, breezy skies—perfect for a Thunderbirds "high show."

Overhead, the Thunderbirds executed their maneuvers with precision and snap: diamond rolls, loops, opposite passes, high-G turns, surprising tactical dashes, and delta formation flybys. A Chinese newspaper later described the popular bomb-burst maneuver as "a blossoming flower in the sky."

Putting the F-16s through their paces were Capt. Dave Robinson, Capt. Joe Bulmer, Capt. Lance Undhjem, Capt. Tom Weiler, and Capt. K. C. Schow, with Colonel Riggs leading in Thunderbird One.

ABOVE: SSgt. Larry Chandler offers assistance to Chinese officials who were documenting the arrival of the Thunderbird team in Beijing. According to the Chinese, the Thunderbird visit marked the first time that a foreign air force had given a flight demonstration in China. LEFT: The Thunderbird team, in a six-ship delta formation, executes a vertical climb at show center. The weather for the show at Nanyuan Airfield just south of Beijing was bright, cool, and clear.

It had been almost forty years since an American combat aircraft last flew over in peace and landed on Chinese soil. According to the *Liberation Army Daily,* it was also the first time that a foreign air force had given a flight demonstration in China.

"Breathtaking! Wonderful!" the *Liberation Army Daily* said of the event. Secretary Aldridge had his own summation.

As the Thunderbirds taxied in after their performance, the powerful music of "America the Beautiful" filled the air. Secretary Aldridge strode out to greet the pilots and told them, "You guys make me proud to be an American!" ■

Everybody knows that defense business is lucrative, that fraud and waste are rampant, and that contractors are cozy with the Pentagon, right? Read on.

Fallacies and Facts About Aerospace

BY F. CLIFTON BERRY, JR.

WHEN the going gets tough, the tough return to fundamentals. That's the case with the US aerospace industry today. To prevail in the current and expected turbulence, companies are analyzing the situation, separating fallacies from facts, and setting course for survival. Companies that don't concentrate on such fundamentals will be increasingly vulnerable to failure.

Sorting out the facts and fallacies is essential not only for companies in the aerospace industry. Their customers—the defense establishment and the men and women of the armed services—need that understanding. So do those with mighty influence over the activities of the aerospace industry—Congress and the international financial community.

What fallacies need debunking, and what facts require concentration? One is often the obverse of the other. Let us consider a few current fallacies and determine the facts on the other side of the coin. With that done, we can look ahead to factors that are buffeting the aerospace industry now and that will for the next several years.

Fallacies Abound

Fallacy: The defense business is more profitable than other commercial business; defense profits are "huge" by comparison. The facts are different. In a 1985 study called DFAIR, the Department of Defense concluded that defense contractor profits were generally comparable to those for commercial firms. (DFAIR stands for Defense Financial and Investment Review.) However, later studies by the General Accounting Office and the Navy differed, claiming defense industry profits were higher than the norm.

Which study was right? DFAIR, said the Financial Executives Institute (FEI). It is a professional organization of senior financial officers in more than 6,000 companies. The FEI evaluated all three profit studies and concluded that the DFAIR

product was a sound piece of work. It said both the GAO and Navy studies had fundamental flaws.

However, looking at DoD acquisition policy changes, the FEI said, "The basic business equation is out of balance." It says that recent policy shifts have thrown the business equation out of whack by "significantly increasing the contractor's risk while eroding the potential return." Furthermore, the recent policy changes "threaten to disrupt the [former] business environment, which supported investment, promoted cost efficiencies, and encouraged competition."

Both government and industry will be harmed by the consequences, the financial institute concluded. Major adverse effects include curtailing investment in new facilities and efficient production capabilities, shifting cash flow downstream by several years, eroding the US competitive position in the world market, and damaging the worldwide technology lead of the US defense industry.

Market Response

Stock market behavior provides current—and valid—judgment on defense profits. If defense companies were hugely profitable, one would expect their shares to soar. In fact, during the extraordinary bull market of 1987, stock prices in defense companies underperformed. They did not run up to the artificial heights of other issues.

Fact: Media General Financial Services reported that for 1987 into mid-November, stock prices in its aerospace manufacturing group improved by eighty percent for all of 1987, compared with the Standard & Poor's 500 index of 100 percent. Investors concluded that DoD policy to drive down profits made those stocks less attractive in the roaring bull market that preceded the crash. When the crash came in October 1987, stock prices of the aerospace companies fell about the same as the Standard & Poor's 500 index, down thirty-two percent from the market peak on August 25 to the end of October.

Fallacy: Defense companies are "welfare queens" securely afloat on government largess. Wrong again. The basic business equation balances risk and reward. But in 1988, the potential returns on defense business are not commensurate with the increased risk. The equation is skewed, with more risk being shifted to the aerospace companies seeking defense business.

For instance, risk-shifting means that each of the two industry teams competing for the Air Force's huge Advanced Tactical Fighter (ATF) program must share nearly half the risk of development as the price of admission to the contest. Each will incur costs of $400 million to $500 million more than the $691 million fixed-price contract they received. Even the winning team is not sure of recouping the money risked on the ATF venture. (The teams are Lockheed with Boeing and General Dynamics vs. Northrop with McDonnell Douglas.) That is risk with a capital R.

Losing Technology Lead

Such risk-shifting strategies may present an illusion of benefits now. However, there is potential for severe damage over the long run. In such a climate, technologically strong companies may be unwilling to take such extraordinary financial risks and may opt out instead. Cautious managers may decide to let someone else take the risks of development and bid for part of the production business when the unknowns are whittled down. That leads to technological stagnation.

US technological preeminence has been taken for granted since the days of the Kentucky long rifle. Experience in World War II and the decades that followed justified the belief. However, that comfortable feeling is no longer true. If the defense industrial base is not healthy enough for money to be available for investment in basic research and development, the stagnation can mean that some other country's industry will make the breakthroughs that ultimately make the difference in battle. *(See John Correll's edi-*

Profit Comparisons by Industry

(Percentages)

Industry Composite	Return on Equity (Twelve Months) 1986	Profits as a Percentage of Sales Third Quarter 1987	Third Quarter 1986
Aerospace	9.6	3.5	3.0
Appliances	14.9	4.4	4.8
Automotive	14.2	3.9	2.5
Conglomerates	10.1	6.7	NM
Drugs	21.2	12.9	12.1
Electrical and Electronics	12.1	5.2	4.0
Food Processing	19.0	4.2	4.3
Metals/Mining	5.4	9.6	3.4
Office Equipment and Computers	11.5	7.9	6.7
Oil Service and Supply	−23.8	6.5	NM
Publishing and Broadcasting	18.5	9.6	10.5
Retailing, Nonfood	14.2	2.5	2.3
Steel	−28.0	3.2	NM
Textiles and Apparel	12.9	5.2	4.6

NM=Not material
SOURCE: 1986 results: *Business Week* "Top 1000" (April 1987); Third Quarter results: "Corporate Scoreboard," *Business Week*, November 16, 1987.

Acquisitions Targets in Defense Electronics

(June 1985–September 1987)

Target	Acquisitor	Price (millions)	Price/ Earnings	Price/ Book Value
ARGO Systems	Boeing	$ 275	27	5.0
Dalmo Victor	Singer	174	21	NA
Electrospace	Chrysler	367	21	6.3
Goodyear Aero	Loral	588	18	NA
Hazeltine	Emerson	189	NM	3.4
Hughes Aircraft	GM	5,700	35	5.0
Lear Siegler*	GEC (UK)	205	23	NA
Lear Siegler**	Smiths Ind.	350	17	NA
Sanders	Lockheed	1,200	NM	3.3
Sperry Flight	Honeywell	1,025	23	NA
Tracor	Westmark	694	21	2.5
Median			21	3.4

*= 3 units of LSI
**= 2 units of LSI
NA = Not available
NM = Not material
SOURCE: Phil Friedman, Drexel Burnham Lambert, Inc.

torial, "Our Endangered Industrial Base," in AIR FORCE *Magazine, October '87 issue.)*

Fallacy: Fraud, waste, and abuse are rampant in the defense industry. High-priced hammers and toilet seats are part of contemporary mythology. Even knowledgeable legislators and officials have come to accept that fallacy. In fact, companies in the industry have detected and reported most of the alleged abuses, as they should. Defense companies must follow a higher standard than that of the letter of the law, because they are dealing with large sums of public money. In fact, the Packard Commission noted in its 1986 report that the aerospace industry was taking the lead in establishing programs of ethics and self-governance within its companies. Those programs are effective in meeting the higher standard required in the defense business.

Stanley C. Pace, Chairman and CEO of General Dynamics, told me how his company's ethics "hot line" has worked out in more than a year and a half. Employees are encouraged to call the hot-line number with ways of improving the company's ethical practices. Mr. Pace says that they have done that with tangible results.

But there has also been an unexpected and beneficial by-product. Employees began using the ethics hot line to put forth methods of improving production processes and for a host of other suggestions. The result: GD set up another hot line for suggestions. It now generates more than 450 calls per month, all of which are followed up. The number of calls to the ethics hot line has declined as the suggestion line's volume has increased. Both results have been salutary.

Fallacy: Defense industry is cozy with the Pentagon. In fact, the Aerospace Industries Association (AIA) calls the current relationship "negative, adversarial rather than a partnership, with an underlying lack of trust." Don Fuqua, twelve-term former congressman from Florida and now President of AIA, charitably attributes it to "legislative and regulatory overkill."

DoD and industry certainly need to negotiate at arm's length on contracts, but should cooperate as partners in executing the work. Instead, a lack of trust and a negative outlook pervade the current scene. Industry is presumed guilty, not the opposite. As Mr. Fuqua puts it, "We have lost the confidence of the nation."

Fallacy: Fixed-price contracts are the way for the Pentagon to get the new products it wants. Fixed-price contracts make sense in certain situations, but are foolish in others. For volume acquisition of standard items, fixed-price contracting is valid and well established. In those cases, the basic development is over. The "unknowns" are known. The contractor can compete with others to calculate his costs. If he wins the business but exceeds the fixed price, that's his problem. His profit or loss is related directly to his ability to control production costs.

For research and development projects, however, the use of fixed-price contracting is foolish. By definition, research and development deals with unknowns, advancing knowledge and technology. In signing the September 1987 revision of the basic procurement policy directive, Deputy Secretary of Defense William H. Taft IV said that fixed-price contracts for development are inappropriate. Industry sees that as a step in the right direction, recognition of the folly of fixed-price R&D contracting.

Fallacies are not easily dispelled. Facts seldom catch up. But the armed services and the aerospace industry must deal from facts, not fallacies, if the industrial base is to be preserved and strengthened.

Facts of Aerospace Business Life

Having examined current fallacies, it is now time to look at forces and trends in the international marketplace that affect US aerospace companies. Understanding these trends and their effects is essential to making sense out of aerospace corporate behavior in 1988 and the years ahead.

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made. Clearly, flat or declining US defense budgets are here. The spending binge is over. In addition, the Department of Defense is a tougher customer than ever before.

A measure of nuclear arms limitations between the two superpowers is being achieved, emphasizing the need for conventional parity. Aerospace industry profits are being squeezed by forces at home and competition from abroad. Overcapacity in the global aerospace and electronics industries is leading to consolidation—acquisitions, mergers, and takeovers.

Competition the Key Word

All these forces can be summarized in one word: competition. They all intensify competition for US aerospace companies. Thus, in the views of many aerospace executives, the late 1980s and the whole decade of the 1990s will see a Darwinian struggle for survival of the fittest.

Take competition in the US defense business. For the Air Force, competition for the F100 engines in its F-15 and F-16 fighters improved readiness and brought down unit prices. Through the same competition, General Electric's engine group was able to achieve a significant increased market share, while Pratt & Whitney's overall share dropped. Both engine companies got tighter and smarter in the process.

But not all competition for defense business—competition for competition's sake—makes such sound sense. It is foolish competition if the "winner" cannot eventually make a profit. USAF's competition for the Advanced Tactical Fighter may turn a profit for the winning team, but only after a long spell of red ink. In this climate, astute industry executives are having to decide whether to even enter competition for defense programs at all.

Why would an aerospace company strive for business that will not produce a profit? John J. O'Brien, President of Grumman, said his company was competing for the Navy's Advanced Tactical Aircraft (ATA) in order to keep the business through the year 2000, despite the prospect of no profits on the program.

For example, if the Grumman-Northrop team had won the Navy's ATA competition, Grumman would have needed immediately to add $100 million to its long-term debt to pay for the tooling and workers required. The company's debt/equity ratio would have deteriorated, and its share prices might have fallen. Some victory. The engineering and production teams might remain intact, however, and Grumman should survive to compete for more profitable programs.

Elsewhere, Dan Tellep, Executive Vice President of Lockheed's Missiles and Space Group, says the company is "not walking away from sensible bids," but is not participating in senseless ones. And from St. Louis, Stanley C. Pace of General Dynamics defines the criteria for GD's deciding to participate: "If GD has the technology and the customer has clearly defined, hard requirements." If those conditions are not met, GD opts out.

Other CEOs echo that sentiment. Hughes Aircraft decided against bidding on the radar for the Advanced Tactical Fighter, concluding it would never recover the funds invested to compete, even if it won.

Takeover Situation

After the October crash, the market value of most listed companies dropped nearly thirty percent. (Market value is share price times the number of shares outstanding.) Companies whose share prices in early October were so high as to turn off potential buyers looked more attractive in November and December at discounts of twenty-five and thirty percent.

Companies whose share prices dropped significantly became more attractive takeover candidates after the crash. On the buying side, companies with large cash holdings began to take another look at takeover targets, seeking potential bargain buys.

Companies with strong cash positions took advantage of the sharp price crashes to buy back chunks of their own shares. That had two purposes—first, to decrease the shares available to potential raiders, and second, to demonstrate management's confidence in their own companies to employees, shareowners, and the public.

Major aerospace companies conducted strong share buyback programs after the crash. Boeing bought back $600 million worth and Lockheed $300 million of its own shares. Rockwell International and Raytheon had been repurchasing their shares for some time before the crash. In electronics, Watkins-Johnson and E-Systems were among the firms to buy back their own stock after the crash.

Continued consolidation within the aerospace industry is the outlook, as weaker companies are absorbed by richer ones, both US and foreign.

Foreign Competition

At the end of World War II, American aerospace products were the world standard, and the whole world bought them. In the late 1980s, American aerospace products are still technically sound. However, both civil and military customers worldwide have a multitude of sources from which to buy aerospace products.

One need only look at military trainer aircraft, for instance, to see the shift. British Aerospace's Hawk trainer design will become the centerpiece of the US Navy's aviator training system in the next couple of years as the T-45 Goshawk. While using the Hawk as an advanced trainer, the Royal Air Force at the same time picked the up-engined Embraer Tucano design from Brazil as its primary trainer.

In commuter aircraft with nineteen passengers or fewer, the Brazilian Embraer Bandeirante design captured the US market from domestic aircraft manufacturers and then moved on to dominate the world market at that size.

Trainer and commuter aircraft are but two visible examples of foreign capture of former US markets at home and abroad. In deliveries of commercial wide-body jetliners, the European Airbus Industrie consortium more than doubled its share of the market from 1984 to 1987 (ten percent to twenty-two percent). Boeing held its share in the same period (forty-nine percent in 1984, forty-eight percent in 1987). However, McDonnell Douglas's share of jetliners shipped dropped from thirty-two percent in 1984 to an estimated fourteen percent in 1987.

Industry's Big Ten Issues

In late summer 1987, the board of directors of the Aerospace Industries Association (AIA), whose members include more than fifty of the top aerospace companies, identified ten major issues on which the association should focus attention and action. They are:

- Financial health of the industry—maintain profitability and health.
- DoD-industry relations—restore trust.
- Legislative/regulatory overkill—micromanagement has impact on every phase of industry.
- Material requirements planning (MRP)—a mutual problem to be fixed.
- Independent research & development (IR&D)—artificial ceilings should be lifted to spur IR&D.
- Eight key technologies for the 1990s—"must develops."
- The race in space—rekindle American yearning to be number one.
- Quality and productivity—making the best aerospace products in the world.
- Ethics and self-governance—industry policing itself.
- Competitiveness in the world market—foreign competitors subsidized; US competing with one hand tied.

SOURCE: AIA

Seen another way, the overall pattern of US aerospace exports and imports has worsened. US aerospace exports have for decades made a positive contribution to the nation's trade balance. In the 1960s, virtually no aerospace imports occurred; the export figures were the positive trade balance for aerospace. That began changing in the late 1970s, when the first billion-dollar aerospace import years occurred. By 1986, aerospace imports into the US totaled $7.9 billion, offsetting exports of $19.7 billion.

The trend is expected to continue, as US dominance of the world aerospace market is challenged and further diminished. Other countries have developed their own aerospace industries competitive with US companies technologically. Don Fuqua of AIA found that twenty-three countries now produce components for high-performance military aircraft. Numbers alone create intense competition for the business. Furthermore, in such countries as Brazil and Indonesia where solid aerospace industries have blossomed, the labor rates and government subsidies enable their products to beat US products on price.

Teaming and Joint Ventures

"If you can't fight 'em, join 'em" is the old saying. That is happening in international aerospace at an ever-accelerating pace. Europeans have experience with forming multinational consortiums to compete. Examples include the military Panavia Tornado aircraft and commercial Airbus transport. Executives with European aerospace companies maintain that their national markets are too small, and even regional markets are barely large enough. They form consortiums to gain access to several national markets with one program—as with Tornado and Airbus—while setting their sights on capturing additional markets outside the consortium.

Now, with more players in the international aerospace game, foreign companies are trying to penetrate the US defense marketplace. That places added pressure on US companies in two ways: to compete smartly to retain Defense Department business and to join with foreign companies to capture overseas sales.

For now, the most intense struggle is for the European jet fighter market of the 1990s and into the twenty-first century. The three countries in the consortium that built the Tornado (UK, Germany, and Italy) plus Spain have joined to produce the EFA, or European Fighter Aircraft.

At the same time, France is deciding whether to go ahead with development of its new fighter, the Rafale—either alone or with partners from Europe and the US. US industry and the Defense Department would like to see the Europeans select a derivative of the multinational F-16 (such as the Agile Falcon) or the F/A-18 (for France vice the Rafale), followed by purchase of USAF's Advanced Tactical Fighter (ATF) when it comes along in the mid-1990s.

As the smart aerospace companies concentrate on fundamentals for survival, Congress and the Defense Department should also stay focused. One of the bedrocks of US power and national security is its continuing technological lead. The nation must now grapple with the "twin towers" of budget and trade deficits. Tough economic choices are necessary for survival. In making the choices, the nation's leaders must ensure that a healthy aerospace industry is retained. Otherwise, the world leadership enjoyed by the US for so long could slip away. ■

F. Clifton Berry, Jr., is a former Editor in Chief of AIR FORCE *Magazine. He has written on international security topics for nearly twenty years. He saw USAF service in the Berlin Airlift, 1948–49. Later, he was a paratrooper and officer in the 82d Airborne Division. He commanded airborne and infantry units in the US and Korea and saw Vietnam combat as operations officer of a light infantry brigade. He is a principal in FCB Associates, an information service on international aerospace topics.*

Industrial Associates

Listed below are the Industrial Associates of the Air Force Association. Through this affiliation, these companies support the objectives of AFA as they relate to the responsible use of aerospace technology for the betterment of society and the maintenance of adequate aerospace power as a requisite of national security and international amity.

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The Air Force thinks a variant of the F-16 can handle close air support. OSD, however, isn't so sure and wants to look at other options.

More Flak in the AirLand Battle

BY JAMES W. CANAN
SENIOR EDITOR

IN 1985, the civilian leadership of the Air Force directed the blue-suit community to get ready to develop a new aircraft that would be dedicated to the close air support mission in the 1990s as the successor to the similarly dedicated A-10.

There was more than a suggestion in that directive that the Air Force would have to slow down its Advanced Tactical Fighter program in order to make way, as a matter of fiscal and operational priorities, for the new CAS aircraft.

The reaction in the upper reaches of the uniformed Air Force was sour to say the least. The generals were not about to slight the ATF or any other blue-ribbon program in favor of pouring resources into a new CAS aircraft that might be nice to have but could be done without.

The generals were already looking to an existing fighter for conversion to the CAS mission and were bent on leaving it at that.

Supported by then-Secretary of Defense Caspar W. Weinberger, who ruled flatly against any new program starts, the generals had their way. USAF now has a different set of civilian leaders who agree with their uniformed counterparts.

But the CAS controversy persists. It came to the surface at the Air Force Association's symposium on "The US Air Force: Today and Tomorrow" late last year in Los Angeles.

Addressing it at length were Air Force Chief of Staff Gen. Larry D. Welch, Deputy Under Secretary of Defense for Tactical Warfare Programs Donald N. Fredericksen, and Vice Commander of Tactical Air Command Lt. Gen. James R. Brown.

A-16 for Close Support?

General Welch reaffirmed USAF's view that a variant of the F-16—the A-16—will do quite nicely in the CAS mission, just as the fighter can do in the battlefield air interdiction (BAI) penetrating mission, because of its agility, speed, and weapons-delivery accuracy. The key to a CAS aircraft surviving over tomorrow's battlefields will be

In this artist's rendering, an A-16 careens low over the battlefield on an armor-assaulting mission in support of US ground troops. The Air Force plans to dedicate such ground-attack variants of the F-16 fighter to the close air support (CAS) mission and to the deeper-ranging battlefield air interdiction (BAI) mission. While the Army is said to favor this for CAS, the Office of the Secretary of Defense has doubts.

"not getting hit" rather than absorbing hits as the A-10 was designed to do, General Welch said.

Mr. Fredericksen said he fears that the F-16, even so, will be too vulnerable—"too soft"—to survive the fire from increasingly accurate and abundant guns and missiles that CAS aircraft will encounter over battlefields of the coming decade.

From TAC's point of view, General Brown said that assigning the A-16 to CAS is consistent with the command's goal of getting the most out of all tactical aircraft in the inventory by exploiting their built-in versatility. Like General Welch, General Brown also was at pains to point out that the Army, whose troops are the beneficiaries of CAS, has no quarrel with the A-16 and that USAF is committed to dedicating ten wings of CAS aircraft to the Army's call.

The AFA symposium also featured the views of other high-ranking officials on a variety of subjects. Among those officials were Commander of Air Training Command Lt. Gen. John A. Shaud, Vice Commander in Chief of Military Airlift Command Lt. Gen. Robert D. Springer, and A. Denis Clift, the Defense Intelligence Agency's Deputy Director for External Relations.

As to trainer aircraft—a topic that has also engendered controversy in recent years amid the ups and downs and, finally, the cancellation of the T-46 program—General Shaud made it clear that new trainers for would-be fighter pilots are not in the cards until the mid to late 1990s in the case of the T-37 primary jet trainer and until the year 2000 and beyond in the case of the advanced T-38 trainer.

General Springer tipped his hat to the C-5B for its having greatly increased MAC's airlift capacity. But MAC is most certainly not in the market for any more of them, he said in response to a question from the audience of aerospace industry and Air Force officials.

The C-17 "will give us capabilities unheard of before," General Springer declared, but he also cautioned that it "will require good people" to make up each C-17 crew of only three—pilot, copilot, and loadmaster—and that attracting such people and retaining them is MAC's top priority across the board.

—Photo by William A. Ford

A thick-skinned A-10 is readied for a CAS practice run. USAF believes that the going will be too tough for A-10s on CAS missions amid the heavy fire they would receive over battlefields of the 1990s.

Mr. Clift recounted Soviet advances in the strategic, space, and tactical air, ground, and naval realms. He made the point that the Kremlin's incessant buildup of all such forces seems to belie any softening of its military posture as indicated in nuclear arms talks and in the utterances of General Secretary Mikhail Gorbachev.

The DIA official took note of a number of Soviet developments that could make the US CAS mission, for example, a whole lot tougher in the years immediately ahead. Among these are new reactive armor on battle tanks that detonates incoming shells and missiles and prevents their penetration, battlefield lasers that "could soon be with Soviet forces in the field" as rangefinders, "not as weapons per se," but that "could be used to damage eyes," and new Su-27 and MiG-29 fighters and a new air-to-air helicopter that pose grave threats to US and NATO aircraft in the CAS, BAI, and air-superiority missions.

In the context of all such missions, General Welch claimed that the Air Force and the Army are "in solid agreement" about the forces and weapons that USAF "needs to provide to the AirLand Battle."

For starters, he said, "we fully agree that a robust air-superiority capability is a very high priority," because "it's needed to give us the freedom of action required to provide all those other kinds of support that the Army must have—and to provide the maritime support that the sea services must have."

Lingering Controversy

General Welch acknowledged "some controversy in the close air support arena, but not," he emphasized, "between the US Army and the US Air Force," which, he noted, is "pursuing the [enhanced] A-7 as an approach to providing close air support and pursuing variants of the F-16 for close air support and battlefield air interdiction."

Elaborating on this under audience questioning, General Welch was emphatic in his opinion that "it

makes no sense to go out and build a new airplane" just for the CAS mission. In the battlefield of the 1990s, he said, a CAS aircraft will have to have the same hot-performance capabilities as those of a BAI aircraft in order to be able to elude formidable fire from ground-launched and air-launched radar and heat-seeking missiles as well as from guns of ever-higher power and ever-greater accuracy on the ground.

A CAS aircraft would not survive amid all this if it were built as "a 23-mm sponge," the Chief of Staff asserted. Rather, it will be capable of surviving only by virtue of its speed and maneuverability, which means, he said, "staying close to the target at a reasonable speed—in the vicinity of 350 knots or so"—and "handling itself at 500 knots or so."

He added: "All those characteristics that I've just described also happen to be the characteristics needed to perform the BAI mission. For one mission, you need persistence; for the other, range. Persistence is always translatable into range and vice versa.

"Having looked at all the requirements, the Air Force preference was to proceed with a variant of the F-16 for both. The Air Force role is to propose a solution. The OSD [Office of the Secretary of Defense] role is to evaluate it. There are those in OSD who thought it to be an inadequate solution, so we have gone out to contractors and have asked if there is a better solution, and we are waiting to see if it comes in. If it says you can buy an airplane at an affordable price that is substantially better than the [A-16] for CAS, then we'd be happy to look at it. . . .

"If we can get an airplane that's ten percent better, then what are we willing to pay for that extra ten percent? Let me tell you what we're *not* willing to pay for it—the ATF program or the ATB [Advanced Technology Bomber] program or the C-17 program or the AMRAAM [Advanced Medium-Range Air-to-Air Missile] program. I would much rather do the mission with a ninety-percentile airplane. I have the distinct impression that I do all my missions with no-better-than-ninety-percentile airplanes."

Answering questions, General Welch also rejected the idea of upgrading the F-4 for close air support and of taking on the AV-8B VTOL fighter that the Marines use for that purpose. The F-4, while a "great airplane" in its time, is simply too old, and the AV-8B, even though "I like it," would be logistically cumbersome to incorporate in the Air Force and would be less suitable to USAF demands than it is to Marine Corps requirements, he said.

Tough CAS Environment

Mr. Fredericksen, who had preceded General Welch in addressing the symposium, was clearly one of those in OSD who have reservations about the A-16, even though he emphasized that "I am not among those who are pushing the simple end of the spectrum"—a cheap, low-tech CAS aircraft.

He also noted that it is "very important" for OSD and the Air Force to promote "the growth of the F-16" as an evolutionary operational fighter and as a continuing big seller in foreign markets, with emphasis on Europe.

"I love the F-16 as a fighter," Mr. Fredericksen said. "It's relatively inexpensive to buy and own. It's great on air-to-air and air-to-ground. So what's wrong with it? I just think it's too soft an airplane for CAS."

The area of the F-16 airframe that is vulnerable to 23-mm ammunition is "nine times that of the A-10," and the vulnerable area of the A-7 is "thirteen times that of the A-10," he said. Those numbers actually go up, not down, in terms of vulnerability to "smaller stuff," he said, also noting that "Soviet machine gunners are trained to shoot up in the air."

"Man-portable missiles are a really tough threat, too, and are getting tougher. For example, the Stinger missile that's killing Soviet aircraft in Afghanistan is *nothing* compared to the latest version of the Stinger, in terms of resistance to countermeasures. . . .

"If you can do CAS without getting in close, that's one thing. But I don't think you can. The good guys won't call you in unless they're getting overrun, and you've got to know exactly where they are. You've got to worry about fratricide. So you've got to get down in there, and you're going to take an awful lot of fire."

Even if a CAS aircraft is fast and maneuverable, "it will get its lunch eaten on the second or third pass," Mr. Fredericksen said, if it keeps trying to get in close and is not sufficiently thick-skinned.

The Israelis, he said, "have given up on" fixed-wing aircraft for CAS and "are doing it with helicopters. I'm not ready to do that. But we have a problem."

He also raised the point that CAS pilots would not have the luxury of always flying at night—courtesy of night navigation and targeting gear—when it is difficult to detect them, but would "have to do CAS when it's needed," often in daytime.

Despite differences with the Air Force over CAS aircraft, Mr. Fredericksen left no doubt that he champions USAF's major modernization programs and believes that they are well-managed. He described the ATF, AMRAAM, F-15, F-16, and LANTIRN (Low-Altitude Navigation and Targeting Infrared for Night) programs as indispensable to US plans for countering the Soviet tactical threat and for carrying out NATO's follow-on forces attack (FOFA) doctrine of interdicting enemy second-echelon forces.

As the OSD official who rides herd on all the services' tactical R&D and procurement programs, Mr. Fredericksen noted that unmanned vehicles "are coming in for a lot more roles" across the services as decoys and for surveillance and to determine enemy radar frequencies and to attack such radars.

"In war games over the last two years, remotely piloted aerial vehicles have played very effectively," he declared.

Among OSD's foremost tactical priorities, Mr. Fredericksen enumerated, as well, standoff missiles, survivability of air bases, cover and deception, damage repair of combat systems, more joint programs, and much greater emphasis on affordability of all systems.

Dedicated to the Army

TAC's General Brown approached the CAS affair from the standpoint that USAF's ten active and Reserve wings of A-10s and A-7s are unquestionably ill-suited "to deal with the dynamics of what we perceive the 1990s battlefield will be."

The upgraded A-7 that TAC wants—with its afterburning, tur-

An A-7D ground-attack aircraft is being stripped down at LTV's Texas plant while taking shape as the first prototype YA-7F. USAF hopes to build such enlarged and "enhanced" A-7s for interim duty as CAS aircraft in support of the Army well into the 1990s.

bofan, higher-thrust engines, forward-looking infrared system, wide-angle head-up display (HUD), ring-laser gyro, and stretched, aerodynamically enhanced fuselage—"will give us a new airplane by 1990 at half the cost of the F-16, or $6.5 million, and will give us three and a half of the ten wings" to be devoted to close air support, General Brown declared.

Among aerospace executives at the AFA symposium, there was some hallway speculation that the Air Force, despite its best intentions, would not be able to resist the temptation to divert A-16s from CAS and employ them as fighters should the odds worsen for it in the air battle.

General Brown was not asked about this, but addressed it anyway. "We want the A-16s to be dedicated to the Army commanders, and we are going to do that," the TAC Vice Commander declared. The A-16 "will be their airplane," and "we will even give it an Army paint scheme," he said, adding:

"We are going to provide accurate and survivable attack platforms and timely and accurate airpower whenever needed to support AirLand Battle. We thoroughly understand that close air support is very important from the Army commander's point of view, and we intend to provide it."

With both the A-16 and the upgraded A-7, "we will be able to do this day and night and in adverse weather," General Brown said.

In exercises of the AirLand Battle doctrine, the General said, "the Army is asking us to put A-10s far deeper beyond the FLOT [Forward Line of Troops] than they're capable of going and surviving."

The reason, he said, is that "AirLand Battle places increasing emphasis on attacking time-sensitive targets over the full spectrum of the battlefield—so the separation between CAS and BAI has become more indistinct."

"Friendly ground forces," he continued, "have higher mobility and greater lethality of weapons" and are in need of CAS "well beyond the FLOT."

And this requires CAS aircraft capable of getting there, doing the job, and getting back, he said.

As part of his argument against developing a new aircraft for the CAS mission, General Brown said: "Experience shows that it takes between nine and eleven years to develop and field a new weapon system."

As the A-10s are phased out of the CAS role, they will be converted to the forward air control (FAC) mission, General Brown said.

He underscored TAC's dedication to getting the ATF through development and into production as quickly and as prudently as possible. And he called AMRAAM "our number-one tactical priority" in the near term.

Phased Trainer Replacement

ATC's General Shaud claimed that his command is "producing the highest-quality pilots ever in the free world, and maybe in the whole world." He also declared that "we have turned around" the high rates of attrition of pilot trainees that have been plaguing the command. A major reason for this, he said, was the recent extension of pilot training from forty-nine weeks to fifty-two weeks, a move that helps trainees with border-line aptitudes and skills get over the hump.

At this writing, the first new aircraft planned for ATC will be an off-the-shelf business jet to serve as a TTB—tanker, transport, bomber—trainer. All such jets that General Shaud has flown can meet his basic operational requirements of "300 to 350 knots at 500 feet" and capacity for a crew of three, he said.

"So what I'm mainly interested in in those airplanes is their reliability and maintainability and their ruggedness," General Shaud declared. "You've got to remember that what I'm going to be doing with them is smoothing out the runways of central Texas—a lot more takeoffs and landings than many of the business jet manufacturers had in mind."

Acquiring the TTBs in a program that the Air Force has approved "will free up at least half of our T-38s" to join the rest of the command's T-38s as advanced trainers for fighter pilots, said General

Shaud. After that, the next order of business will be to replace the T-37s.

"We don't need to replace the T-37s and the T-38s all at once," he said.

The life-extension upgrading of the T-37s now in process "will give them another 18,000 hours," he said, thus matching the hours they have already amassed, and "will enable us to make an easy transition from them to their replacements between 1995 and 2000."

Meanwhile, he said, he is convinced that "the T-37 is a very safe airplane—the only cracks I've seen are oxidation cracks aft of the canopy—and we intend to keep it that way through the Service Life Extension Program."

General Shaud also predicted that the trainer that eventually replaces the T-37 "will look suspiciously like the T-37" and, in his opinion, will have "the side-by-side seating" that the Air Force believes is best for primary training. Such seating is "particularly useful for communicating with brand-new students or foreign students" and for such moves on the part of instructors as "reaching over and grabbing the oxygen mask."

Current plans call for replacing the T-38s "past the year 2000," he said, adding: "I love the T-38. If you can handle a T-38, you can handle any airplane in the Air Force inventory, and that's not bad." Even so, he said, "there are a couple of things I do not like about it," and one of them is that "you can't see from the back seat in a no-flaps landing, which can get very exciting at night."

General Shaud was asked for his opinion on the McDonnell Douglas/British Aerospace Hawk trainer now being bought by the US Navy.

"If I got issued a Hawk and if we did away with the T-38s, that would be great," he said. "But I don't think the Hawk would be such a good idea," he added, in getting student pilots ready to fly "the iron that we have on the ramps right now."

Doing Something About Retention

MAC's General Springer devoted much of his discussion at the AFA symposium to the many and varied peacetime missions that MAC carries out without fanfare, such as those for aeromedical evacuation and other humanitarian purposes, throughout the world.

US airborne troops head for a USAF C-141 airlifter. Military Airlift Command C-141s showed off MAC's prowess last year in maintaining radio silence while ferrying a US Ranger battalion from McChord AFB, Wash., to a drop zone at the foot of the Alps in southern Germany.

He also emphasized that MAC quite often shows in exercises what it will be capable of doing in wartime. For example, he recounted a recent strategic airdrop mission in which six C-141s ferried 415 paratroopers of the 2d Battalion, 75th Rangers, from McChord AFB, Wash., to the Benedickt drop zone just north of Garmisch near the Bavarian Alps. After the formation refueled over the Canadian east coast, it maintained radio silence the rest of the way.

"Think of that," General Springer said. "We moved a fighting force to Europe without any outside communication—and that clearly reflects the discipline and ability of our aircrews to go anywhere and do their job well.

"Operating without radio contact made it difficult for others to monitor, and the significance of that was not lost on our adversaries."

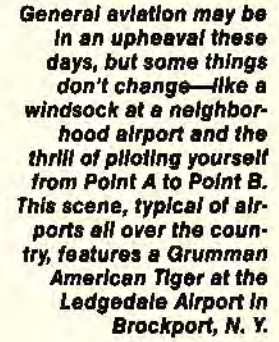
In the context of all such accomplishments and of increasingly sophisticated aircraft, led by the C-17, MAC must attract and hang on to excellent personnel, the General said. He noted that MAC's "pilot-retention figures are dropping again" and that the command is "feeling the pressure" of the wide-open commercial airlines job market—one in which 24,000 pilots have been hired since 1984 and that is expected to soak up an average of 5,000 pilots a year for the next five years.

"Some people refer to us as the league-leading farm team for the airlines," General Springer said wryly.

"My bottom line," asserted General Springer, "is this: The time has come to stop talking about 'people programs' in the Air Force and to start doing something about them. It may be time to get a little tougher with the people in Congress—who have the power to change things—and to tell them exactly how things are and what it will really take to fix them." ■

You can no longer learn to fly on a grocery clerk's pay. General aviation has gotten complex and expensive, and since 1980, the number of pilots with civilian licenses has been declining.

The Low-Level World of the Bug-Smashers



General aviation may be in an upheaval these days, but some things don't change—like a windsock at a neighborhood airport and the thrill of piloting yourself from Point A to Point B. This scene, typical of airports all over the country, features a Grumman American Tiger at the Ledgedale Airport in Brockport, N. Y.

—Staff photo by Guy Aceto

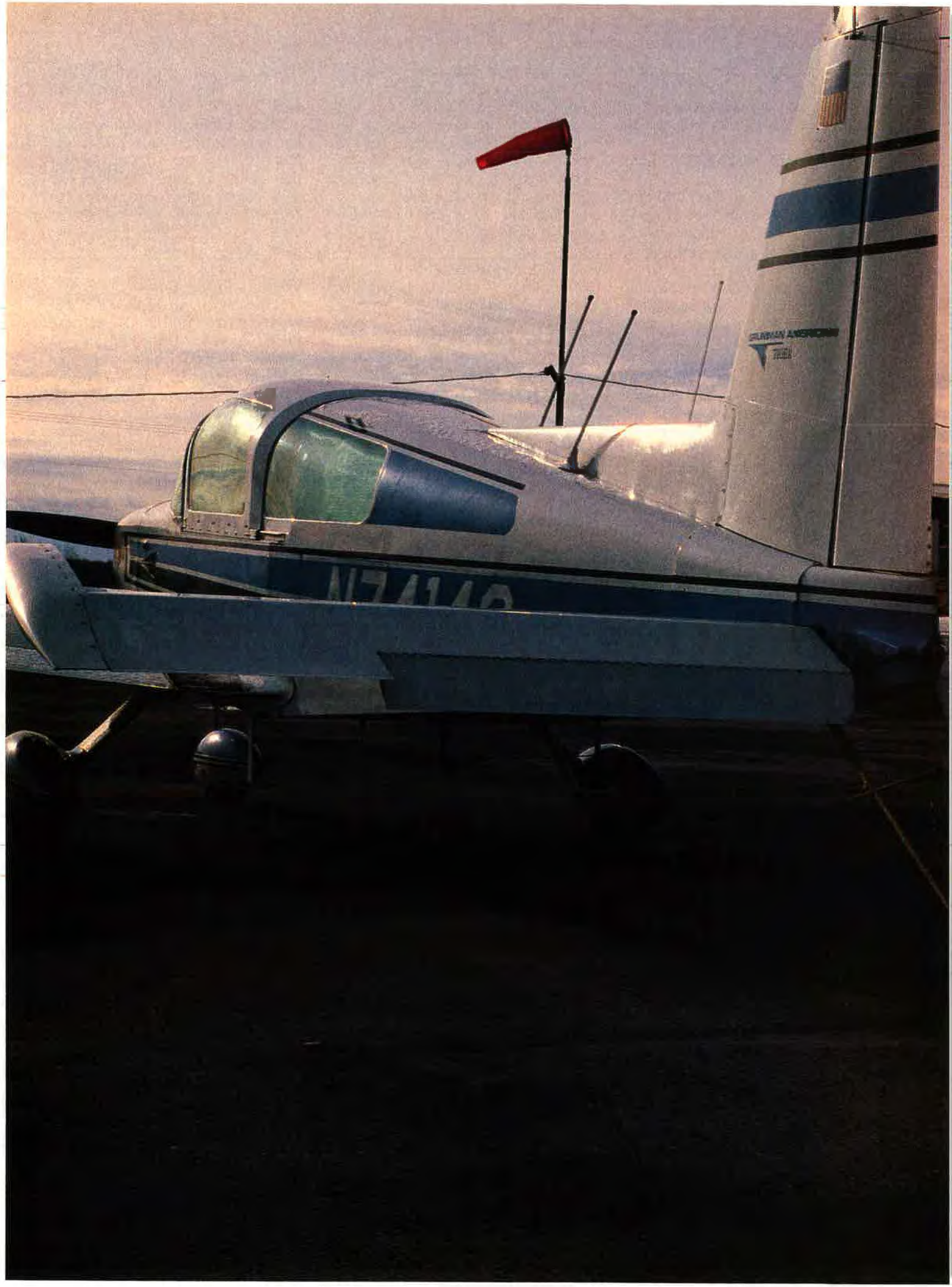
BY C. V. GLINES

WHEN pilots talk about the "good old days," chances are that those whose memories go back far enough are referring to the pre-World War II days when airplanes seldom got above 10,000 feet, were powered by one piston engine, and had few instruments, no radios, no tailwheels, and no brakes, and you flew them "contact" by visual reference with the ground. You cruised at much less than 100 mph down in bug country, where your windshield and goggles became plastered with multitudinous specimens from the insect world. In short, you were flying in the glory days of the single-engine "bug-smashers," when rules and procedures were simple and you could learn to fly on a grocery clerk's pay.

Those days may not be gone, but they're certainly fading fast. Fewer piston-powered planes are being manufactured now, there are more instruments and radio equipment needed if you intend to go out of sight of the home airport, and most aircraft are flying far above bug altitudes. Flight rules and procedures are much more complicated, the navigation and radio equipment may cost as much as or more than the plane itself, and learning to fly requires a substantial investment of time, study, and money. Those who fly the bug-smashers these days can be sure of only one thing: The bugs are still there.

What's it like out there in bug-smasher land in 1988?

According to the Federal Aviation Administration, there are 709,100 civilian licensed pilots in the US and 188,044 single- and multiengine piston aircraft in the national inventory. The number of pilots is actually receding from the all-time high of 827,000 recorded in 1980. The number of active student pilots entering the flying game has declined about six percent a year from a high of 210,000 in 1980 to fewer than 150,000 now. Those with pri-



vate pilot licenses are dropping out of flying for fun at a rate of about two percent annually. There were 357,000 private pilots in 1980, 320,000 now.

The Federal Aviation Administration predicts further decline over the next five years. The number of hours flown annually by private pilots is forecast to decline slightly from 22,400,000 hours in 1986 to 22,100,000 by 1998.

Why, in this age of supersonic aircraft, computers, and satellites, should there be fewer Americans interested in learning to fly and going after commercial and air transport ratings? The FAA posed the question and then attempted to answer it in its annual aviation forecast:

"The general-aviation industry is undergoing deep and broad structural changes," the agency says. "For the past nine years, production of general-aviation aircraft has declined from a peak of 17,811 units in 1978 to only 1,495 in 1986; 1,123 of them were piston-powered aircraft." (Fewer than 1,000 US-built aircraft are expected to be manufactured in 1987, an expected decline of about fourteen percent. Of these, only 340 single- and forty-two twin-engine planes will be built.)

Airplanes Are Older

As a result of this decline in production, according to James L. Churchill, Chairman of the General Aviation Manufacturers Association, "the average FAA-registered single-engine aircraft in the US is almost twenty years old. The average twin [is] fifteen years old. In fact, *one-half* of the entire US-registered fleet was built in 1968 or before. *One-quarter* of the fleet dates back to 1958 or before."

The FAA forecast comments: "The major independent manufacturers have been taken over by conglomerates, and Cessna and Piper [largest manufacturers of light aircraft] have suspended production of most of their piston-engine aircraft." In carefully guarded language, the FAA advances a number of possible theories about the decline in the numbers of piston-powered planes being produced and the decline in pilots:

"Some cite high aircraft prices and the availability of such low-cost alternatives as ultralights. Others say that high operating costs and interest rates have been responsible for depressing the industry. Still others say that the changes in the tax laws and high product liability costs are responsible. And there are some who feel that the overvalued dollar severely depressed the export market. To be sure, each one of these factors has had some effect. . . .

"As a nation becomes wealthier, households can afford to pay the higher prices of specialized items, and a proliferation of varieties generally takes place. This intensifies the competition in specific types of markets. During the recent strong economic recovery, the demand for recreational flying in conventional aircraft has been rapidly declining, while the demand for relatively expensive cars, homes, and boats has been expanding. This lost market may be difficult to recover even if the economic forces shift in favor of aviation."

Louis G. Thibault, owner of Petersburg-Dinwiddie Aviation, a fixed-base operator (FBO) in Petersburg, Va., would agree that the changing lifestyles of the young people who would normally be interested in flying has had an impact on his business. He has three part-time flying instructors on call and has found that their students don't stick with flying for long.

"They drive in all bushy-tailed and eager in their sports cars, and then we don't see them again after they solo," he said. "It seems like it's a 'macho' thing with them just to solo and then quit. That's why most instructors can't make a living at the local airport anymore."

Yuppies Prefer Cars

Commenting in *AOPA Pilot*, the journal of the Aircraft Owners and Pilots Association, Thomas A. Horne observes that the nation's swelling groups of "yuppies" (young, urban professionals) and "dinks" (double income, no kids) are lured away from flying, even though they can afford it.

"Among today's status symbols, lightplanes somehow lack the panache of a BMW, a yacht, or a second condominium," he says. "To deal with these items, no special knowledge is required, nor is there the burden of excessive regulation. Moreover, status cars, boats, and homes have the easy visibility, recognition, and attraction as social media that lightplanes do not, at least in the eyes of the majority that continues under the false impres-

—Staff photo by Guy Aceto

One of the most popular and least expensive two-seat trainer aircraft around these days is the Cessna 172, but it's still not cheap to learn to fly. The average cost to earn a private pilot's license in 1969 was roughly $500. Now it's close to $3,000.

sion that lightplanes—especially those with a single engine—are inherently dangerous."

The Aviation Consumer, a periodical that pulls no punches in commenting on aircraft safety, editorializes that the general perception that small aircraft are inherently unsafe "is what keeps general aviation locked into its cottage-industry status. Until light aircraft are as safe as the family car (and perceived as such by the public), the $50,000 Porsche and the $50,000 sailboat will continue to outnumber the $50,000 airplane by a large margin."

Proof that younger members of the population are less interested in flying in the '80s is shown by the statistics on the average ages of student pilots over the years. In 1970, the average student pilot was 29.9 years; a decade later, it had inched to 30.6 years. Today, it is nearly 32.5 years. It could well be that by the turn of the century, the average student pilot would approach the "old-geezer" age of fifty if the yuppies and the dinks don't look skyward for their recreational pleasures.

Elwyn V. "Bit" Fretwell, a part-time flying instructor at the Manassas, Va., airport, sees this trend already. He has had several students over the middle-century mark and attributes their interest late in life to the fact that their children have grown and gone.

They come to him for flying instruction because "it is something they have always wanted to do." He believes that these older students are approaching the peak of their earning years, and, with kids grown up and out of the house, they want to do all the things they haven't had time for or couldn't afford before. "I have found they are generally serious about flying, are more conservative, and stick to it through the private license," Mr. Fretwell said.

Costs are also increasing to hangar, operate, and maintain general-aviation aircraft. In addition, available acreage for airfields catering only to "puddlejumpers" is decreasing while congestion around terminal control areas is increasing.

—Staff photo by Guy Aceto

The Good Old Days

As one who looks back fondly on the "good old days" of learning to fly bug-smashers before World War II, I am privileged to have known what it was like then. I began flying in 1939 when ten of us purchased a used Piper J-2 Cub for $400. It cost us $1.15 an hour to fly it, which covered gas, oil, and hangar rent. If an instructor went along, we had to pay him a dollar an hour for his services. Since most of us were working for Depression wages then, we didn't ask him to go along very often. After eight hours of instruction, I soloed and flew about fifty hours alone before I invested the extra dollar to pay for the instructor. As a result, I practiced my mistakes over and over and got pretty good at them.

Fortunately, the Cub was (and is) a forgiving airplane. In 1941, I arrived at the Air Corps primary flying school in Tulsa, Okla., with about ninety unstructured and undisciplined solo hours and fewer than fifteen hours of dual in my logbook. I vividly recall my instructor, a former airmail pilot, shouting over the PT-19's one-way Gosport tube, "Mr. Glines, I wish you had never *seen* an airplane before you came to me!"

In those prewar days, the rules required that a student have a minimum of eight hours of dual instruction before soloing. There is no minimum number of dual hours required now, but, because there are more rules and because more information must be absorbed by a student in these days of high-density traffic and faster, more complicated aircraft, the average student takes about thirteen hours before the happy privilege of going up alone is granted by his instructor.

Before soloing, a student must "hold at least a current third-class medical certificate" and "must have demonstrated to an authorized instructor that he is familiar with the flight rules," according to the Federal Aviation Regulations (FARs). Instruction is required in "at least" the following procedures and operations:

- Flight preparation procedures, including preflight inspection and powerplant operation;
- Ground maneuvering and runups;
- Straight and level flight, climbs, turns, and descents;
- Flight at minimum controllable

airspeeds and stall recognition and recovery;

- Normal takeoffs and landings;
- Airport traffic patterns, including collision avoidance precautions and wake turbulence; and
- Emergencies, including elementary emergency landings.

Forty-Hour Minimum

The minimum flight time required for the private license is forty hours of flight instruction and solo flight time. Twenty hours of the total must be instruction time with an authorized flight instructor and include three hours of cross-country flying and three hours of night flying "for applicants seeking night-flying privileges." A minimum of twenty hours of solo flight time is required, which must include ten hours of cross-country flights with landings at a point more than fifty nautical miles from the original point of departure. One of the cross-country flights must be at least 300 nautical miles with landings at a minimum of three points, one of which is at least 100 nautical miles from the original point of departure.

According to Mr. Fretwell, the average student takes about sixty-six hours' total time to qualify for the private license these days, which allows the holder to take along a passenger. He cannot accept compensation, but he can allow his passenger to share the cost of the flight. Some students need more time than the average, like one determined woman student of Mr. Fretwell's in her fifties who took about twenty-five hours of dual instruction before Mr. Fretwell would let her solo and who had a total of 125 hours before she eventually qualified for the private license.

Ground school is not required, but a private license candidate "must pass a written test on the subject areas on which instruction or home study is required." In addition, a private license applicant must pass an oral and flight test administered by an FAA inspector or examiner. The oral test includes questions on weather, navigation, communications, and flight rules. Many junior colleges offer ground school courses, which teach the required information.

Although the basic requirements for the student and private licenses haven't changed much over the years, the cost of learning to fly has increased manyfold since my beginning days. Mr. Fretwell owns a Cessna 150, the most popular and least expensive two-seat trainer around these days. (More than 22,000 have been built; the last one came off the production line in 1977.) He says that the high cost of flight instruction and aircraft rentals is the basic reason that public interest in flying for fun is tapering off after many years of growth.

He insures his plane for $12,000 and carries $1 million in liability insurance at a cost of $200 per month. Gasoline costs about $1.70 a gallon for eighty octane at his airport, but can be as much as $1.95 a gallon at other airports in the area. But eighty-octane fuel is not as readily available as it used to be, and he must sometimes use 100-octane low-lead gasoline with an additive. (The average cost of 100LL nationally is $1.75 per gallon.) Unfortunately, this is not good for his engine and increases engine maintenance because of occasional sticking valves.

Regulations require that Mr. Fretwell have the two-seat Cessna checked by a licensed mechanic every hundred hours of flight because he is using it for commercial purposes; this inspection costs him $250. He considers himself fortunate at that price because a shop at a nearby airport charges $450 "just to take the cowling off the engine." If work is required to pass the inspection, labor costs a minimum of $40 an hour, and any parts required are, of course, on top of that.

To meet his costs and break even, Mr. Fretwell must fly his plane with students or rent it to them about 200 hours a year. He charges $35 per hour for the plane and $15 an hour for his instruction time. It cost Mr. Fretwell $500 in 1969 to get his private license; the average cost today is about $3,000.

Learning for Less

If you were interested in learning to fly, once had your license and let it lapse, or learned to fly in the Air Force and haven't flown much since, is it possible to get into the air at less cost?

One answer: Join a not-for-profit flying club. Gordon Furbish did. A retired Air Force lieutenant colonel who flew B-17s in the Eighth Air Force during the Big War, he joined with five others and purchased a Cessna 150 seven years ago. The group now has eighteen members, ranging in age from twenty-eight to sixty-eight, and two Cessna 172s based at Arthur Godfrey Field, Leesburg, Va.

A share in the club costs $2,000, with a fixed monthly fee of $30. This kitty pays for tie-down costs, routine maintenance, and $1 million liability and hull insurance. Each hour of flight costs a member $25 for the instrument-flight-equipped 172 and $20 for the older Cessna, which has less sophisticated cockpit instrumentation.

One-plane flying clubs along the East Coast typically charge an entry fee of from $100 to $500 and monthly dues of $15 or more a month. The cost per hour of flight depends on the size and value of the aircraft, with a minimum of about $25 for the Cessna 150. Some may assess extra fees as needed to accumulate a fund for inspections and maintenance or to ensure having a plane always capable of flying under instrument flight rules.

Some clubs will not admit student or low-time private pilots and cater to a sophisticated pilot group that will keep planes in the air and show a high utilization rate. Fixed-base operators (FBOs), often in competition with flying clubs, must charge higher rates to a steady stream of students and private pilots to keep their planes flying a profitable number of hours. Many require that a pilot rent the aircraft for a minimum of two to three hours at a time.

In addition to the ever-higher cost of flying small aircraft, another problem that threatens to stifle bug-smasher flying is the ever-decreasing number of airfields available for "the little guy." The acreage taken up by an airport in an expanding residential or light industrial area is a temptation for developers to make an offer the airport owner can't refuse.

Complaints and lawsuits by homeowners about aircraft noise also cause some airport owners to give up. Since 1984, according to the FAA, nearly 150 airports around the country have closed down, and more are threatened. There are

many examples along the Eastern Seaboard.

Charles D. Benn, owner of the Washington-Virginia Airport at Bailey's Crossroads in the Washington, D. C., area, sold out to developers in the late 1960s and bought the eighty-acre Woodbridge Airport about fifteen miles farther into the countryside in 1970. He built it over the years into the sixth-busiest of the sixty-three general-aviation airports in Virginia and the most popular of the light aircraft fields in the Washington area.

Last May 31, he held a party for the pilots and field employees who had flown and worked there. It was his last day of operations; developers had made him an offer that persuaded him, at age sixty-seven and after forty years of flying, to call it quits. At least five more small airports in the Washington, D. C., area are threatened with extinction.

Despite the increased regulations and skyrocketing costs, most of the fun of flying slow and low and without a flight attendant is still there. In addition to providing fun, this Citabria is also capable of the ultimate in small plane flying—aerobatics.

—Staff photo by Guy Aceto

The Fun Is Still There

Although this is discouraging to bug-smasher pilots, it does not mean the fun has been completely drained from flying light aircraft—yet. It does mean that those determined to recapture the thrill of old-fashioned low and slow flying must go outside the metroplexes and into the countryside to find a general-aviation airport that encourages private pilots.

The ground trip to get to the airport may be an inconvenience, but it's safer out there. The chance of midair collisions between small aircraft and airliners around the large airports grows greater and greater. The skies are now more crowded at the higher altitudes with large, fast aircraft, but the danger is also present when they climb or descend through "Indian country" where the slow-flying Piper Cherokees, Comanches, Apaches, and other brands of bug-smashers ply their way at low altitudes.

Between 1975 and the end of 1986, there were 329 midair collisions with 777 fatalities involving US civil aviation aircraft. These tragedies have resulted in a proposed rule that will require all aircraft operating in terminal control areas (TCAs) and airport radar service areas (ARSAs) surrounding busy airports to have electronic equipment aboard (transponders with altitude-encoding capability) that will enable air traffic controllers to see conflicting traffic on their radarscopes and thus enable them to warn pilots of potential midair collisions. At about $1,200 per unit, this will constitute a new expense to the bug-smasher pilot/owner who wants to fly in busy airspace.

Another equipment requirement that has been in effect for several years is the FAA mandate for general-aviation aircraft to have an emergency locator transmitter (ELT) aboard. This device, when activated by a crash or by the pilot when his aircraft is down, sends out a homing signal that can be picked up by searching aircraft, ships, or satellites. Although the ELT is relatively inexpensive at about $100, the requirement to have it and the altitude transponder aboard the bug-smashers is an indication of the trend by federal regulators to require even small aircraft owners to install electronic equipment aboard their planes for the safety of all who fly.

So, much as we may not want to admit it, the "good old days" of the 1930s and '40s when we could fly uninhibited without radios, instruments, or black boxes and could go almost anywhere we chose without fear of running into another bug-smasher or an airliner are mostly gone. Oh, there are still some free-flying, wide-open areas left in the Midwest and Alaska, but if you live near any large city with "heavy iron" airline or corporate jet traffic zipping through your skies, flying for the sheer fun of it requires a lot more concentration, time, and study—and money. ■

C. V. Glines, a retired Air Force colonel, is a free-lance writer, a magazine editor, and the author of numerous books. A frequent contributor to this magazine, his most recent offerings have included "Wanted: Yesterday's Airplanes" in the July '87 issue, "What Has Happened to the Airlines?" (May '87 issue), "Brain Buckets" (August '86), and "A Bolt From the Blue" (May '86).

Announced at the annual Air Force Ball...

1987 SCAMP Scholarship Winners

EVERY fall, the annual Air Force Ball in southern California raises thousands of dollars for AFA's Aerospace Education Foundation and SCAMP (Scholarships for Children of American Military Personnel). This past year, which marked the fortieth anniversary of the Air Force and the sixteenth annual Ball, five scholarship awards went to these SCAMP recipients:

- **Lisa Lynn Danielson** is the daughter of Capt. Mark Giles Danielson, USAF, who was reported MIA in 1972 and in 1973 was presumed killed in action. She is pursuing a marketing degree at Arizona State University.
- **Heather L. Hall,** San Diego, Calif., daughter of Navy Lt. Cmdr. Harley Hubert Hall, who in 1980 was presumed killed in action.
- **Carter Dietrich Latendresse** is the son of Navy Capt. Thomas B. Latendresse, who was a POW from 1972–73. Mr. Latendresse is studying English literature at the University of Washington in Seattle.
- **Kevin Panek** is the son of Lt. Col. Robert J. Panek, Sr., USAF, who was reported MIA in 1970 and in 1978 was presumed killed in action. Mr. Panek is pursuing a degree in architecture at the University of Illinois.
- **John Chilcott Tobias II,** Los Angeles, Calif., son of Army Lt. Col. John Chilcott Tobias, who was killed in action in 1970.

—BY JAMES A. MCDONNELL, JR.

—Photo by Gary Kikus

AFA National President Sam Keith, Jr., left, was on hand at the Air Force Ball to congratulate, from right, Carter D. Latendresse, Kevin A. Panek, and Lisa L. Danielson, who received three of five Scholarships for Children of American Military Personnel presented last fall at the Ball.

—Photo by Gary Kikus

Among the guests who attended the sixteenth annual Air Force Ball were, from left, Air Force Chief of Staff Gen. Larry D. Welch, Mrs. Marty Harris, Air Force Secretary and Mrs. Edward C. Aldridge, actor Jimmy Stewart, Mrs. Larry Welch, AFA Board Chairman Marty Harris, and Mrs. Keith and AFA National President Sam Keith. The Ball raises funds to support education.

JANE'S

ALL THE WORLD'S AIRCRAFT SUPPLEMENT

FEBRUARY 1988

This new photograph of 'Backfire-C', in a hurry to get away from the inquisitive interceptor, shows the wedge intakes and underwing pylons for 'Kitchen' missiles

TUPOLEV

TUPOLEV DESIGN BUREAU; USSR

Among new illustrations in the 1987–88 edition of *Jane's* is the first photograph of the 'Backfire-C' version of the Tu-26 bomber and maritime reconnaissance/attack aircraft to appear in a non-restricted publication. The following entry updates information given in earlier *Jane's* Supplement and Soviet Gallery listings:

TUPOLEV Tu-26 (Tu-22M)

NATO reporting name: Backfire

NATO first acknowledged the existence of a Soviet variable geometry medium bomber in the Autumn of 1969. A prototype was observed in July 1970, on the ground near the manufacturing plant at Kazan in Eastern Russia, and was confirmed subsequently as a twin-engined design by the Tupolev Bureau. At least two prototypes were built, and flight testing is believed to have started in 1971. Up to twelve pre-production models followed, for development testing, weapons trials, and evaluation, by the beginning of 1973. Soviet delegates to the SALT II treaty talks referred to the type as the **Tu-22M**, suggesting its role as a replacement for the Tu-22 (NATO 'Blinder'), but the designation of the major production versions is believed to be **Tu-26**. The NATO reporting name allocated to the aircraft is 'Backfire'.

By 1987, three versions of the Tu-26/Tu-22M had been identified by NATO reporting names:

Backfire-A. Initial version, with large landing gear fairing pods on the wing trailing-edges. Believed to have equipped only one squadron.

Backfire-B. Initial series production version, with increased wing span, and landing gear fairing pods eliminated except for shallow underwing fairings, no longer protruding beyond the trailing-edge. Inward retracting main landing gear units. During the SALT II treaty negotiations, 'Backfire-Bs' were seen with the previously-standard flight refuelling nose probe removed, although the housing remained. This was assumed to stress Soviet assertions that the aircraft are intended for peripheral/theatre operations rather than for long-range strategic use, and were therefore exempt from restrictions that would have been imposed on interconti-

nental bombers by the treaty. Initial armament was normally a single 'Kitchen' missile semi-recessed under the fuselage. Current aircraft have a rack for a 'Kitchen' under each fixed wing centre-section panel, although the fuselage mount is retained. External racks for bombs and other stores seen frequently under fuselage. Twin guns in tail mounting, initially beneath ogival radome, later with drum shape radome of larger diameter.

Backfire-C. This advanced production version with wedge type engine air intakes, like those of the MiG-25, was first reported in the 1980–81 *Jane's*. The accompanying illustration became available in the Autumn of 1987, by which time this version was operational in large numbers, in both long-range bomber and maritime roles. Other features include an upturned nosecone with a small pod at the tip; no visible flight refuelling probe; and a single twin-barrel gun in the tail mounting, beneath a large drum shape radome.

'Backfire-B and C' are capable of performing nuclear strike, conventional attack, anti-ship, and reconnaissance missions. Low-level penetration features make them more survivable than previous Soviet bombers, and they have adequate range to be employed against the contiguous United States on high-altitude subsonic missions, although such a flight profile would render them far more vulnerable. Their low altitude transonic dash capability makes them formidable weapons with which to support military operations in Europe and Asia. The removable in-flight refuelling probe on 'Backfire-B' makes possible extended-range missions.

Nearly 350 'Backfire-Bs and Cs' are in service, in roughly equal proportions. Two-thirds of them oppose NATO in Europe and over the Atlantic, with the others in the far east of the Soviet Union. The latter are observed frequently over the Sea of Japan, and at least 30 of them are reportedly drawn from the 150 'Backfire-Bs and Cs' deployed in a maritime role by Soviet Naval Aviation. As long ago as FY 1979, the Annual Report of the DoD stated: "There is increasing evidence that the Soviet bomber and cruise missile force may be overtaking their submarine force as a threat to our fleet and to our forces necessary for the resupply of Europe. They can concentrate aircraft, co-ordinate attacks with air, surface, or submarine-launched missiles, and use new technology to find our fleet units, jam our defenses, and screen their approach."

The effectiveness of the 'Backfire' bomber force in theatre operations and its survivability have been greatly enhanced by the introduction into service of Sukhoi Su-27 (NATO 'Flanker') long-range escort fighters, working in conjunction with 'Mainstay' airborne early warning and control aircraft developed from the Il-76 four-turbofan transport.

It is expected that the 'Backfire' strategic/maritime force will be maintained eventually at a total of at least 400 aircraft. Production appears to be limited to the average rate of 30 aircraft a year that was specified by the SALT II treaty, although it was not ratified. 'Backfires' have been used for development launches of new-generation Soviet cruise missiles, but are not expected to become designated carriers of the AS-15 (NATO 'Kent') ALCM.

'Backfire-B' version of the Tupolev Tu-26 with wings spread, photographed from a Swedish Air Force fighter *(via FLYGvapenNYTT)*

The following details refer specifically to 'Backfire-B', but are generally applicable to 'Backfire-C' except for the differences already noted:

TYPE: Twin-engined medium bomber and maritime reconnaissance/attack aircraft.

WINGS: Cantilever low-wing monoplane, made up of a large span fixed centre-section and two variable geometry outer panels. No anhedral or dihedral, but wing section is so thin that considerable flexing of the outer panels takes place in flight. Leading-edge fence towards tip of centre-section on each side. Each outer wing panel is believed to be fitted with a full span leading-edge slat, aileron, and three-section slotted trailing-edge flap aft of three similar-span spoilers/lift dumpers. Wing sweep appears to be variable from fully spread (20°) to fully swept (65°), rather than limited to one intermediate position as on earlier Soviet combat aircraft.

FUSELAGE: Forward of wings, fuselage is basically circular with large ogival dielectric nosecone. Centre-fuselage is blended with box section air intake trunks, each fitted with a large splitter plate and assumed to embody complex variable geometry ramps. There is no evidence to suggest external area rule 'waisting' of these trunks.

TAIL UNIT: Cantilever structure, with sweepback on all surfaces. All-moving horizontal surfaces; conventional inset rudder. No tabs.

LANDING GEAR: Retractable tricycle type. Each mainwheel bogie comprises three unequally spaced pairs of wheels in tandem, which pivot inward from the vestigial fairing under the centre-section into the bottom of the fuselage.

POWER PLANT: Two unidentified turbofans with afterburners, mounted side by side in the rear fuselage. Reported to be uprated versions of the Kuznetsov NK-144 engines (each 196.1 kN; 44,090 lb st) that were developed for Tupolev's Tu-144 supersonic transport. Fuel tankage is believed to include integral tanks in the entire fixed portion of the wings and much of the centre-fuselage above the weapon bay. Removable flight refuelling nose probe; after one observed refuelling, a 'Backfire' prototype remained airborne for a further 10 h.

ACCOMMODATION: Pilot and co-pilot side by side on flight deck. Two crew members farther aft, as indicated by position of windows between flight deck and air intakes.

AVIONICS AND EQUIPMENT: Large bombing and navigation radar (NATO 'Down Beat') inside dielectric nosecone. Radar (NATO 'Bee Hind') for tail turret, above guns. Fairing with flat glazed front panel under front fuselage is believed to be for a video camera to provide visual assistance for weapon aiming.

ARMAMENT: Primary armament of two 'Kitchen' air-to-surface missiles (Mach 4.6; range 160 nm; 300 km; 185 miles), carried under the fixed centre-section panel of each wing, or a single 'Kitchen' semi-recessed in the underside of the centre-fuselage. Multiple racks for 12 to 18 bombs sometimes fitted under the fuselage. Alternative weapon loads include up to 12,000 kg (26,450 lb) of conventional bombs, carried internally. US reports have suggested that the Soviet Union is developing decoy missiles to assist penetration of advanced defence systems, in addition to very advanced ECM and ECCM. Two twin-barrel 23 mm guns in radar directed tail mounting.

DIMENSIONS, EXTERNAL (estimated):

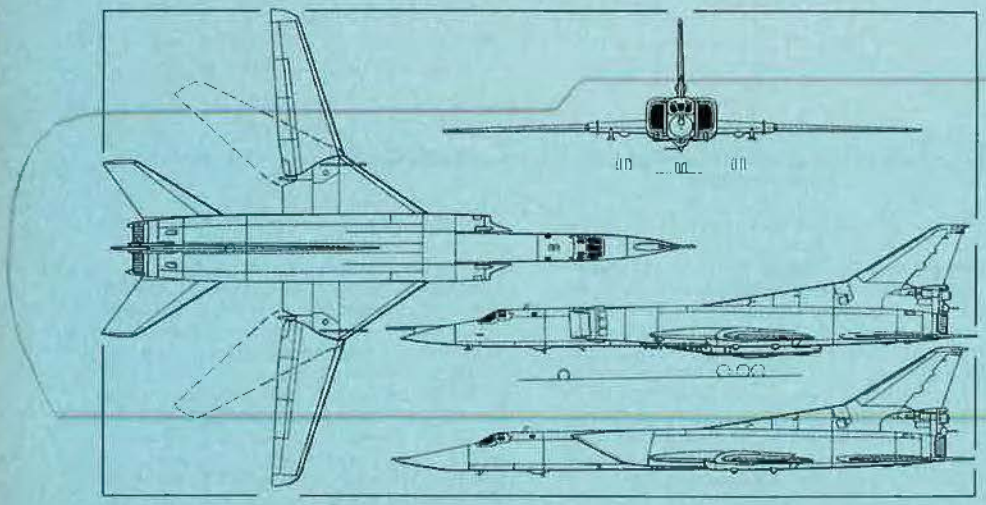
Wing span:	
fully spread	34.30 m (112 ft 6½ in)
fully swept	23.40 m (76 ft 9¼ in)
Length overall	39.60 m (129 ft 11 in)
Height overall	10.80 m (35 ft 5¼ in)
Tailplane span	12.60 m (41 ft 3 in)
Wheel track	8.30 m (27 ft 2½ in)
Wheelbase	approx 13.15 m (43 ft 1½ in)

WEIGHTS:

Nominal weapon load	12,000 kg (26,450 lb)
Max T-O weight	130,000 kg (286,600 lb)

PERFORMANCE (estimated):

Max level speed: high altitude	Mach 2.0
low altitude	Mach 0.9
Max unrefuelled combat radius	2,160 nm (4,000 km; 2,485 miles)



Tupolev Tu-26 (NATO 'Backfire-B') bomber and maritime reconnaissance/attack aircraft, with additional side view (bottom) of 'Backfire-C' *(Pilot Press)*

CANADAIR

CANADAIR INC; Cartierville Airport, 1800 Laurentien Boulevard, Ville Saint-Laurent, Québec H4R 1K2, Canada

CANADAIR CHALLENGER CL-601 RJ

Canadair has been working with a number of

Artist's impression of the Canadair Challenger 601 regional jet

airline companies since late 1986 to study the possible market for a 40/50-seat 'stretched' version of the Challenger 601, and at the Paris Air Show in June 1987 company spokesmen indicated that "interesting potential" for such a version had been shown. The project was officially announced to have entered a one-year full advanced design phase in the following November.

Intended primarily for commuter and package express service operators, the Challenger CL-601 RJ (for regional jet) has fuselage extensions of 3.05 m (10 ft 0 in) forward of the wings and 2.67 m (8 ft 9 in) aft. This more than doubles the capacity of the 19-passenger Challenger 601, enabling the RJ to accommodate up to 48 people, four-abreast at 81 cm (32 in) seat pitch with centre aisle, in its passenger form, while retaining a generous baggage capacity; or a maximum payload of 4,536 kg (10,000 lb) in all-cargo configuration. Emergency exits are increased to three: one overwing each side, plus one opposite the port-side (forward) passenger door.

To meet field length requirements for this class of aircraft, some modifications will also be made to the wings. The General Electric CF34-3A twin-turbofan power plant of the Challenger 601-3A (40.66/38.48 kN; 9,140/8,650 lb st with/without automatic power reserve) will be retained in the RJ.

DIMENSIONS, EXTERNAL:

Wing span	19.61 m (64 ft 4 in)
Length overall	26.57 m (87 ft 2 in)
Fuselage: Max diameter	2.69 m (8 ft 10 in)
Height overall	6.30 m (20 ft 8 in)
Tailplane span	6.20 m (20 ft 4 in)
Wheel track (c/l of shock struts)	3.175 m (10 ft 5 in)

WEIGHTS (estimated. A: 48-passenger commuter, B: container cargo version):

Manufacturer's weight empty:	
A	10,886 kg (24,000 lb)
B	11,108 kg (24,490 lb)
Operating weight empty:	
A	13,390 kg (29,520 lb)
B	12,396 kg (27,330 lb)
Max fuel: A, B	4,441 kg (9,792 lb)
Max payload: A	4,354 kg (9,600 lb)
B	4,536 kg (10,000 lb)
Max T-O weight: A, B	21,024 kg (46,350 lb)
Max ramp weight: A, B	21,092 kg (46,500 lb)
*Typical zero-fuel weight:	
A	17,744 kg (39,120 lb)
B	16,932 kg (37,330 lb)
**Typical landing weight:	
A	18,703 kg (41,234 lb)
B	17,874 kg (39,407 lb)
Max landing weight:	
A, B	19,050 kg (42,000 lb)

PERFORMANCE (estimated):

Range at cruising speed of 424 knots (785 km/h; 488 mph):

A with 48 passengers
868 nm (1,609 km; 1,000 miles)

B with max cargo payload
1,216 nm (2,253 km; 1,400 miles)

*Fuel weight calculated for range of 868 nm (1,609 km; 1,000 miles), cruising at Mach 0.74, with FAR Pt 121 reserves

**At typical zero-fuel weights quoted, with reserve fuel and max payload

EHI

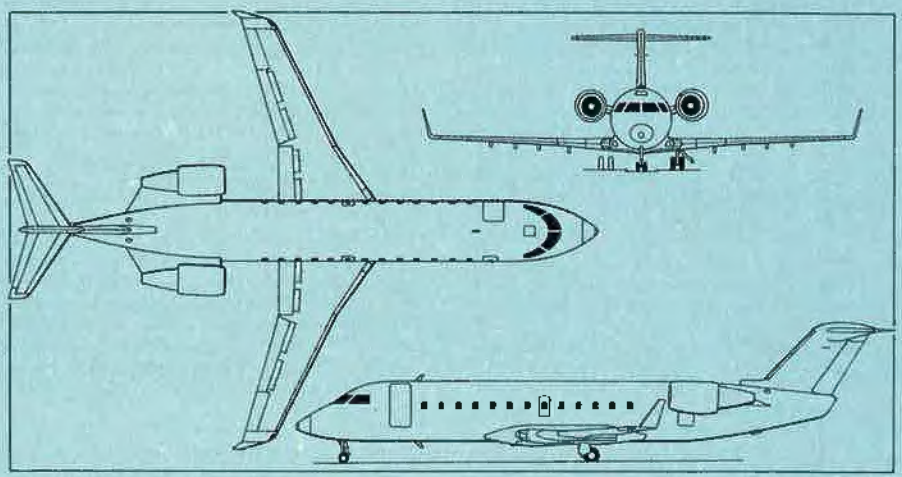
EH INDUSTRIES LIMITED; 500 Chiswick High Road, London W4 5RG, England

EH Industries was formed in June 1980 by Westland Helicopters and Agusta to undertake the joint development of a new anti-submarine warfare helicopter, for which the Royal Navy and Italian Navy both have a requirement. Such a programme was initiated by Westland in the UK in 1977 in response to Naval Staff Requirement 6646, leading to the WG 34 helicopter described under that company's heading in the 1979–80 *Jane's*. Following extensive market research and project definition, it was established that civil and military requirements were compatible with the naval requirements.

British and Italian government approval for the nine-month project definition phase was given on 12 June 1981, and full programme go-ahead was announced by the two governments on 25 January 1984. A formal contract for full development of the naval version was signed on 7 March 1984. The programme is being handled on behalf of both governments by the British Ministry of Defence. Technical responsibility rests with Westland Helicopters and Agusta, each of which has a 50% interest in EHI. Westland has design leadership for the commercial version, and Agusta for the rear loading military/utility version; the naval version is being developed jointly by the two companies for their respective navies and export customers.

EH INDUSTRIES EH 101

In the Spring of 1977 the British MoD (Navy) completed a series of feasibility studies for a new ASW helicopter, and examined what sensors and performance standards it would require. Westland's WG 34 design, marginally smaller than the Sea King but with substantially more disposable load capability, was selected by the MoD (Navy) for development in the late Summer of 1978. The Italian Navy, although it would place more emphasis on shore-based than shipboard operation, has a requirement broadly similar to that of the Royal Navy, and in 1980 Westland and Agusta decided to combine forces in a joint design, the EH 101, to meet the requirements of both services. Subsequent market research indicated that commercial payload/range and military tactical transport/logistics requirements for a medium sized helicopter were also compatible with the basic airframe design requirements of the naval version, and it was decided to develop all three variants, based on a common aircraft. Development of the EH 101 is now proceeding, and



Canadair Challenger 601 RJ (two General Electric CF34-3A turbofans) *(Jane's/Mike Keep)*

the commercial version is expected to enter service in 1990, followed shortly afterwards by the naval and military variants.

Ten pre-production aircraft are planned, one of which is an 'iron bird' being used in Italy for ground tests. Of the other nine, four (PP1, 2, 4, and 7) will be used to qualify the basic aircraft, the first one (ZF641) making its initial flight at Yeovil on 9 October 1987. A third EH 101 (PP2) was due to fly by the end of 1987. The fourth EH 101 (PP3) is due to fly in Spring 1988, and will be used by Westland to speed the award of civil certification, planned for mid-1990. Aircraft PP5 and PP6 will be devoted respectively to development of the Royal Navy and Italian Navy versions; PP8 and PP9 will be used for reliability proving and will serve as demonstrators for the commercial and utility versions. Metal for the first two aircraft was first cut in March 1985, and all nine are expected to fly within about two years of the first flight. First deliveries of the commercial version are planned for 1990, followed by deliveries to both navies. Aircraft will be produced by single source manufacture of components, with a final assembly line in each country. Major design responsibilities at present include Westland for the front fuselage, cabin, cockpit, and main rotor blades; Agusta for the rear fuselage, rotor head and drive system, hydraulic system, and part of the electrical system.

general purpose frigates; it has also been announced that the helicopter will operate from 'Invincible' class aircraft carriers, Royal Fleet Auxiliaries, and other ships, as well as from land bases. Initial orders will comprise 50 for the Royal Navy and 42 for the Italian Navy.

After eliminating the only other contender (the Aérospatiale Super Puma), which did not comply with all of its requirements, the Canadian government confirmed in August 1987 its selection of the EH 101 to meet the Canadian Navy's NSA (new shipborne aircraft) need for a Sea King replacement. It will fund further development of the EH 101 to meet the exact specifications of the NSA programme. Canada is expected eventually to buy between 30 and 50 EH 101s, and EHI is joined in the contract definition phase by four Canadian companies (Bell Helicopter Canada, Canadian Marconi, the IMP Group, and Paramax Electronics), plus Sikorsky Aircraft of the USA.

Intended to operate from patrol frigates and destroyers as a fully autonomous weapons system, the Canadian Navy EH 101 will have three to four times the capability of the service's present CH-124A Sea Kings when it enters service in the mid-1990s. Bell Canada will assemble and flight-test the Canadian version; Paramax will have prime responsibility for mission systems integration, assisted by Canadian Marconi and Sikorsky; IMP will provide long-term

PP1 first prototype of the EH Industries EH 101 multi-role helicopter

The airframe, power plant, rotor and transmission systems, flight controls, and utility systems are common to all three variants. The design philosophy is to provide significant improvements in performance, integrity, availability, operating cost, and crew/passenger acceptability. Design features include the use of three engines, providing higher power margins; fail-safe, damage-tolerant airframe structure and rotating components; greater system redundancy; and onboard monitoring of the engines, transmission, avionics, and utility systems.

The **naval EH 101** is designed for fully autonomous all-weather operations, and will operate from land bases, large and small vessels (including merchant ships), and oil rigs. It is specifically designed for operation from a 3,500 tonne frigate, and its physical dimensions are designed for compatibility with frigate hangar size. It will be capable of launch and recovery from a frigate in sea state 6, with the ship on any heading, and in wind speeds, from any direction, of up to 50 knots (93 km/h; 57 mph). It will have the greater endurance and carrying capacity necessary to meet the expanding maritime tactical requirements of the 1990s, with the ability to operate distantly for up to 5 hours with new technology detection equipment and weaponry currently under development.

Primary roles of the maritime version will be anti-submarine warfare, anti-ship surveillance and tracking, anti-surface-vessel, amphibious operations, and search and rescue. Other roles include airborne early warning, vertical replenishment, and electronic countermeasures (deception, jamming, and missile seduction). For the Royal Navy, the EH 101 has been specified as equipment for its Type 23 integrated support for the helicopter once it has entered service. To co-ordinate the international team and manage the Canadian programme, EHI has formed a new, Ottawa-based company known as EH Industries (Canada) Inc.

The **commercial variant,** based on the common aircraft but with detail design tailored to meet civil requirements, will offer a range of 500 nm (926 km; 576 miles), with full IFR reserves, carrying 30 passengers and their baggage. The three-engine configuration gives the EH 101 a Category A VTO performance, capable of offshore and oil rig operations or scheduled flights into inner cities at high all-up weights under the more rigorous civil operating rules of the future. It will be operated by a crew of two, with provision for a cabin attendant, and will offer airline standards of comfort with stand-up headroom, airline style seating, overhead baggage storage, full environmental control, passenger entertainment, plus a toilet and galley. It will also be available, if required, with a large rear-loading ramp.

The **military variant,** in a tactical transport or logistic configuration, will incorporate a rear-loading ramp for vehicles and cargo, and will be able to airlift a load of almost 6 tons. Alternatively, up to 38 fully equipped and seated troops will be carried. Initially, 25 of this version are to be ordered for the British Army. A **civil/utility version** will also be available to commercial operators requiring a rear-loading facility.

TYPE: Multi-role helicopter.

ROTOR SYSTEM: Five-blade main rotor, hub of which is designed on multiple load path concept, incorporating fail-safe principles, and is formed from composites materials surrounding a metal core. Blades, also of composites construction, have an advanced aerofoil section, special high-speed tips resulting from British Experimental Rotor Programme (BERP), and are attached to the hub by multi-path loading including elastomeric bearings. Naval version has fully automatic power folding of main rotor blades (optional on other versions) and tail rotor pylon, with manual system for emergency backup. Electric de-icing of main and tail rotor blades (Lucas Spraymat system) standard on naval version, optional on other versions. Four-blade tail rotor, mounted on port side of tail rotor pylon.

ROTOR DRIVE: Front drive directly into main gearbox from all three engines, with all gears straddle mounted for greater rigidity. External driveshaft to tail rotor gearbox.

FUSELAGE AND TAIL UNIT: Main fuselage is an aluminium alloy stressed skin structure. Composites are used where cost-effective in parts of complex shape such as forward fuselage, windscreen structure, entire tail-fin and tailplane, and upper fuselage cowling panels. Main fuselage panels are of bonded honeycomb. Fuselage is divided into four major modules, with front and centre fuselage common to all three variants. Modified rear fuselage and slimmer tailboom on military version, to accommodate rear-loading ramp/door in underside. Tailcone and tail rotor pylon of composites construction; on naval version, this folds forward and downward so that starboard half of tailplane passes underneath rear fuselage.

LANDING GEAR: Hydraulically retractable tricycle type, with single mainwheels and steerable twin-wheel nose unit, designed and manufactured by AP Precision Hydraulics in association with Officine Meccaniche Aeronautiche. Main units retract into fairings on sides of fuselage. Goodrich wheels, tyres, and brakes.

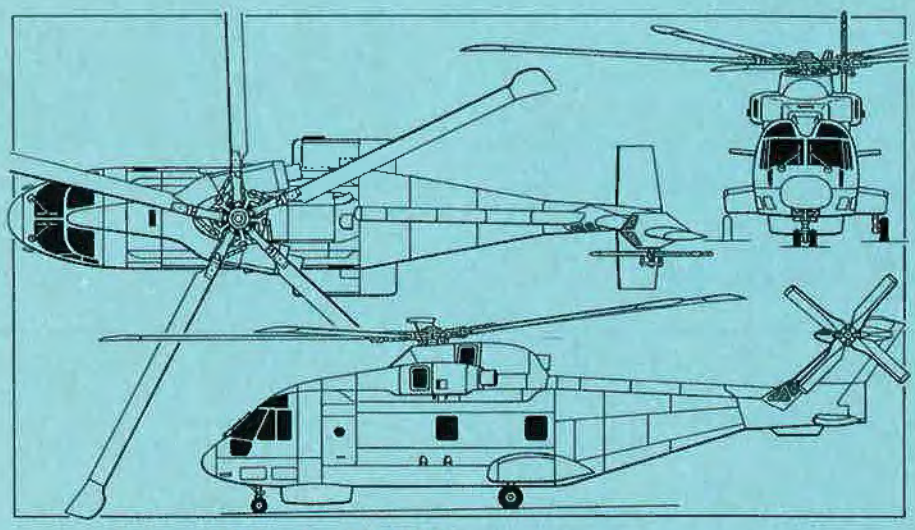
POWER PLANT: Three General Electric T700-GE-401A turboshafts in naval variant, rated at 1,278 kW (1,714 shp) max contingency, 1,254 kW (1,682 shp) intermediate, and 1,071 kW (1,437 shp) max continuous at S/L, ISA. Engines for naval variant will be assembled by Alfa Romeo. Commercial and military variants powered by three General Electric CT7-6 turboshafts with ratings of 1,432 kW (1,920 shp) max and intermediate contingency, 1,230 kW (1,649 shp) max continuous. A possible alternative engine is the Rolls-Royce Turbomeca RTM 322. Computerised fuel management system. Dunlop electric anti-icing of engine air intakes, which are of Kevlar reinforced with aero-web honeycomb.

ACCOMMODATION: One or two pilots on flight deck (naval version will be capable of single-pilot operation, commercial variant will be certificated for two-pilot operation). ASW version will normally also carry observer and acoustic systems operator. Martin-Baker crew seats in naval version; Socea or Ipeco crew seats in commercial variant. Commercial version able to accommodate 30 passengers, four abreast at approx seat pitch of 76 cm (30 in), plus cabin attendant, with toilet, galley, and baggage facilities (including overhead bins). Military variant can accommodate up to 38 combat-equipped troops or equivalent cargo. Main passenger door/emergency exit at front on port side, with additional emergency exits on starboard side and on each side of cabin at rear, above main landing gear sponson. Large sliding door at mid-cabin position on starboard side, with inset emergency exit. Commercial variant has baggage bay aft of cabin, with external access via door on port side. Cargo loading ramp/door at rear of cabin on utility version.

SYSTEMS: Hamilton Standard/Microtecnica environmental control systems. Dual redundant integrated hydraulic system, pressurised by three Vickers pumps each supplying fluid at 207 bars (3,000 lb/sq in) nominal working pressure, with flow rates of 55, 59, and 60 litres (14.5, 15.6, and 15.9 US gallons; 12.1, 13.0, and 13.2 Imp gallons)/min respectively. Hydraulic system reservoirs are of the piston load pressurised type, with a nominal pressure of 0.97 bars (14 lb/sq in).

Primary electrical system is 115/200V three-phase AC, powered by two Lucas brushless, oil-spray-cooled 45kVA generators (90kVA if Lucas Spraymat blade ice protection system fitted), with one driven by main gearbox and the other by accessory gearbox, plus a third, separately driven standby alternator. APU for main engine air-starting, and to provide electric power, plus air for ECS, without running main engines or using external power supplies. Fire detection and suppression systems by Graviner and Walter Kidde respectively. BAJ Ltd four-float emergency flotation system.

AVIONICS: Integrated avionics system of naval and military variants based on two MIL-STD-1553B multiplex databuses that link the basic aircraft management, avionics, and mission systems. Integrated avionics system of commercial variant based on ARINC 429 data transfer bus. On naval variant, main processing element of the management system is a dual redundant aircraft management computer, which carries out navigation, control and display management, performance computation, and health and usage monitoring of the principal systems (engines, drive systems, avionics, and utilities); it also controls the basic bus. On civil variant, dual redundant management system provides performance calculations and health and usage monitoring of the principal systems (as for naval variant); a flight management system providing R/Nav and navigation management is optional. Smiths Industries/OMI dual redundant digital AFCS is standard, providing fail-operational autostabilisation and four-axis autopilot modes (auto hover, auto transitions to/from hover standard on naval variants, optional on commercial and military variants). AFCS sensors on naval variant include British Aerospace LINS 300 ring laser gyro inertial reference unit (IRU), and Litton Italia LISA-4000 strapdown AHRS; IRU also provides self-contained navigation, with Racal Doppler 91E velocity sensor; Navstar Global Positioning System is optional. AFCS sensors on commercial variant include two Litton Italia LISA-4000 strapdown AHRS. Advanced flight deck incorporates standard Smiths Industries/OMI electronic instrument system (EIS) providing colour flight instrument, navigation, and power systems displays.



Basic naval ASW version of the EH 101 multi-role helicopter *(Jane's/Mike Keep)*

Other avionics on naval variants include Plessey/Elettronica PA 5015 I-band radar altimeters, GEC Avionics low airspeed sensing and air data system, MEL pilot's mission display unit, Selenia/Racal cabin mission display unit, and Selenia/Ferranti aircraft management computer. On commercial variant, standard avionics include Penny and Giles air data system, Racal intercom system, optional Collins or King/Bendix com/nav systems, optional Sperry or Bendix weather radar.

ARMAMENT AND OPERATIONAL EQUIPMENT (naval and military utility versions): Naval version able to carry up to four homing torpedoes (probably Marconi Sting Ray in RN version) or other weapons. ASW version will have 360° search radar (Ferranti Blue Kestrel in RN aircraft) in a 'chin' radome, plus dipping sonar, two sonobuoy dispensers, advanced sonobuoy processing equipment, Racal ESM, and an external rescue hoist. GEC Avionics AQS-903 ASW system and Fairey Hydraulics deck lock have been selected for Royal Navy aircraft. ASST (anti-ship surveillance and tracking) version will carry equipment for tactical surveillance and OTH (over the horizon) targeting, to locate and relay to a co-operating frigate the position of a target vessel, and for midcourse guidance of the frigate's missiles. On missions involving the patrol of an exclusive economic zone it can also, with suitable radar, monitor every hour all surface contacts within an area of 77,700 km² (30,000 sq miles); can patrol an EEZ 400 × 200 nm (740 × 370 km; 460 × 230 miles) twice in one sortie; and can effect boarding and inspection of surface vessels during fishery protection and anti-smuggling missions. ASV version is designed to carry air-to-surface missiles and other weapons, for use as appropriate, from strikes against major units using sea-skimming anti-ship missiles to small-arms deterrence of smugglers. Various duties in amphibious operations could include personnel/stores transportation, casualty evacuation, surveillance over a beachhead, and logistic support. The military tactical transport or logistic support variant can seat up to 38 troops; alternatively, palleted internal loads up to a total of 5,443 kg (12,000 lb), or external sling loads of up to 6,804 kg (15,000 lb), can be carried. Armament and self-protection systems are optional.

Troops disembarking from a mockup of the military tactical transport version of the EH 101

DIMENSIONS EXTERNAL:

Main rotor diameter	18.59 m (61 ft 0 in)
Tail rotor diameter	4.01 m (13 ft 2 in)
Length: overall, both rotors turning	22.81 m (74 ft 10 in)
main rotor and tail pylon folded (naval variant)	16.00 m (52 ft 6 in)
Width:	
excl main rotor	4.52 m (14 ft 10 in)
main rotor and tail pylon folded (naval variant)	5.49 m (18 ft 0 in)
Height:	
overall, both rotors turning	6.65 m (21 ft 10 in)
main rotor and tail pylon folded (naval variant)	5.21 m (17 ft 1 in)
Passenger door (fwd, port):	
Height	1.70 m (5 ft 7 in)
Width	0.97 m (3 ft 2 in)
Sliding cargo door (mid-cabin, stbd):	
Height	1.63 m (5 ft 4 in)
Width	1.83 m (6 ft 0 in)
Baggage compartment door (rear, port, commercial variant):	
Height	1.63 m (5 ft 4 in)
Width	0.79 m (2 ft 7 in)
Rear-loading ramp/door (rear, military/utility variant):	
Height	1.80 m (5 ft 11 in)
Width	2.11 m (6 ft 11 in)

DIMENSIONS, INTERNAL:

Cabin:	
Length: naval variant	7.09 m (23 ft 3 in)
commercial/utility variant	6.50 m (21 ft 4 in)

Max width 2.49 m (8 ft 2 in)
Width at floor 2.39 m (7 ft 10 in)
Max height 1.83 m (6 ft 0 in)
Volume: naval variant 29.0 m³ (1,024 cu ft)
commercial variant 27.5 m³ (970 cu ft)
Baggage compartment volume (commercial variant) 3.82 m³ (135 cu ft)

AREAS:
Main rotor disc 271.51 m² (2,922.5 sq ft)
Tail rotor disc 12.65 m² (136.2 sq ft)

WEIGHTS (A: naval variant, B: commercial variant, C: military/utility variant):
Basic weight empty (estimated):
A 7,121 kg (15,700 lb)
B 6,967 kg (15,360 lb)
C 7,284 kg (16,060 lb)
Operating weight empty (estimated):
A 9,298 kg (20,500 lb)
B (IFR, offshore equipped) 8,718 kg (19,220 lb)
C 8,618 kg (19,000 lb)
Max fuel weight (internal tanks only):
A 3,438 kg (7,580 lb)
B, C 3,370 kg (7,430 lb)
Max fuel weight with optional auxiliary tank:
A 4,298 kg (9,475 lb)
B, C 4,213 kg (9,288 lb)
Disposable load/payload:
A (four torpedoes) 960 kg (2,116 lb)
B (30 passengers plus baggage) 2,721 kg (6,000 lb)
C (38 equipped troops) 4,309 kg (9,500 lb)
Max T-O weight:
A 13,000 kg (28,660 lb)
or 13,530 kg (29,830 lb)
B, C 14,288 kg (31,500 lb)

PERFORMANCE (estimated):
Never-exceed speed 167 knots (309 km/h; 192 mph) EAS
Average cruising speed 160 knots (296 km/h; 184 mph)
Best range cruising speed 140 knots (259 km/h; 161 mph)
Best endurance speed 90 knots (167 km/h; 104 mph)
Range (B, estimated):
standard fuel, offshore IFR equipped, with reserves, 30 passengers 500 nm (926 km; 576 miles)
auxiliary fuel, offshore IFR equipped, with reserves, 30 passengers 625 nm (1,158 km; 720 miles)
with zero T-O distance (Category A rules) 330 nm (611 km; 380 miles)
Ferry range:
B (standard fuel, IFR equipped, with reserves) 630 nm (1,167 km; 725 miles)
B (auxiliary fuel, IFR equipped, with reserves) 800 nm (1,482 km; 921 miles)
C (standard fuel plus auxiliary tanks) 1,130 nm (2,094 km; 1,301 miles)

GATES LEARJET

GATES LEARJET CORPORATION; Tucson International Airport, PO Box 11186, Tucson, Arizona 85734, USA

GATES LEARJET 31

Gates Learjet introduced the Learjet Model 31 at the National Business Aircraft Association Convention at New Orleans, Louisiana, in late September 1987, at which time the prototype (N311DF) had completed more than 50 hours of flight testing. This aircraft combines the fuselage, eight-passenger cabin, and 15.6 kN (3,500 lb st) Garrett TFE731-2 turbofans of the Learjet 35A and 36A with a longer span wing with winglets, similar to that employed on the earlier turbojet powered Learjet Model 28 'Longhorn'.

A new feature introduced on the Learjet 31 is a pair of outward-canted ventral strakes that Gates Learjet calls Delta-Fins. Installed on each side of the lower rear fuselage, the aluminium and composite construction fins enhance directional stability at all airspeeds, and are said to be most effective at low speeds and high angles of attack where they produce lift in undisturbed airflow and exert a nose-down pitching moment as the aircraft approaches the stall. As a result, the Learjet 31 is not required to have a stick pusher system, and exhibits such improved yaw and Dutch roll characteristics that only a single yaw damper is required and is not a vital item for flight despatch.

Certification of the Learjet 31 and first customer deliveries are anticipated in the second quarter of 1988.

TYPE: Twin-turbofan light executive transport.

AVIONICS: Standard Collins avionics package comprises dual VHF-22A com with CTL-22 controls, dual VIR-32 nav receivers with CTL-32 controls, pilot's ADI-70/HSI-70 and co-pilot's AIM-510-24HG/HSI-70 flight instruments integrated with J.E.T. FC-530 autopilot, ADF-60 with CTL-62 control, DME-42 with IND-42A indicator, TDR-90 with CTL-92 control, dual Allen 3137 RMIs, dual marker beacon receivers, dual DB audio systems, Bendix RDS-81 four-colour weather radar, dual J.E.T. DN-104B compass systems, J.E.T. VG-206D vertical gyro, I.D.C. electric encoding altimeter with altitude alert and I.D.C. air data unit, co-pilot's I.D.C. barometric altimeter, dual Teledyne IVSIs, dual Davtron 877 digital clocks, dual I.D.C. Mach/IAS indicators, J.E.T. PS-835D/AI-804 emergency battery and attitude gyro, avionics master switch, and single J.E.T. yaw damper.

EQUIPMENT: Gravity flow fuel system, fuel filler screens, throttle-mounted landing gear warning mute and go-around switches, nacelle heat annunciator, dual Gill-Teledyne G-6381E high capacity lead-acid batteries, recognition light, wing ice light, emergency press override switches, transponder ident switch in pilot's control wheel, engine synchroniser and synchroscope, flap preselect, crew lifejackets, cockpit dome lights, cockpit speakers, crew oxygen masks, and fire extinguisher are standard. Cabin furnishings include a three-seat divan, four individual tracking and reclining seats, side facing seat with toilet, two folding tables, refreshment cabinet with ice chest, baggage compartment, coffee warmer, water dispenser, cup and miscellaneous storage, coat rod, forward privacy curtain, overhead panels with reading lights, indirect lighting, air vents and oxygen masks, and passenger lifejackets.

Data as for Gates Learjet 35A, except:

DIMENSIONS, EXTERNAL:
Wing span 13.36 m (43 ft 10 in)
Length overall 14.83 m (48 ft 8 in)
Height overall 3.73 m (12 ft 3 in)

WEIGHTS:
Weight empty 4,471 kg (9,857 lb)
Basic operating weight 4,652 kg (10,257 lb)
Max payload with max fuel 627 kg (1,383 lb)
Max fuel weight 1,864 kg (4,110 lb)
Max T-O weight 7,031 kg (15,500 lb)
Max ramp weight 7,144 kg (15,750 lb)
Max landing weight 6,940 kg (15,300 lb)
Max zero-fuel weight 5,715 kg (12,600 lb)

PERFORMANCE (at max T-O weight, S/L, ISA, except where indicated):
Never-exceed speed 300 knots (555 km/h; 345 mph) IAS
Max operating speed Mach 0.78
Cruising speed (typical) 400–447 knots (741–828 km/h; 461–515 mph)
Stalling speed at typical landing weight 84 knots (156 km/h; 97 mph) CAS
Max certificated ceiling 15,545 m (51,000 ft)
T-O balanced field length, FAR Pt 25 899 m (2,950 ft)
Landing distance at max landing weight 884 m (2,900 ft)
Range at econ cruising speed with four passengers, 45 min reserves:
standard fuel 1,630 nm (3,021 km; 1,877 miles)
extended range fuel 1,850 nm (3,428 km; 2,130 miles)

CCE

COLANI/COMPOSITE ENGINEERING; Josef-Baumann-Strasse 29, 4630 Bochum 1, Federal Republic of Germany

COLANI CORMORAN CCE-208

Conceived by industrial designer Luigi Colani and sponsored by the Tohshin Company of Japan, the Cormoran is a stylish four/five-seat light aircraft of which a prototype (D-EBCN) is being built by Composite Engineering in West Germany, for a planned first flight in 1988. A full size mockup was displayed at the 1987 Paris Air Show.

Powered by a 164 kW (220 hp) Porsche PFM N 03 or 182.7 kW (245 hp) PFM T 03 Turbo engine driving a three-blade pusher propeller via a carbonfibre extension shaft, the Cormoran is of all-composites construction, some 65 per cent of the structural weight consisting of carbonfibre material. Access to the cabin is via a pair of 'gull wing' doors, hinged on the centreline and opening upward. Accommodation is provided for a pilot and four passengers, with ample baggage space.

Since its appearance in Paris, the Cormoran has undergone further redesign, notably to the wings, which are now of shorter span although retaining the same gross area. According to Composite Engineering at the end of August 1987, three prototypes and eight production aircraft had been ordered at that time, and certification to FAR Pt 23 is planned for 1989.

TYPE: Four/five-seat light aircraft.

WINGS: Cantilever mid-wing monoplane, of safe-life all-composites construction (carbon/aramid/glass fibres and foam sandwich). Newly developed Wortmann wing sections, with thickness/chord ratios of 18.8% at root and 16% at tip. No sweepback. Ailerons and trailing-edge Fowler flaps are of carbonfibre/sandwich construction.

FUSELAGE: Elliptical-section all-composites structure of carbon/aramid fibre and Nomex sandwich. Carbonfibre/sandwich airbrake under rear fuselage.

TAIL UNIT: Cantilever T tail, construction as for wings and fuselage. Electric rudder and tailplane trim.

LANDING GEAR: Retractable tricycle type, with electric actuation; single wheel on each unit. Mainwheels retract inward, nosewheel forward. Mainwheels are carried on self-sprung cantilever

Gates Learjet 31 eight-passenger twin-turbofan business aircraft

The Colani/Composite Engineering Cormoran CCE-208 five-seat all-composites light aircraft in latest configuration

carbon/glass fibre legs; nosewheel on a hydraulic oleo strut. Wheel sizes 6.00-6 (main) and 5.00-5 (nose), all three having Goodyear tyres. Composite Engineering hydraulic brakes on mainwheels.

POWER PLANT: One 164 kW (220 hp) normally aspirated Porsche PFM N 03 or turbocharged 182.7 kW (245 hp) PFM T 03 engine, installed in centre-fuselage with carbonfibre driveshaft to a Hoffmann three-blade constant-speed pusher propeller aft of tail unit. NACA type flush air inlet on top of fuselage. Fuel in two 378 litre (100 US gallon; 83.15 Imp gallon) integral wing tanks, giving total capacity of 756 litres (200 US gallons; 166.3 Imp gallons). Gravity refuelling point above each tank. Oil capacity 10 litres (2.6 US gallons; 2.2 Imp gallons).

ACCOMMODATION: Fully enclosed cabin seats pilot and one passenger in front, three more passengers at rear. Baggage space, with external access, aft of engine bay. Window/door on each side, forward of wing, hinged at centreline to open upward for access to all seats.

SYSTEMS: 24V electrical system (two 24V alternators) for landing gear and trim tab actuation. Oxygen mask for each passenger in turbocharged version.

AVIONICS AND EQUIPMENT: Range of Becker or King avionics, to customer's requirements. Blind-flying instrumentation optional.

DIMENSIONS, EXTERNAL:

Wing span	12.00 m (39 ft 4½ in)
Wing aspect ratio	10.3
Length overall	8.60 m (28 ft 2½ in)
Height overall, propeller turning	3.60 m (11 ft 9¾ in)
Fuselage: Max diameter	1.38 m (4 ft 6⅓ in)
Tailplane span	4.50 m (14 ft 9¼ in)
Wheel track	3.00 m (9 ft 10 in)
Wheelbase	2.75 m (9 ft 0¼ in)
Propeller diameter	2.50 m (8 ft 2½ in)
Cabin doors (each):	
Height	1.00 m (3 ft 3¼ in)
Width	0.90 m (2 ft 11½ in)
Baggage door (rear):	
Height	0.60 m (1 ft 11½ in)
Width	0.55 m (1 ft 9¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.40 m (7 ft 10½ in)
Max width	1.28 m (4 ft 2½ in)
Max height	1.10 m (3 ft 7¼ in)
Baggage compartment volume	0.70 m³ (24.7 cu ft)

AREAS:

Wings, gross	14.00 m² (150.7 sq ft)
Horizontal tail surfaces (total)	3.00 m² (32.29 sq ft)

WEIGHTS AND LOADINGS

(A: 220 hp, B: 245 hp):	
Weight empty, standard: A	795 kg (1,753 lb)
B	825 kg (1,819 lb)
Max fuel:	
A, B	544 kg (1,199 lb)
Max payload	630 kg (1,389 lb)
Max T-O weight: A, B	1,500 kg (3,307 lb)
Max landing weight	1,425 kg (3,141 lb)
Max wing loading:	
A, B	107.1 kg/m² (21.94 lb/sq ft)
Max power loading:	
A	9.49 kg/kW (15.6 lb/hp)
B	8.21 kg/kW (13.5 lb/hp)

PERFORMANCE (estimated, at max T-O weight with normally aspirated N 03 engine):

Never-exceed speed	270 knots (500 km/h; 311 mph)
Max level speed at 5,490 m (18,000 ft)	245 knots (454 km/h; 282 mph)
Max cruising speed (84% power) at 5,490 m (18,000 ft)	230 knots (426 km/h; 265 mph)
Econ cruising speed (70% power) at 5,490 m (18,000 ft)	214 knots (396 km/h; 246 mph)
Stalling speed:	
flaps up	65 knots (121 km/h; 75 mph)
flaps down	55 knots (102 km/h; 64 mph)
Max rate of climb at S/L	393 m (1,290 ft)/min
Service ceiling	7,620 m (25,000 ft)
T-O to 15 m (50 ft)	453 m (1,486 ft)
Range at 2,440 m (8,000 ft):	
with four passengers and 100 kg (220 lb) of baggage, cruising at 188 knots (348 km/h; 216 mph)	1,477 nm (2,737 km; 1,701 miles)
with one passenger only, cruising at 214 knots (396 km/h; 246 mph)	3,577 nm (6,629 km; 4,119 miles)

This photograph of the cockpit of the CCE-208 emphasizes the pilot's excellent field of view

HARBIN

HARBIN AIRCRAFT MANUFACTURING CORPORATION; Harbin, Heilongjiang Province, People's Republic of China

HARBIN SH-5

Since the description in the October 1987 *Jane's Supplement* was written, further (and official Chinese) details of this maritime patrol/ASW amphibian have become available. Its Chinese name is **Shui** (not Sui) **Hongzhaji-5**, or **Shuihong-5** for short, and it is now in operational service with the PLA Naval Air Force at Tuandao, Shandong Province. Design work began in 1969, the first prototype was rolled out in 1971, and the first flight was made on 3 April 1976.

Avionics and operational equipment include an inertial navigation system, air data computer, radio altimeter, radio compass, and Doppler radar. The SH-5 is, as stated previously, equipped also with MAD and sonobuoys. Armament includes two C-101 anti-shipping missiles, carried on the inboard underwing pylons. The C-101, currently under development by CPMIEC, employs an active radar seeker and has a sea skimming attack profile. It is powered by two ramjets and a tandem solid rocket booster; overall length of the missile, including the booster, is about 6 m (19 ft 8 in). Other armament can include lightweight anti-submarine homing torpedoes, depth charges, mines, and bombs.

The SH-5 carries a crew of eight and is also somewhat larger than originally estimated. Revised data are as follows:

DIMENSIONS, EXTERNAL:

Wing span	36.00 m (118 ft 1¼ in)
Wing aspect ratio	9.0
Length overall	38.90 m (127 ft 7½ in)
Height overall	9.79 m (32 ft 1½ in)
*Span over tail-fins	11.40 m (37 ft 4¾ in)
*Wheel track	3.70 m (12 ft 1¾ in)
*Wheelbase	10.50 m (34 ft 5½ in)
*Propeller diameter	3.80 m (12 ft 5½ in)

AREA:

Wings, gross	144.0 m² (1,550.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped:	
SAR and transport	less than 25,000 kg (55,115 lb)
ASW	26,500 kg (58,422 lb)
Fuel weight (max)	16,500 kg (36,376 lb)
Max internal weapons load	6,000 kg (13,228 lb)
Max payload (bulk cargo)	10,000 kg (22,045 lb)
Normal T-O weight	36,000 kg (79,366 lb)
Max T-O weight	45,000 kg (99,208 lb)
Wing loading:	
at normal T-O weight	250.0 kg/m² (51.2 lb/sq ft)
at max T-O weight	312.5 kg/m² (64.0 lb/sq ft)
Power loading:	
at normal T-O weight	3.31 kg/kW (5.44 lb/ehp)
at max T-O weight	4.14 kg/kW (6.80 lb/ehp)

*estimated

PERFORMANCE:

Max level speed	299 knots (555 km/h; 345 mph)
Max cruising speed	243 knots (450 km/h; 280 mph)
Min patrol speed	124 knots (230 km/h; 143 mph)
T-O speed (water)	87 knots (160 km/h; 100 mph)
Landing speed (water)	92 knots (170 km/h; 106 mph)
Service ceiling	7,000 m (22,965 ft)
T-O run (water)	548 m (1,798 ft)
Landing run (water)	240 m (788 ft)
Max range	2,563 nm (4,750 km; 2,951 miles)
Endurance (2 engines)	12 to 15 h

Full scale mockup of the PZL-126 Mrówka sprayplane

WSK-PZL WARSZAWA-OKECIE

WYTWÓRNIA SPRZETU KOMUNIKACYJNEGO-PZL WARSZAWA-OKECIE (Transport Equipment Manufacturing Centre, Warsaw-Okecie); Al. Krakowska 110/114, 02-256 Warszawa-Okecie, Poland

PZL-126 MRÓWKA (ANT)

Design of this very small agricultural aircraft, and of an innovatory new airborne spraying system, was initiated in the late 1970s by Dipl Eng Andrzej Slocinski of PZL Warszawa-Okecie, who remains in charge of the Mrówka programme today. Its propeller, rear fuselage, and parts of the landing gear were designed by students of the factory's training college. Preliminary design was completed in late 1982, and initial design work in the second quarter of 1983, but original plans for a first flight in 1985 were revised pending a reappraisal of the project. One reason for this was the unavailability at that time of production PZL-F (Franklin) engines; it was also felt that the proposed use of many components from other existing production Polish aircraft might not be as satisfactory as was thought, and that more effort should also be expended in perfecting the new agricultural equipment. However, by the Autumn of 1985 the project was sufficiently advanced for a full-size mockup to be built and exhibited at the Olsztyn agricultural aviation exhibition. Construction of three prototypes has now begun, and the first of these was due to fly in the second half of 1987.

As now configured, the PZL-126 design meets the requirements of FAR Pt 23 (USA) and CAR Section K (UK). It can be dismantled quickly for long-distance transportation in the cabin of an An-2 biplane, or can be towed on its own landing gear by a light all-terrain vehicle. Landing gear is normally of tricycle type, with a 'taildragger' gear available optionally. Another option to be tested on the prototypes is a wing with full span flaps, airbrakes, and spoilers, instead of the basic slotted flaps plus 'flaperons' system. The dedicated agricultural spray system is in the form of vaned and pressurised wingtip pods of chemical, attached by quick-fastening locks to facilitate rapid replacement of empty pods by full ones. A special retractable device for spreading biological agents is installed in the fuselage underside aft of the cockpit. (Further details of individual dispersal systems are given in the 'Equipment' paragraph.)

The primary use intended for the Mrówka is as an economical small aircraft for use on farms and smallholdings, but it is considered suitable also for patrol and liaison missions (*e.g.*, for detecting/controlling forest fires, identification of diseased vegetation, and monitoring areas of polluted land and water).

TYPE: Single-seat light agricultural and general purpose aircraft.

WINGS: Cantilever low-wing monoplane, of constant chord and NASA GA(W)-1 wing section. Single-spar metal structure, with trailing-edge single-slotted flaps inboard and 'flaperons' outboard. Some components of glassfibre/epoxy construction. Alternative wings with full span flaps, airbrakes, and spoilers also to be tested.

FUSELAGE: Conventional metal semi-monocoque structure, built in two portions. Some elements constructed of glassfibre/epoxy composite material.

TAIL UNIT: Cantilever all-metal structure, comprising rectangular fin and rudder and low-set tailplane with one-piece elevator. Trim tab on rudder and starboard half of elevator.

LANDING GEAR: Non-retractable tricycle gear standard. Cantilever self-sprung mainwheel legs; shock absorber in nosewheel unit. Mainwheels fitted with differential hydraulic disc brakes. Tailwheel configuration optional.

POWER PLANT: One 44.7 kW (60 hp) PZL-F 2A-120-C1 flat-twin engine, driving a two-blade fixed-pitch wooden propeller with spinner. (Interchangeable propellers for agricultural flying or patrol mission.) Integral fuel tanks in wing torsion box.

ACCOMMODATION: Single adjustable reclining seat under one-piece moulded canopy. Seat and canopy taken from SZD-51 Junior sailplane.

SYSTEMS: Hydraulic system for mainwheel brakes only; 12V DC electrical system.

AVIONICS: VFR instrumentation standard, plus 720-channel UHF com, 10-channel radio telephone, and radio navigation equipment.

EQUIPMENT: Dedicated system for spraying with low volume liquid chemicals (pyrethroids) consists of a 25 litre (6.6 US gallon; 5.5 Imp gallon) pod at each wingtip. Spraying is controlled electrically by a push-button on the throttle lever and effected by dispersing the liquid under pressure via an atomiser at the rear of each pod. An area of 25 ha (61.8 acres) can be covered with one pair of full pods. Biological agents, such as the eggs of the Trichogramma wasp, are carried in capsules in a paper tape wound on a reel that is housed in the lower fuselage behind the cockpit and extended through an openable hatch in the floor. One spreader holds a 3 kg (6.6 lb) package of eggs, on four reels, and at a drop rate of four capsules every 50 m (164 ft) can cover an area of 800 ha (1,977 acres) on a single loading. Like the spray system, the spreader's actuation is electrical, by means of a push-button on the throttle lever. Other equipment can include cameras and first aid appliances.

DIMENSIONS, EXTERNAL:

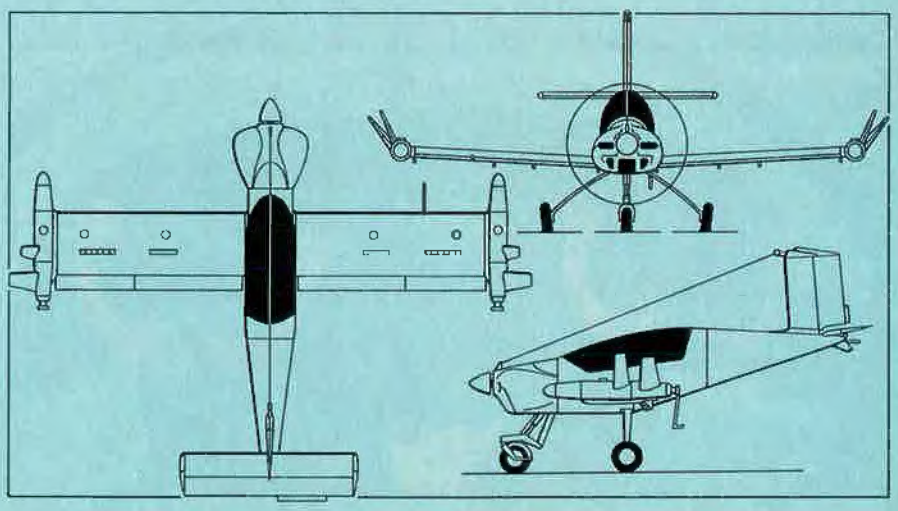
Wing span (excl spraypods)	5.00 m (16 ft 4¼ in)
Length overall	4.75 m (15 ft 7 in)
Height overall	2.60 m (8 ft 6½ in)

WEIGHTS:

Weight empty (without agricultural equipment)	230 kg (507 lb)
Max T-O and landing weight	375 kg (827 lb)

PERFORMANCE (estimated):

Operating speed:	
agricultural mission	65–86 knots (120–160 km/h; 74–99 mph)
patrol mission	65–108 knots (120–200 km/h; 74–124 mph)
Stalling speed (depending on equipment)	41–46 knots (76–84 km/h; 48–53 mph)
Max rate of climb at S/L at max T-O weight	186 m (610 ft)/min
T-O run	142 m (466 ft)
T-O to 15 m (50 ft)	282 m (926 ft)
Swath width (spraying)	13 m (43 ft)
Endurance (patrol mission)	6 h



PZL-126 Mrówka small agricultural aircraft *(Jane's/Mike Keep)*

Airman's Bookshelf

Mules and Sharks

Whittle: The True Story, by John Golley (with technical assistance from Bill Gunston). Foreword by Felix C. Lowe. Smithsonian Institution Press, Washington, D. C., 1987. 272 pages with illustrations, appendices, bibliography, and index. $24.95.

The biography of Sir Frank Whittle is less the story of the taming of a tiger—the development of the jet engine—than it is the story of political mules and corporate sharks, two beasts that at first stymied and then stifled Whittle's efforts.

It is a wonder Sir Frank, now eighty and living in Columbia, Md., does not have a flat forehead—he certainly had the opportunities to beat his head against the wall during the late 1930s and early 1940s when the first engines were developed and built.

Whittle was met with adversity at every turn from the time he first proposed the turbojet engine in 1928 to when his company, Power Jets Ltd., was nationalized in 1946, and he was squeezed out of taking an active role in further engine development.

Sir Frank paid dearly for being the "father of the jet engine." He suffered three nervous breakdowns, including one that took him more than a year and a half to recover from, that ultimately forced him to resign from the Royal Air Force. He received several large monetary awards—"prizes" mostly after his career was over—but he never shared in any of the monetary rewards from his invention that revolutionized aviation.

Not that he really wanted commercial profits or wide acclaim (which came only at the end of his direct involvement with jets). Sir Frank was a serving RAF officer during the whole development effort, and he was filled with a strong sense of duty. He knew he was doing something to help his country win World War II and that would have great applications later.

He and his invention easily impressed the movers and shakers—USAAC Gen. H. H. Arnold, who, after viewing a demonstration in 1941, moved quickly to have Whittle's W.1X engine shipped to the US to begin jet development here, or Winston Churchill, who, in 1942, after seeing a Gloster Meteor (the first production RAF jet fighter) easily outclass a Supermarine Spitfire, asked why jet-engine development had not been given a greater emphasis.

Overcoming the mechanical hurdles was hard enough, but what proved most frustrating to Whittle were the bureaucrats.

In 1929, Whittle's idea of using a turbojet engine to power a high-altitude, high-speed mailplane (which he had first envisioned while at the RAF College in Cranwell more than a year earlier) was damned with faint praise by Dr. A. A. Griffith. Griffith, a noted academician, was working on what became turboprop engines and was in no mood to endorse what he clearly saw as a viable competitor. This was the first of many similar incidents.

Whittle was eventually put on the RAF's Special Duty list and was allowed to develop the engine as part of a strictly private venture—Power Jets Ltd. The British government still did not think a practical jet could be built, and neither did the company forging the parts for the engine.

Whittle had to fight round after round with British Thompson-Houston over what he wanted. Whittle would design a part, such as a turbine blade, to an exact specification, and the mechanics at BTH would build it completely different. BTH felt that no upstart engineer could possibly know what he was talking about—even after Whittle graphically showed that the way BTH had been building turbines for many years was inefficient and just plain wrong.

Despite the handicap of a recalcitrant subcontractor, the first jet engine, the WU (Whittle Unit), was built and was started on April 12, 1937. The engine ran out of control on that test (and the next four, too), but the principle worked.

What followed was one of the largest outpourings of apathy ever recorded. Whittle had to rebuild the WU several times because he wasn't allowed to forge parts to build new engines. Eventually, though, interest started growing (slowly), and Gloster was given a contract for the E.28/39, which first flew in 1941. Because of delays (a number mechanical, but a greater number bureaucratic), the E.28/39 was not the first jet aircraft to fly—that honor fell to the Heinkel He-178 in Germany.

In the beginning, Power Jets had been led to believe, when limited government monies started flowing, that the company would develop the engine and then would compete with BTH to build production engines. As time wore on, though, it became increasingly clear that Power Jets would be the developer only. Late in the development effort, Rolls-Royce entered the picture. Whittle got on better with RR engineers than he did with those at BTH, but Rolls-Royce eventually grew to dominate both the further development effort and the market.

With an active-duty officer serving as the head of Power Jets, a private company, it became much harder, as development progressed, for the company to operate as a private entity after the government declared the jet engine a wartime secret.

This awkward situation led to a very narrow role for Power Jets, and the company was nationalized in 1946. It then operated as a research and development office only. When it appeared that Power Jets (R&D) wasn't going to have any influence at all, most of the original Power Jets engineering team, including Whittle, resigned *en masse*. They had had enough.

Whittle was knighted and won much fame after hanging up his uniform in 1948. He became a sought-after lecturer and consultant, finally immigrating to the US in 1976 and becoming a research professor at the US Naval Academy.

While it may seem that *Whittle: The True Story* is only about Sir Frank's efforts to get through problems apart from engine development, the book

also talks at great length about how Power Jets actually got the jet engine to work. The book wanders occasionally into the overly technical on this point, but these sections are not so numerous as to slow the narrative.

The book is a quality profile of a brilliant engineer. If there is a criticism of this work, it is that author Golley tends to paint Sir Frank in angelic hues. Whittle is portrayed as always being in the right, even when it appeared that he might have been the one who was obstinate and an impediment to progress.

Whittle: The True Story is an interesting and worthwhile book, but is somewhat depressing because of all the political backbiting and bureaucratic obstacles that confronted Sir Frank. By the end of the book, the reader wants to go out and find a petty bureaucrat to kick in the pants. It is a good thing, however, that Sir Frank didn't.

—Reviewed by Jeffrey P. Rhodes, Aeronautics Editor.

Eagles All

Makers of the United States Air Force, edited by John L. Frisbee. Published by the Office of Air Force History; available from Superintendent of Documents, US GPO, Washington, D. C. 20402, 1987. 347 pages with illustrations. $13.

There have been several major books written about the key roles played by such daring and dedicated Air Force leaders as Hap Arnold, Tooey Spaatz, Billy Mitchell, and Ira Eaker. Realizing that it took more than a handful of leaders to ensure the creation, growth, and success of the Air Force, the Air Force Historical Foundation, in support of the USAF Warrior Studies series, decided to produce this anthology, which profiles twelve individuals whose work marked major milestones in the history of military aviation. These twelve officers, it was agreed, best represented a cross section of Air Force leadership in the last half century.

John F. Shiner, in "In the Beginning," outlines the career of aviation pioneer Benjamin D. Foulois. The Army's only active pilot in 1910, "Benny" was slight of stature, outspoken, combative, often impetuous, and seldom diplomatic. These characteristics endeared Benny to Army flyers and the public, but not always to his military and civilian superiors. He became Chief of the Air Corps in 1931 and supervised much progress for the small air force. When he retired in 1935, there was no ceremony or medal for the man who had done so much for US military aviation.

"Marshall's Airman" was Frank M. Andrews, writes DeWitt S. Copp. But General Andrews crashed in a B-24 in foggy weather in Iceland on May 3, 1943—a shattering loss, since he had just been named as commanding general of the newly formed European Theater of Operations. His story is one of forward thinking in a time of rigidity and one that will always be remembered when the subject is strategic airpower and the fight for air independence.

Haywood S. Hansell, Jr., chronicles the career of Harold L. George, the "Apostle of Air Power." Commander of the World War II Air Transport Command, Harold George added to airpower a new element of global strategic mobility and proved a farsighted and courageous prophet and a curator of strategic air concepts, doctrine, and plans. Tooey Spaatz wrote to George, "Your progressiveness and imagination led to the development of a plan for the air war in Germany, which was so sound that it was utilized as the basic plan."

As told by Murray Green, Hugh J. Knerr, who swept up in Orville Wright's bicycle shop at the age of ten, relied on "The Pen and the Sword" in his advocacy of airpower. Open cockpits on bombers, the court-martial of Billy Mitchell, and Army airmail operations are just a few of the many subjects on which he wrote with conviction and insight. In retirement, he continued to write prolifically on military aviation. Knerr was called out of retirement to serve as the first Inspector General of the Air Force.

Herman S. Wolk calls George C. Kenney "The Great Innovator," and Kenney certainly fits the description. Unimpressed with his own rank or anyone else's, his motto was, "Hell, let's try it." Kenney's career spanned two world wars, stretching from the era of the Wright brothers to that of the atomic Air Force. A determined and eloquent champion of air independence, he played an important role in the establishment of the Air Force.

In "All the Way to Berlin," Paul F. Henry presents the reader with a scrapper—William E. Kepner. World War II reporters loved to write about the feisty Kepner. Kepner figured prominently in the Air Corps's brief flirtation with airships, and he went on to become an early explorer of the stratosphere and a stout defender of fighter aviation. His innovations as head of VIII Fighter Command during World War II played a major part in the defeat of the Luftwaffe.

John Schlight profiles Elwood R. Quesada in "Tac Air Comes of Age." During his twenty-six-year career, Elwood "Pete" Quesada dealt with most of the issues associated with the growth of American airpower. In the years before World War II, the airplane had yet to become fully assimilated into America's military mainstream. Quesada was one of a small group of visionary men in the Army's aviation branch who worked for the recognition of the airplane's military potential.

"Building the New Air Force," says Noel F. Parrish, was the daunting task that faced Hoyt S. Vandenberg, the first full-term Chief of Staff of the newly independent Air Force. Though Vandenberg knew full well that he was not the founder, he was destined to lay the foundation for the new service. His steadiness and powers of persuasion served him well in this endeavor, and today's Air Force still bears his mark.

Benjamin O. Davis, Jr., faced "History on Two Fronts," writes Alan L. Gropman. As a cadet at West Point, Davis suffered four years of "silence" because of his race. But he endured to graduate thirty-fifth in a class of 276. He served as leader of the first flying training class at Tuskegee Army Air Field and went on to compile an impressive war record. His example contributed to the end of segregation in the Air Force—a reform of incalculable benefit.

Donald J. Mrozek describes how Nathan F. Twining brought "New Dimensions" to the postwar Air Force. As the first Air Force officer appointed Chairman of the Joint Chiefs of Staff, Twining contributed to the building of the bomber force that became the backbone of early postwar deterrence. He also underscored the importance of the ICBM program and contributed to the evolution of the military administration system in the Pentagon.

Bernard A. Schriever never shrank from "Challenging the Unknown," writes Jacob Neufeld. He is linked most closely with the postwar development that reshaped the world balance of power—the development of the nuclear-tipped ballistic missile. Schriever contributed mightily to the research, development, and acquisition of the modern weapons that

came into the Air Force in the 1950s and 1960s.

In his incredible saga of a fighter pilot's fighter pilot, T. R. Milton describes "The Indispensable Ingredient" that caused Robinson Risner to stand out among his peers. Risner, who received the first-ever Air Force Cross and who appeared on the cover of *Time* magazine, served seven years in purgatory as a recalcitrant prisoner of the North Vietnamese. You will be out of breath when you finish reading his story.

Under the steady editorial hand of John L. Frisbee, former Editor of AIR FORCE Magazine, this book fulfills its mission of acquainting readers with these twelve distinguished airmen who contributed so much to this nation's Air Force. AFAers will be proud to note that the Association's affiliate, the Aerospace Education Foundation, furnished one of the two grants that helped to underwrite this worthwhile effort.

I recommend this book without hesitation to both the serious student and the casual reader, who are certain to be inspired by the examples of these makers of the United States Air Force.

—Reviewed by Richard H. Becker. Mr. Becker is a National Director of the Air Force Association.

New Book in Brief

The Iran-Iraq War and Western Security 1984–87, by Anthony H. Cordesman. The Gulf War, now dragging into its eighth year with no end in sight, is, as the author stresses, "of critical importance to Western security." Prominent among Western concerns are the flow of oil from the Gulf, Soviet intentions in the area, and the fissiparous effects of the war on the entire Middle East. Author Cordesman navigates gingerly through this "war of lies" to present as clear a picture of the fighting as is possible and ventures several policy prescriptions for the West. The "best outcome" of the war for the West is clear, he believes: The preservation of "the present national structure of Iran and Iraq, without one side dominating the other." But even if Western policy engenders this best-case scenario, the author warns that so long as the West tolerates a long-term dependence on imported oil, "no regional policy can ever provide it with the degree of security it needs." With charts and maps, chronology, bibliography, and index. A RUSI Military Power Book/ Jane's Publishing Inc., New York, N. Y., 1987. 185 pages. $28.

Valor

A Place Called the Doumer Bridge

Former X-15 pilot Col. Bob White led the first strike against the most heavily defended target in North Vietnam.

BY JOHN L. FRISBEE
CONTRIBUTING EDITOR

ROLLING Thunder, the JCS strategic plan for eliminating ninety-four high-value targets in North Vietnam, was prepared early in 1965. But the plan was orchestrated timidly by Washington officials who feared Chinese intervention and believed the war would be won in the South. Single targets were released from time to time, but most were south of the twentieth parallel.

The big one that Air Force crews wanted to get was the Paul Doumer Bridge at Hanoi, a railroad and highway span more than a mile long but only thirty-eight feet wide. Over it passed an average of twenty-six trains a day and many trucks, carrying more than 6,000 tons of supplies to enemy forces in South Vietnam and Laos.

That key link in Hanoi's logistic systems was surrounded by AA guns ranging from 37-mm to 100-mm, automatic weapons, SA-2 SAMs, and MiGs at nearby fields.

At 1000 hours on August 11, 1967, the 355th Tac Fighter Wing at Takhli, the Korat-based 388th, and the 8th at Ubon received long-awaited orders to hit the bridge—not tomorrow, but *that afternoon*. The 355th would lead the strike force with Col. Robert M. White, Deputy Commander for Operations, as mission commander.

Colonel White's credentials were impeccable. He had flown P-51s in Europe during World War II and fighters in the Korean War and had piloted the experimental X-15 to a record altitude of 59.6 miles and a speed of 4,093 miles an hour. For his X-15 flights, he was awarded both the Harmon and Collier Trophies and NASA's Distinguished Service Medal.

Recalling the events of August 11, Colonel White, now a retired major general, said: "The intensity in the 355th rose to a higher level than I had seen since joining the wing." Everyone, knowing full well the risks, wanted to go to that superdefended target. Three squadron commanders who had not been on the day's schedule volunteered to lead flights. But a miracle of mission planning and preparation had to be worked in the short time before takeoff.

The wing's F-105s, to take only one example, had been configured with 750-pound bombs for the previously assigned mission. Tanks had to be changed and 3,000-pound bombs substituted—normally an hour's work per aircraft. It was completed in about twenty minutes for each plane by waiving regulations against arming and refueling simultaneously. "You'd have [had] to be there to understand" how the support people and planners did what seemed impossible when the mission order came in, says General White.

Start-engines was at 1350 hours. At 1418, the strike force started to roll. It was clear skies all the way, target time 1558. After refueling over Laos, the F-105s, preceded by their Wild Weasel and flak-suppression flights, crossed the Red River and headed southeast along Thud Ridge toward Hanoi. As they approached the bridge, they were met by MiGs in a head-on attack that failed.

Moments later, Colonel White rolled into his bomb run from 13,000 feet. In the seconds before bomb release at 8,000 feet, he and the pilots who followed held the intense concentration demanded for accurate bombing, flying into a highly visible barrage of flak and several SAM launches. But the experience of those veterans paid off as the 3,000-pounders blossomed below.

The leader of the second flight looked back. They had done it! A span of the railroad bridge lay in the water. A few minutes later, the other two wings dropped two spans of the highway bridge. Thanks to the outstanding work of the Weasel and flak-suppression flights, the entire force made it safely home or to friendly bases.

After bomb release, Colonel White broke hard to the left, down the Red River, then led the force west, low and fast across a plain to hills twenty miles away, rather than withdrawing along Thud Ridge as mission planners had recommended. His judgment proved correct. No one was hit on the way out. The entire mission had been a textbook demonstration of professionalism.

The following morning, at the suggestion of newly arrived 355th Commander Col. John Giraudo, Colonel White trooped the line with a large blow-up of the downed bridge "to show the people who worked so hard to ready the aircraft how their efforts paid off." It was a team victory.

For his leadership of the strike force, Colonel White was awarded the Air Force Cross. The same decoration went to 8th Wing Commander Col. Robin Olds; Col. James McInerney, leader of the Weasels, and his EWO, Capt. Fred Shannon; and Lt. Col. Harry Schurr, Commander of the 469th Squadron.

That first of many attacks on the Paul Doumer Bridge will always hold for Colonel White a special place among the seventy combat missions he flew in Southeast Asia. It wasn't just another rail or road cut south of the twentieth, but "a real target that, once hit, would hurt the enemy and help our people in the South."

That mission was what tacair and professionalism and valor are all about. ■

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Intercom

By Robin Whittle, ASSISTANT TO THE EXECUTIVE DIRECTOR FOR COMMUNICATIONS

The AFA White Paper

Reports are still arriving on the reaction to AFA's white paper, "What Deep Cuts to Defense Would *Really* Mean," published last November 6. The paper described in detail how pending cuts to the FY '88 defense budget would translate into specific impact on forces, capabilities, and people. It also demonstrated with charts and numbers that defense spending was not responsible for the rise of the federal deficit.

AFA field organizations worldwide used the white paper to support their messages to elected officials, community leaders, and the news media, explaining why radical reductions to defense would endanger the nation's ability to field and sustain an adequate military force.

"It is particularly gratifying to me to see our field leaders seize the opportunity to make the case for the Air Force, particularly at such a critical juncture," said AFA President Sam E. Keith, Jr. "This is what AFA is in business to do, and we intend to do more of it. If there ever was a need for AFA to act, it is now."

President Keith had directed the staff to prepare the white paper when signs of trouble appeared on the budget horizon and said that it should be ready in time for presentation at a November 6 meeting of AFA state presidents and regional vice presidents in Washington, D. C. Giving the task a priority effort, the staff completed the paper a few hours before the deadline. Nearly all of the regional leaders at the meeting wrote to their Senators and congressmen on the spot. Many called their chapters to alert them that a special report was on the way.

Members had hundreds of letters in the mail within a few days, with many more sent in the week ahead, but the honor for fastest action probably belongs to National Treasurer William N. Webb of Midwest City, Okla. He went directly from the meeting to Capitol Hill, where he presented copies of the white paper in person to the Oklahoma delegation.

Since the main work of disseminating the paper was carried out by field units, AFA headquarters does not have a complete tally of usage or results. Sample clippings and copies of letters that members received from their congressmen indicate, however, that chapters put their muscle into the effort. AFA President Keith further says that he has had numerous letters from Air Force and defense leaders thanking AFA for its actions on this issue. The white paper was cited in a front-page article on December 17 by the Washington *Times*.

Arkansas AFA President Bud Walters, in Washington on November 6, sent copies of the paper by overnight mail to the Blytheville *Courier News*, whose editor, Jim Waller, gave it front-page coverage in connection with a forthcoming visit by AFA President Keith to Blytheville. *Courier News* reporter Michelle Doi wrote another article the following day. The newspaper also used material supplied by Blytheville Chapter President Bill Jefferies to tell its readers about AFA and its work.

AFA Board Chairman Marty Harris and Florida State President Roy Whitton sent in a clipping from the Orlando *Sentinel*, in which Charley Reese drew on the white paper for a column headed "Stop Skimping on Defense Needs While Enemies Grow Strong."

Minnesota AFA President Earl Rogers took the paper to the Duluth *Budgeteer*, whose Dick Palmer reported on it in a page-one article entitled "Budget Defense Cuts Alarming." "AFA Fights Cuts" was the headline above New Jersey President Bob Gregory's letter that appeared in the McGuire AFB *AirTides* and in the New Egypt *Press*.

Pennsylvania AFA Vice President Ron Chromulak used the white paper for an opinion piece in the Mon Valley *Independent* that was headed "Valley Would Be Affected by Cuts in Defense Budget." (The white paper showed how the economic impact of a defense reduction would be felt, state by state.) Mr. Chromulak pointed out that thousands of companies within a short radius of the Valley have federal contracts, most of them concerned either directly or indirectly with defense, and many would be affected.

New York AFA President Gerald Hasler, a former AFA National President and Board Chairman, distributed copies throughout his state and says that top business, civic, and congressional people have heard the message from New York AFA. In Illinois, AFA State President Glen Wensch decided that broader circula-

New Directory of AFA Life Members

AFA's 30,000-plus Life Members will be the subject of a new comprehensive volume to be handled by Harris Publishing Co. of White Plains, N. Y., which does the Yale Law School Alumni Directory, among other prestigious volumes.

The AFA Life Member Directory will provide current biographical data, including name, address, spouse's name, current military status, occupation, firm name, business address, and telephone numbers. Scheduled for release in February 1989, the new directory will be a valuable tool for locating and contacting other AFA Life Members around the country. It will be easy to use because of its alphabetical and geographical listings.

Watch for a special questionnaire that will go to all AFA Life Members this coming May. If you are not a Life Member now but would like to be listed, simply sign up as a Life Member by June 30, 1988. The directory will be compiled and printed at no cost to AFA. Expenses incurred by Harris Publishing are covered through directory sales to AFA members only. At the completion of the project, AFA will be receiving a thoroughly updated Life Member file and a few complimentary books for its permanent records. So it's a great deal all around.

Watch for the questionnaire. Participation is strictly voluntary. For more information, contact AFA headquarters.

The Peace River Chapter in Florida was recently chartered as one of AFA's newest chapters at a ceremony that included, from left, Florida AFA President Roy Whitton, then-National Vice President for the Southeast Region H. Lake Hamrick, Chapter President Joe Musil, and Florida AFA Operations Director Jack Rose.

tion was in order and so duplicated enough copies for every AFAer in the state.

For Washington AFA, the publication of the white paper coincided perfectly with an appearance before the Greater Seattle Chapter by Brig. Gen. John R. Allen, Jr., Vice Commander of the Sacramento Air Logistics Center, whose speech topic was "Defense Spending: What Are We Really Cutting?"

In Texas, AFA leaders Bryan Murphy, Ollie Crawford, George Weinbrenner, and others forwarded the white paper to members of the Texas delegation in Congress. Glen Martin used the paper as the basis for a column in the San Antonio *Express-News*. Maine AFA President Alban Cyr reports that "our writing to our congressmen and state senators certainly drew congressional attention."

Others who worked the white paper with effective results—with more reports coming in all the time—were Ohio AFA President Cecil Hopper, National Director Phil Saxton, and National Vice Presidents Ed Monaghan of the Northwest Region, Jim LeBlanc of the South Central Region, Don Adams of the Midwest Region, Paul Markgraf of the North Central Region, and Joe Falcone of the New England Region.

Fred Musi Retires as AFA Comptroller

December 31 was Fred Musi's last day as AFA's Assistant Executive Director/Comptroller, ending a twenty-three-year career that indirectly dates back to 1948. As a junior accountant with Aaron Fuchs & Co., AFA's independent outside auditor located in New York City, Fred was assigned the AFA account.

Sixteen years later, he joined the AFA staff and shortly thereafter became AFA's Comptroller. He quickly became an indispensable senior executive, serving as AFA's Acting Deputy Executive Director for an interim period in the early 1980s. A Certified Public Accountant and member of the New York State Society of CPAs, Fred's accounting acumen has ensured AFA's financial health.

This fact was underscored when AFA's current Treasurer, Bill Webb, and all former treasurers gathered to honor Fred at a retirement party on December 11. Members of AFA's Executive and Finance Committees, in town for meetings, joined current and former AFA staff personnel for a "roast" and tribute to Fred's contributions to the Association over the years.

AFA's longtime Assistant Executive Director/Comptroller, Fred Musi, has retired after a twenty-three-year career with the Association.

AFA's Board of Directors sponsored Fred as both a Gen. Jimmy Doolittle Fellow and Gen. Ira Eaker Fellow of AFA's Aerospace Education Foundation, and these honors were presented at the retirement party along with a gift to Fred's wife, Sarah, who attended with son Phil. (Their other son, Christopher, who resides in upstate New York, could not attend.)

That weekend, during the Dallas Cowboys vs. Washington Redskins football game, son Phil had arranged for the scoreboard to flash "Happy Retirement, Fred Musi" three times during the game. AFA National President Sam Keith, Jr., and his wife, Mary Sue, attended the game with the Musis.

Currently, Fred is serving as a consultant to AFA.

Pat Muncy Retires from AFA

Also retiring December 31 was Patricia Muncy, AFA Assistant Executive Director/Administration. Pat joined AFA in 1962 as Secretary to the Director of Military Relations. She served as Military Affairs Editor for AIR FORCE Magazine prior to leaving AFA for a position on Capitol Hill as Administrative Assistant to Rep. Robert Mollohan (D-W. Va.).

Another AFA national staffer who has retired is Patricia Muncy. Ms. Muncy was AFA's Assistant Executive Director for Administration.

AFA recruited her back six years la-

Tennessee's Lt. Gen. Frank M. Andrews Chapter hosted an installation ceremony for new Chapter officers last fall. Among those present for the ceremony were, from left, outgoing Chapter President Hugh D. Perry, AFA Under-Forty National Director and Chapter Secretary Dan Callahan III, Chapter President Pat Maxwell, attorney and Chapter guest speaker James W. Price, Jr., AFA Man of the Year and former Tennessee State AFA President Jack Westbrook, and AFA National Director and former AFA Board Chairman Dan Callahan II.

New York State AFA President Gerry Hasler recently served as master of ceremonies at a brunch sponsored by AFA's Nassau-Mitchel Chapter and Queens Chapter. Proceeds from the brunch benefited the Aerospace Camp of Long Island.

ter to serve as Executive Secretary to Executive Director Jim Straubel. Subsequently, she was promoted to Director of Administrative Services and finally to Assistant Executive Director/Administration in May 1982.

A joint Life Member of AFA/AEF, Pat is affiliated with the Roanoke, Va., Chapter.

On the Scene

Under-Forty National Director **Dan Callahan III** reports a highly successful installation of officers at the Lt. Gen. Frank M. Andrews Chapter banquet in Tennessee last fall. AFA Man of the Year, Tennessee AFA Man of the Year, and former Tennessee AFA President **Jack Westbrook** did the honors for the new President, **Pat Maxwell; Leo Bolster,** Vice President/Aerospace Education; **Mark Johnson,** Vice President/Programs; **Dan Callahan III,** Secretary; and **Jack Gilpin,** Treasurer.

On hand for the ceremonies were former AFA Board Chairman **Dan Callahan II,** father of the newly installed Secretary and a former Andrews Chapter President, and former Under-Forty Director **Nancy Campbell.** Two of the newly installed officers also serve Tennessee AFA. Mr. Bolster is State Vice President for the Western Region, and Mr. Gilpin is Vice President for Veterans Affairs. Both represent the Andrews Chapter in the United Tennessee Veterans Association.

During the evening, Mr. Westbrook was honored with a plaque by outgoing Andrews President **Hugh D. Perry** for outstanding contributions to AFA at all levels. Mr. Perry received a Past President's pin for his outstanding work in the Chapter. The evening speaker was **James W. Price, Jr.,** a local attorney and Vietnam veteran who discussed the US Constitution. On hand for the event were Tennessee State Professor of Aerospace Studies **Lt. Col. Tom Saulsberry** and cadets **Christy Hobson** and **David Fackler,** who are engineering students at Vanderbilt University.

Nell Bright, Vice President of McCracken Securities in Sedona,

"Technology Match-Up"

That's the subject of the upcoming Aerospace Education Foundation-sponsored Roundtable to be held on Thursday, February 18, at the Air Force Association Building, 1501 Lee Highway, Arlington, Va. The Moderator will be Gen. Robert T. Marsh, USAF (Ret.), former Commander of Air Force Systems Command. For more information, call Bonnie Meyers at (703) 247-5803.

Lake Superior-Northland Chapter members presented a plaque marking the dedication of a newly restored F-101B Voodoo aircraft during ceremonies last November at K. I. Sawyer AFB, Mich. Chapter President Jim Grundstrom called the painstaking restoration effort "a fine example of the civilian and military communities working together to complete a project." Also attending the dedication ceremony was Rep. Bob Davis (R-Mich.).

AFA State Contacts

Following each state name are the names of the communities in which AFA chapters are located. Information regarding these chapters or any of AFA's activities within the state may be obtained from the appropriate contact.

ALABAMA (Birmingham, Gadsden, Huntsville, Mobile, Montgomery, Selma): **Roble Hackworth,** 206 Dublin Circle, Madison, Ala. 35758 (phone 205-532-4920).

ALASKA (Anchorage, Fairbanks): **Theron L. Jenne,** 2501 Banbury Dr., Anchorage, Alaska 99504 (phone 907-337-3360).

ARIZONA (Green Valley, Phoenix, Sedona, Sierra Vista, Sun City, Tucson): **Robert A. Munn,** 7042 Calle Bellatrix, Tucson, Ariz. 85710 (phone 602-747-9649).

ARKANSAS (Blytheville, Fayetteville, Fort Smith, Little Rock): **Bud A. Walters,** 903 Dixie Dr., Blytheville, Ark. 72315 (phone 501-763-1825).

CALIFORNIA (Apple Valley, Camarillo, Edwards, Fairfield, Fresno, Los Angeles, Merced, Monterey, Novato, Orange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, Sunnyvale, Vandenberg AFB, Yuba City): **Harold Strack,** 28063 Lobrook Dr., Rancho Palos Verdes, Calif. 90274 (phone 213-541-6226).

COLORADO (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Littleton, Pueblo): **Jack G. Powell,** 1750 S. Ironton, Aurora, Colo. 80012 (phone 303-370-4787).

CONNECTICUT (Brookfield, East Hartford, Middletown, Storrs, Stratford, Torrington, Waterbury, Westport, Windsor Locks): **Joseph Zaranka,** 9 S. Barn Hill Rd., Bloomfield, Conn. 06002 (phone 203-242-2072).

DELAWARE (Dover, Milford, Newark, Rehoboth Beach, Wilmington): **Horace W. Cook,** 112 Foxhall Dr., Dover, Del. 19901 (phone 302-674-1051).

DISTRICT OF COLUMBIA (Washington, D. C.): **Denny Sharon,** 1501 Lee Highway, Arlington, Va. 22209-1198 (phone 703-247-5820).

FLORIDA (Avon Park, Broward County, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Homestead, Jacksonville, Leesburg, Miami, New Port Richey, Orlando, Palm Harbor, Panama City, Patrick AFB, Port Charlotte, Redington Beach, Sarasota, Tallahassee, Tampa, West Palm Beach, Winter Haven): **Roy P. Whitton,** P. O. Box 1706, Lake Placid, Fla. 33852 (phone 813-465-7048).

GEORGIA (Athens, Atlanta, Columbus, Dobbins AFB, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): **Robert W. Marsh, Jr.,** P. O. Box 542, Springfield, Ga. 31329 (phone 912-964-1941, ext. 206).

GUAM (Agana): **Michael C. Wilkins,** Box CV, Agana, Guam 96910 (phone 671-646-5259).

HAWAII (Honolulu, Puunene): **Don J. Daley,** P. O. Box 3200, Honolulu, Hawaii 96847 (phone 808-525-6296).

IDAHO (Boise, Mountain Home, Twin Falls): **Chester A. Walborn,** P. O. Box 729, Mountain Home, Idaho 83647 (phone 208-587-7185).

ILLINOIS (Belleville, Champaign, Chicago, Elmhurst, Moline, Peoria, Springfield-Decatur): **Glen W. Wensch,** R. R. #1, Box 54, Champaign, Ill. 61821 (phone 217-352-2777).

INDIANA (Bloomfield, Fort Wayne, Grissom AFB, Indianapolis, Lafayette, Marion, Mentone, South Bend, Terre Haute): **Don McKellar,** 2324 Pinehurst Lane, Kokomo, Ind. 46902 (phone 317-455-0933).

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): **Bryan J. Sifford,** Rte. 4, Box 431, Cynthiana, Ky. 41031 (phone 606-234-1642).

LOUISIANA (Alexandria, Baton Rouge, New Orleans, Shreveport): **Paul J. Johnston,** 1703 W. Medalist Dr., Pineville, La. 71360 (phone 318-640-3135).

MAINE (Bangor, Loring AFB, North Berwick): **Alban E. Cyr, Sr.,** P. O. Box 160, Caribou, Me. 04736 (phone 207-496-3331).

MARYLAND (Andrews AFB area, Baltimore, Rockville): **William T. Reynolds,** 11903 Chesterton Dr., Upper Marlboro, Md. 20772 (phone 301-249-5438).

MASSACHUSETTS (Bedford, Boston, East Longmeadow, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): **Leo O'Halloran,** 420 Bedford St., Suite 290, Lexington, Mass. 02173 (phone 617-264-4603).

MICHIGAN (Alpena, Battle Creek, Calumet, Detroit, Kalamazoo, Marquette, Mount Clemens, Oscoda, Petoskey, Southfield): **William Stone,** 7357 Lakewood Dr., Oscoda, Mich. 48750 (phone 517-724-6266).

MINNESOTA (Duluth, Minneapolis-St. Paul): **Earl M. Rogers, Jr.,** 325 Lake Ave. S., Duluth, Minn. 55802 (phone 218-727-8711).

MISSISSIPPI (Biloxi, Columbus, Jackson): **Henry W. Boardman,**10 Bayou Pl., Gulfport, Miss. 39503 (phone 601-896-8836).

MISSOURI (Kansas City, Richards-Gebaur AFB, Springfield, St. Louis, Whiteman AFB): **Raymond W. Peterman,** P. O. Box 9605, Kansas City, Mo. 64134 (phone 816-761-7453).

MONTANA (Bozeman, Great Falls): **Ed White,** 2333 6th Ave., South Great Falls, Mont. 59405 (phone 406-453-2054).

NEBRASKA (Lincoln, Omaha): **Ralph Bradley,** 3902 Davenport, Omaha, Neb. 68131 (phone 402-554-6220).

NEVADA (Las Vegas, Reno): **Emery S. Wetzel, Jr.,** 2938 S. Duneville St., Las Vegas, Nev. 89102 (phone 702-362-1767).

NEW HAMPSHIRE (Manchester, Pease AFB): **Robert N. McChesney,** Scruton Pond Rd., Barrington, N. H. 03825 (phone 603-664-5090).

NEW JERSEY (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, Forked River, Fort Monmouth, Jersey City, McGuire AFB, Middlesex County, Newark, Old Bridge, Trenton, Wallington, West Orange, Whitehouse Station): **Robert Gregory,** R. D. #2, Box 216, Wrightstown, N. J. 08562 (phone 609-758-2973).

NEW MEXICO (Alamogordo, Albuquerque, Clovis): **Louie T. Evers,** P. O. Box 1946, Clovis, N. M. 88101 (phone 505-762-1798).

NEW YORK (Albany, Bethpage, Brooklyn, Buffalo, Chautauqua, Griffiss AFB, Hudson Valley, Nassau County, New York City, Niagara Falls, Patchogue, Plattsburgh, Queens, Rochester, Rome/Utica, Suffolk County, Syosset, Syracuse, Westchester, Westhampton Beach, White Plains): **Gerald V. Hasler,** P. O. Box 5254, Albany, N. Y. 12205 (phone 518-785-5020).

NORTH CAROLINA (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Kitty Hawk, Raleigh): **Robert C. Newman, Jr.,** 3037 Truitt Dr., Burlington, N. C. 27215 (phone 919-584-7069).

NORTH DAKOTA (Concrete, Fargo, Grand Forks, Minot): **Ralph Ehlers,** 1207 Glacial Dr., Minot, N. D. 58701 (phone 701-852-3221).

OHIO (Akron, Cincinnati, Cleveland, Columbus, Dayton, Mansfield, Newark, Youngstown): **Cecil H. Hopper,** 537 Granville St., Newark, Ohio 43055 (phone 614-344-7694).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): **Terry Little,** 4150 Timerlane, Enid, Okla. 73703 (phone 405-234-9624).

OREGON (Eugene, Klamath Falls, Portland): **Hal Langerud,** 10515 S. W. Clydesdale Terrace, Beaverton, Ore. 97005 (phone 503-644-0645).

PENNSYLVANIA (Allentown, Altoona, Beaver Falls, Bensalem, Coraopolis, Drexel Hill, Erie, Harrisburg, Homestead, Indiana, Johnstown, Lewistown, Mon Valley, Philadelphia, Pittsburgh, Scranton, Shiremanstown, State College, Willow Grove, York): **David L. Jannetta,** P. O. Box 643, Altoona, Pa. 16603 (phone 814-943-8023).

PUERTO RICO (San Juan): **Fred Brown,** 1991 Jose F. Diaz, Rio Piedras, P. R. 00928 (phone 809-790-5288).

RHODE ISLAND (Warwick): **Thomas R. Portesi,** 102d Tactical Control Squadron, North Smithfield ANG Station, Slatersville, R. I. 02889 (phone 401-762-9100).

SOUTH CAROLINA (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): **Wesley H. Davis,** 7916 Bay Springs Rd., Columbia, S. C. 29233 (phone 803-788-5267).

SOUTH DAKOTA (Rapid City, Sioux Falls): **John Kittelson,** 141 N. Main, Suite 308, Sioux Falls, S. D. 57102 (phone 605-336-2498).

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tri-Cities Area, Tullahoma): **Everett E. Stevenson,** 4792 Cole Rd., Memphis, Tenn. 38117 (phone 901-767-1315).

TEXAS (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **John P. Russell,** 118 Broadway, Suite 234, San Antonio, Tex. 78205 (phone 915-698-8586).

UTAH (Bountiful, Clearfield, Ogden, Salt Lake City): **Marcus C. Williams,** 4286 South 2300 West, Roy, Utah 84067 (phone 801-627-4490).

VERMONT (Burlington): **Ralph R. Goss,** 8 Summit Circle, Shelburn, Vt. 05482 (phone 802-985-2257).

VIRGINIA (Alexandria, Charlottesville, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **Don Anderson,** Box 54, 2101 Executive Dr., Hampton, Va. 23666 (phone 804-868-8756).

WASHINGTON (Seattle, Spokane, Tacoma, Yakima): **Alwyn T. Lloyd,** P. O. Box 24271, M/S 6A-30, Seattle, Wash. 98124 (phone 206-251-2055).

WEST VIRGINIA (Huntington): **Ron Harmon,** 1933 Ohio Ave., Parkersburg, W. Va. 26101 (phone 304-485-2088).

WISCONSIN (Madison, Milwaukee, Mitchell Field): **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).

Gen. Jack Chain, Jr., Grand Marshal for the Cleveland National Air Show, presented flags to then-Ohio AFA President John Boeman, left, and then-Crawford Chapter President Jim Taddeo in recognition of AFA's contributions to the air show.

Former Aerospace Corp. President Dr. Eberhardt Rechtin, right, was inducted as a General Jimmy Doolittle Fellow of AFA's Aerospace Education Foundation last fall. Doing the honors was current Aerospace Corp. President Sam Tennant.

Ariz., was scheduled to address AFA's Barry Goldwater Chapter in late December, Chapter officials report. She flew with **Jackie Cochran** in World War II as a member of the Women's Airforce Service Pilots, or WASPs.

In November, Chapter members heard from **Dave Schlafman,** who outlined the threats to private flying if the plan for Super TCAs (traffic control areas) is implemented around major urban areas. "The plan will increase the cost of private flying to an extent that could kill off experimental aircraft as well as private ownership. The bottom line," he told the AFA crowd, "is that Super TCAs give an airspace monopoly to the major airlines."

"Life Behind the Iron Curtain" was the topical address by **Col. Don E. Kosovac** to AFA's Sacramento Chapter in November. Colonel Kosovac had recently returned from Czechoslovakia, where he had served for some time as the United States Defense/Air Force Attaché.

AFA National Director **E. F. "Sandy" Faust** elicited glowing remarks from the Commander and Professor of Aerospace Studies at the University of Notre Dame, **Col. David M. Woods,** for his "superb talk on officership, which proved to be both inspirational and motivational for our cadets and staff alike." Colonel Woods continued,

came into the Air Force in the 1950s and 1960s.

In his incredible saga of a fighter pilot's fighter pilot, T. R. Milton describes "The Indispensable Ingredient" that caused Robinson Risner to stand out among his peers. Risner, who received the first-ever Air Force Cross and who appeared on the cover of *Time* magazine, served seven years in purgatory as a recalcitrant prisoner of the North Vietnamese. You will be out of breath when you finish reading his story.

Under the steady editorial hand of John L. Frisbee, former Editor of AIR FORCE Magazine, this book fulfills its mission of acquainting readers with these twelve distinguished airmen who contributed so much to this nation's Air Force. AFAers will be proud to note that the Association's affiliate, the Aerospace Education Foundation, furnished one of the two grants that helped to underwrite this worthwhile effort.

I recommend this book without hesitation to both the serious student and the casual reader, who are certain to be inspired by the examples of these makers of the United States Air Force.

—*Reviewed by Richard H. Becker. Mr. Becker is a National Director of the Air Force Association.*

New Book in Brief

The Iran-Iraq War and Western Security 1984–87, by Anthony H. Cordesman. The Gulf War, now dragging into its eighth year with no end in sight, is, as the author stresses, "of critical importance to Western security." Prominent among Western concerns are the flow of oil from the Gulf, Soviet intentions in the area, and the fissiparous effects of the war on the entire Middle East. Author Cordesman navigates gingerly through this "war of lies" to present as clear a picture of the fighting as is possible and ventures several policy prescriptions for the West. The "best outcome" of the war for the West is clear, he believes: The preservation of "the present national structure of Iran and Iraq, without one side dominating the other." But even if Western policy engenders this best-case scenario, the author warns that so long as the West tolerates a long-term dependence on imported oil, "no regional policy can ever provide it with the degree of security it needs." With charts and maps, chronology, bibliography, and index. A RUSI Military Power Book/ Jane's Publishing Inc., New York, N. Y., 1987. 185 pages. $28.

Valor

A Place Called the Doumer Bridge

Former X-15 pilot Col. Bob White led the first strike against the most heavily defended target in North Vietnam.

BY JOHN L. FRISBEE
CONTRIBUTING EDITOR

ROLLING Thunder, the JCS strategic plan for eliminating ninety-four high-value targets in North Vietnam, was prepared early in 1965. But the plan was orchestrated timidly by Washington officials who feared Chinese intervention and believed the war would be won in the South. Single targets were released from time to time, but most were south of the twentieth parallel.

The big one that Air Force crews wanted to get was the Paul Doumer Bridge at Hanoi, a railroad and highway span more than a mile long but only thirty-eight feet wide. Over it passed an average of twenty-six trains a day and many trucks, carrying more than 6,000 tons of supplies to enemy forces in South Vietnam and Laos.

That key link in Hanoi's logistic systems was surrounded by AA guns ranging from 37-mm to 100-mm, automatic weapons, SA-2 SAMs, and MiGs at nearby fields.

At 1000 hours on August 11, 1967, the 355th Tac Fighter Wing at Takhli, the Korat-based 388th, and the 8th at Ubon received long-awaited orders to hit the bridge—not tomorrow, but *that afternoon*. The 355th would lead the strike force with Col. Robert M. White, Deputy Commander for Operations, as mission commander.

Colonel White's credentials were impeccable. He had flown P-51s in Europe during World War II and fighters in the Korean War and had piloted the experimental X-15 to a record altitude of 59.6 miles and a speed of 4,093 miles an hour. For his X-15 flights, he was awarded both the Harmon and Collier Trophies and NASA's Distinguished Service Medal.

Recalling the events of August 11, Colonel White, now a retired major general, said: "The intensity in the 355th rose to a higher level than I had seen since joining the wing." Everyone, knowing full well the risks, wanted to go to that superdefended target. Three squadron commanders who had not been on the day's schedule volunteered to lead flights. But a miracle of mission planning and preparation had to be worked in the short time before takeoff.

The wing's F-105s, to take only one example, had been configured with 750-pound bombs for the previously assigned mission. Tanks had to be changed and 3,000-pound bombs substituted—normally an hour's work per aircraft. It was completed in about twenty minutes for each plane by waiving regulations against arming and refueling simultaneously. "You'd have [had] to be there to understand" how the support people and planners did what seemed impossible when the mission order came in, says General White.

Start-engines was at 1350 hours. At 1418, the strike force started to roll. It was clear skies all the way, target time 1558. After refueling over Laos, the F-105s, preceded by their Wild Weasel and flak-suppression flights, crossed the Red River and headed southeast along Thud Ridge toward Hanoi. As they approached the bridge, they were met by MiGs in a head-on attack that failed.

Moments later, Colonel White rolled into his bomb run from 13,000 feet. In the seconds before bomb release at 8,000 feet, he and the pilots who followed held the intense concentration demanded for accurate bombing, flying into a highly visible barrage of flak and several SAM launches. But the experience of those veterans paid off as the 3,000-pounders blossomed below.

The leader of the second flight looked back. They had done it! A span of the railroad bridge lay in the water. A few minutes later, the other two wings dropped two spans of the highway bridge. Thanks to the outstanding work of the Weasel and flak-suppression flights, the entire force made it safely home or to friendly bases.

After bomb release, Colonel White broke hard to the left, down the Red River, then led the force west, low and fast across a plain to hills twenty miles away, rather than withdrawing along Thud Ridge as mission planners had recommended. His judgment proved correct. No one was hit on the way out. The entire mission had been a textbook demonstration of professionalism.

The following morning, at the suggestion of newly arrived 355th Commander Col. John Giraudo, Colonel White trooped the line with a large blow-up of the downed bridge "to show the people who worked so hard to ready the aircraft how their efforts paid off." It was a team victory.

For his leadership of the strike force, Colonel White was awarded the Air Force Cross. The same decoration went to 8th Wing Commander Col. Robin Olds; Col. James McInerney, leader of the Weasels, and his EWO, Capt. Fred Shannon; and Lt. Col. Harry Schurr, Commander of the 469th Squadron.

That first of many attacks on the Paul Doumer Bridge will always hold for Colonel White a special place among the seventy combat missions he flew in Southeast Asia. It wasn't just another rail or road cut south of the twentieth, but "a real target that, once hit, would hurt the enemy and help our people in the South."

That mission was what tacair and professionalism and valor are all about. ■

The Planes... The Jets... The Excitement... On Video

AIRSHOW

Tomcats...Hornets...Thunderbolts... Blackbirds; *Airshow* puts you in the pilot's seat of the world's fastest and most formidable aircraft. Special USN Blue Angels show off their renowned precision flying and will give you the ultimate power surge.

SV 0564 **60 Minutes** **$29.95**

TOUCH THE SKY

Christopher Reeve takes you inside the cockpit and into the sky with the world's fastest and most spectacular stunt flying team, the Blue Angels. Experience the Blue Angels' aerobatic maneuvers at 550 mph and all six jets within three feet of each other! Great musical score for the whole family.

TT 8021 **60 Minutes** **$29.95**

THE MIG-29 "FULCRUM"

Here it is, recently de-classified, this formerly TOP SECRET footage was taken as part of a covert photo mission by daring Finnish cameramen. This is a close look at the all-new Soviet counter-air jet fighter. Combined with this exciting new program is a hard-hitting cockpit view of the state-of-the-art F/A-18. Two superb fighting, flying machines for your collection!

FG 9100 **30 Minutes** **$39.95**

WILD BLUE YONDER

The history of the Air Force is magnificently told in this grand video. From its early beginings in 1909 to the present, this is one film any Air Force enthusiast can not do without. Great action footage!

MP 1184 **50 Minutes** **$29.95**

JET FIGHTER

An exciting overview of America's current front line jet fighters that puts you in the cockpit for a 9G ride you won't soon forget. This is a close-up look at the F-14, F-15, F-16, F/A-18, and the new F-20. *Jet Fighter* puts you in the cockpit so you can experience dogfights and weapons demonstrations that will leave you speechless. All action!

FG 9101 **45 Minutes** **$39.95**

U.S. MILITARY AVIATION: 1903-1945

In this one film you can now see four exciting programs. Included-"Wings of the Army 1903-1938," "Handing it Back Navy," which is an aerial gunnery film, "Army Air Force in the Pacific," and "The Navy Flies On." This historical look represents a look back at the way air warfare used to be waged.

VC 7001 **90 Minutes** **$29.95**

75th YEAR OF NAVAL AVIATION

Made in cooperation with the US Navy, in this tape you'll see spectacualr flight demos by the AV-8 Harrier, A-10's, F-14's, and F-15's. Also included is the final public performance of the Blue Angels in the A-4. One fantastic tape to add to your collection!

PF 8942 **110 Minutes** **$39.95**

ADVANTAGE HORNET

Strap yourself into the F/A-18 Hornet, the newest strike-fighter now operational with the US Navy. This is the fighter aircraft that is the choice of the Blue Angels. Experience the exhilaration of flight from tree-top level to 50,000 feet with unmatched filmed sequences.

St 6010 **62 Minutes** **$59.95**

EAGLE COUNTRY

Have you ever dreamed of flying in the world's hottest fighter aircraft? The F-15 Eagle's superior dogfight capabilities will keep you at the edge of your seat as the F-15's go head-to-head against F-14's, F-16's, and F/A-18's. This one is for anyone interested in aviation!

St 6015 **85 Minutes** **$59.95**

THOSE MAGNIFICENT FLYING FIGHTING MACHINES

This thrilling history of the fighter plane includes fascinating footage of aerial dogfights and will thoroughly entertain anyone with an interest in combat or aviation.

MP 1083 **60 Minutes** **$24.95**

B-17:THE FLYING FORTRESS

Narrated by Edward Mulhare. Featuring incredible combat footage, this award-winning film tells the story of the daring daylight bombings that changed the course of WWII.

TT 8057 **30 Minutes** **$19.95**

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"The presence of a distinguished career military officer, director of the Air Force Association, and successful banking executive, such as Colonel Faust, clearly enhanced the success of our Arnold Air Society Dining-In."

It was a record crowd that attended the Arnold Chapter meeting at Arnold AFB, Tenn., recently, thanks to the scheduled appearance of a B-1B pilot and an offensive systems operator from Dyess AFB, Tex. According to Communications Vice President **George Rutland,** the crew couldn't have been more positive about the capabilities of the B-1B.

Said **Maj. Paul Frichtl,** a B-1B offensive systems operator, "It's the best we've ever flown." **Maj. David Stickler,** B-1B pilot, commented on the computerized maintenance system, which checks the condition of thousands of items each minute. It then provides a printout for the aircrew and maintenance workers, allowing problems to be pinpointed quickly. Mr. Rutland said the crew admitted that the system had a low reliability rate at first, but now the "bugs" are being worked out, and it's more than ninety-five percent reliable. It indicates such problem areas as low hydraulic pressure before they show up on instruments. ■

Unit Reunions

Air Forces Escape and Evasion Society
The Air Forces Escape and Evasion Society will hold a reunion in May 1988 in Denver, Colo. **Contact:** David W. O'Boyle, 715 Locust St., Denver, Colo. 80220. Phone: (303) 399-6993.

Flight Nurses
World War II flight nurses will hold a reunion on May 5–7, 1988, at the St. Anthony Hotel in San Antonio, Tex. **Contact:** Mrs. Anthony G. Cerasale, 463 Port Royal Blvd., Satellite Beach, Fla. 32937. Phone: (305) 773-6173.

1st Strategic Reconnaissance Squadron
The 1st Strategic Reconnaissance Squadron will host the seventy-fifth anniversary reunion of the 1st Aero Squadron on March 4–5, 1988, at Beale AFB, Calif. Members of the 1st Strategic Reconnaissance Squadron, 1st Bomb Squadron, and 1st Observation Squadron and their guests are invited. **Contact:** Capt. John Manzi or Capt. Don Watkins, Public Affairs Division, 9th Strategic Reconnaissance Wing (SAC), Beale AFB, Calif. 95903. Phone: (916) 634-2993.

8th Fighter-Bomber Wing
Members of the 8th Fighter-Bomber Wing and other units that served at Itazuke AB, Japan, during 1949–53 will hold a reunion on April 6–10, 1988, in San Antonio, Tex. **Contact:** Lt. Col. Ralph Brant, USAF (Ret.), 302 Granada Dr., San Antonio, Tex. 78216. Phone: (512) 344-8283.

9th Bomb Wing
Members of the 9th Bomb Wing who were stationed at Mountain Home AFB, Idaho, from 1953–65 will hold a reunion on June 10–12, 1988, in Boise, Idaho. **Contact:** Harvey R. McAtee, 10140 Saranac Dr., Boise, Idaho 83709. Phone: (208) 376-3489.

Class 43-D Ass'n
Pilot Class 43-D "Delta Eagles" will hold a reunion on April 27–May 1, 1988, in San Antonio, Tex. **Contact:** Donald A. Conner, P. O. Box 14572, North Palm Beach, Fla. 33408-0572. Phone: (305) 622-6852.

Class 43-I
Members of Pilot Class 43-I (Cuero, Waco, and Lubbock, Tex.) are planning to hold a reunion in October 1988. **Contact:** Roy J. Maggard, 1713 Berkshire, Waco, Tex. 76705.

44th Fighter Squadron
The 44th Fighter Squadron will hold a reunion on May 22–25, 1988, at the La Paloma Resort in Tucson, Ariz. **Contact:** Bill Starke, 614 W. Sherman Ave., Fort Atkinson, Wis. 53538. Phone: (414) 563-4496.

50th Troop Carrier Wing
The 50th Troop Carrier Wing will hold a reunion on September 15–18, 1988, in St. Louis, Mo. **Contact:** Frank Ehrman, 840 Staton Place West Dr., Indianapolis, Ind. 46234. Phone: (317) 271-8568.

B-58 Hustler Ass'n
The B-58 Hustler Association will hold a reunion on June 10–12, 1988, in Fort Worth, Tex. **Contact:** Kenneth W. Ryker, P. O. Box 126158, Fort Worth, Tex. 76126. Phone: (817) 249-2877.

Class 61-F
Pilot Class 61-F will hold a reunion on September 23–24, 1988, in Denver, Colo. **Contact:** David Heller, 220 Ponderosa Dr., Fayetteville, Ga. 30214. Phone: (404) 461-9329.

89th Bomb Squadron
Members of the 89th Bomb Squadron, 3d Bomb Group (New Guinea/Philippines), are planning to hold a reunion in October 1988. **Contact:** H. B. Monroe, 422 Lee Ave., Wadesboro, N. C. 28170.

89th Military Airlift Wing
The 89th Military Airlift Wing will hold a "Sam Fox Reunion '88" on September 29–October 2, 1988, at Andrews AFB, Md. **Contact:** Maj. John Gorczyca, USAF, 89th MAW/Stop 3, Andrews AFB, Md. 20331-5000. Phone: (301) 981-5702 (Col. Brem Morrison).

90th Bomb Group
The 90th Bomb Group "Jolly Rogers" will hold a reunion on April 28–30, 1988, in Long Beach, Calif. **Contact:** Andrew Acampora, 2057 Redondela Dr., Rancho Palos Verdes, Calif. 90732. Phone: (213) 832-0970.

177th Fighter Interceptor Group
The 177th Fighter Interceptor Group will host a farewell to the F-106 Delta Dart on June 10–12, 1988. **Contact:** Capt. Joe Czachorowski or Capt. Bill Silvestri, 177th FIG/Dart-Out '88, 400 Langley Rd., ANGB, Atlantic City IAP, Pleasantville, N. J. 08232-9500. Phone: (609) 645-6255. AUTOVON: 445-6255.

314th Fighter Squadron
The 314th Fighter Squadron, 324th Fighter Group, will hold a reunion on May 20–22, 1988, in Dayton, Ohio. **Contact:** Eugene Rouse, 122 Sheraton Rd., Syracuse, N. Y. 13219.

364th Fighter Group
Members of the 364th Fighter Group and support units of the Eighth Air Force who served in Honington, England, will hold a reunion on September 28–October 1, 1988, in Colorado Springs, Colo. **Contact:** Dan Leftwich, 6630 Caldero Ct., Dayton, Ohio 45415. Phone: (513) 890-3641.

394th Missile Training Squadron
The 394th Missile Training Squadron (now known as the 394th ICBM Test Maintenance Squadron) will hold a thirtieth-year reunion in April 1988 at Vandenberg AFB, Calif. **Contact:** 394th ICBMTMS/CC, Attn: 30th Reunion, Vandenberg AFB, Calif. 93437-5000. Phone: (805) 865-8756. Capt. Thomas Connell or MSgt. Bruce Zielsdorf, Public Affairs Office, Vandenberg AFB, Calif. 93437-5000. Phone: (805) 866-3050 or 866-3595.

403d Troop Carrier Group
The 403d Troop Carrier Group, Thirteenth Air Force, will hold a reunion on June

Reunion Notices

Readers wishing to submit reunion notices to "Unit Reunions" should mail their notices well in advance of the event to "Unit Reunions," Air Force Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

9–11, 1988, at the Howard Johnson's Motor Lodge in Lancaster, Pa. **Contact:** Bob Sylves, 550-E Willow St., Elizabethtown, Pa. 17022. Phone: (717) 367-6360.

AFROTC Det. 410
Air Force ROTC Detachment 410 will hold an alumni reunion on May 7, 1988, to honor the fortieth anniversary of the Air Force ROTC at the College of St. Thomas. **Contact:** Capt. Brian Mundt, USAF, P. O. Box 5016, College of St. Thomas, St. Paul, Minn. 55105-1096. Phone: (612) 647-5085.

442d Troop Carrier Group
The 442d Troop Carrier Group will hold a reunion on May 20–22, 1988, in St. Louis, Mo. **Contact:** Herky S. Barbour, 1135 Trentwood Rd., Columbus, Ohio 43221. Phone: (614) 457-4950.

453d Bomb Squadron
Members of the 453d Bomb Squadron, 323d Bomb Group, Ninth Air Force, will hold a reunion on September 7–11, 1988, at the Best Western Center Inn in Norfolk, Va. **Contact:** C. V. Sochocki, 1314 N. Brookfield St., South Bend, Ind. 46628. Phone: (219) 233-6044.

509th Bomb Group/Wing
The 509th Bomb Group and Wing will hold a reunion on September 21–25, 1988, at the Red Lion Inn in Colorado Springs, Colo. **Contact:** Brig. Gen. Robert R. Scott, USAF (Ret.), 508 W. 27th St., Cheyenne, Wyo. 82001. Phone: (307) 635-3175.

556th Bomb Squadron Ass'n
The 556th Bomb Squadron will hold a reunion on October 20–23, 1988, in Orlando, Fla. **Contact:** Paul R. Priday, 7755 Harriott Rd., Plain City, Ohio 43064.

781st Bomb Squadron
Members of the 781st Bomb Squadron and 465th Bomb Group will hold a reunion on September 14–18, 1988, in San Antonio, Tex. **Contact:** James C. Althoff, 2 Mount Vernon Lane, Atherton, Calif. 94025. Phone: (415) 325-8356.

1370th Photo Mapping Wing
The 1370th Photo Mapping Wing, Aerospace Cartographic and Geodetic Service (MAC), will hold a reunion on September 1–4, 1988, in St. Louis, Mo. **Contact:** Dale Kingsbury, 225 S. Side Ave., St. Louis, Mo. 63119. Phone: (314) 961-0519.

56th Air Depot Group
I would like to renew old friendships and perhaps hold a reunion for members of the 56th Air Depot Group, which served at Tinker AFB, Okla., and with the Twentieth Air Force Air Depot on Guam during World War II.

Please contact the address below.

Lt. Col. Charles H. Northrup, USAF (Ret.)
P. O. Box 5131
Springfield, Ill. 62705

Phone: (217) 544-1144 or 546-2781

F-84F Pilots
We would like to hear from any F-84F "Hog Drivers" who were stationed at MacDill AFB, Fla., from August 1962 to June 1964 and who would be interested in holding a reunion in Tampa, Fla., in October 1988.

Please contact one the addresses below.

Leo Jacobs
6200 Country Estates Dr.
Tipp City, Ohio 45371
or
Dave Warren
433 Columbia Dr.
Tampa, Fla. 33606

Phone: (513) 667-5210 (Jacobs)
(813) 253-3124 (Warren)

320th Fighter Squadron
For the purpose of holding a reunion, I would like to locate former members of the 320th Fighter Squadron, which later became the 132d BTU, who were stationed at Westhampton Beach, Long Island, N. Y., during World War II.

Please contact the address below.

D. Schaaf
46245 Leedy Rd.
Bloomingdale, Mich. 49026

Phone: (616) 521-4927

406th Bomb Squadron
I would like to hear from members of the 406th Bomb Squadron (Aleutian Campaign) who would be interested in attending a reunion in 1988.

Please contact me at the address below.

Doug Courtney
5841 Winding Ridge Dr.
San Antonio, Tex. 78239-2015

Phone: (512) 654-1932

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Clip this form and attach your mailing label (from the plastic bag that contained this copy of your magazine), and send to:

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Important Benefits and Features

Eligibility—All members of the Air Force Association under age 65 are eligible to apply for this coverage . . . and, once insured, to apply for higher levels of coverage.

Flying and Non-Flying Personnel—All insured members of the same age are provided the same amount of coverage regardless of whether or not they are on flying status and regardless of whether or not they are killed in an aviation accident! There is no age restriction for full benefits and there is no benefit or cost difference for those on flyng status. AFA's new Eagle Series Life Insurance program eliminates all these differences and provides strong, reliable coverage for *all* members at the *same* cost.

Coverage to Age 75—Insurance provided under this group program may be retained at the same low group rate to age 75.

War Related Death Benefits—Unlike many programs that severely restrict coverage in the event of war or act of war, AFA's program provides full benefits for war related deaths except for aircraft crew members who are killed in aviation accidents. In such circumstances the death benefit is 50% of the scheduled benefit amount.

Guaranteed Conversion Provision—At age 75 (or if you wish, upon termination of AFA membership) your coverage is convertible, within 31 days of the date you become eligible, to any permanent plan of insurance then being offered by United of Omaha, regardless of your health at that time. The maximum amount convertible is the amount of your group coverage at the time of conversion.

Under the Family Plan, the spouse's coverage is also convertible to permanent insurance in the event the member dies. The application for such coverage must be made within 31 days of the member's death. Children's coverage under the Family Plan, however is not convertible, but upon attaining age 21, each insured child is automatically eligible to apply for a $10,000 Whole Life Insurance policy. This policy includes a guaranteed issue benefit which provides the insured the right to purchase additional coverage at standard rates on future dates specified in the policy.

Schedule of Benefits

Choose the Plan that Fits Your Family's Needs for Security

Member's Attained Age	High Option *PLUS* Plan Premium $20 Per Month COVERAGE	High Option Plan Premium $15 Per Month COVERAGE	Standard Plan Premium $10 Per Month COVERAGE
20-24	$400,000	$300,000	$200,000
25-29	350,000	262,500	175,000
30-34	250,000	187,500	125,000
35-39	180,000	135,000	90,000
40-44	100,000	75,000	50,000
45-49	60,000	45,000	30,000
50-54	40,000	30,000	20,000
55-59	28,000	21,000	14,000
60-64	18,000	13,500	9,000
65-69	8,000	6,000	4,000
70-74	5,000	3,750	2,500

The above schedule of benefits will be paid in the event of any death except one half (50%) of the benefit will be paid in the event of a war related aviation accident.

Disability Waiver of Premium—If you become totally disabled at any time prior to age 60 for a period of at least nine months while your coverage remains in force, you may apply for the Disability Waiver of Premium Benefit. Upon approval, your Eagle Series insurance will remain in force without further payment of premiums for as long as you continue to be totally disabled.

Dividend Policy—AFA has continuously provided program improvements in addition to paying substantial year end dividends based on actual program experience.

Effective Date of Coverage—All certificates are dated and take effect on the last day of the month in which your application for coverage is approved and coverage runs concurrently with AFA membership.

Termination of Coverage—Your coverage can be terminated only if you are no longer an Air Force Association member in good standing, if you do not pay your premium, if the AFA Master Policy is discontinued, or on the first renewal date following your 75th birthday.

Professionally Administered—AFA's Eagle Series Insurance program is administered by the Association's staff of professionally trained insurance personnel with extensive experience in group insurance programs and requirements.

Convenient Payment Plan—Premium payments may be made directly to AFA in quarterly, semi-annual, or annual installments, or by monthly government allotment. If you make payments directly to AFA, the Association will mail renewal statements approximately 30 days in advance of each premium due date. For active duty and retired personnel, however, AFA recommends that payments be made automatically by monthly government allotment (payable to the Air Force Association) so as to prevent any possible lapse in coverage.

Exceptions—Group Life Insurance: Benefits for suicide or death from injuries intentionally self-inflicted while sane or insane shall not be effective until coverage has been in force 12 months. Benefits for a war related aviation accident in which the Insured was serving as pilot or crew member of the aircraft involved are 50% of the scheduled amount of coverage.

The insurance coverage described in this plan is provided under a group insurance policy issued by United of Omaha Life Insurance Company to the First National Bank of Minneapolis as trustee of the Air Force Association Group Insurance Trust.

Optional Family Coverage

(May be added to Standard, High Option, or High Option PLUS Plan)
PREMIUM: $2.50 Per Month

Member's Attained Age	Life Insurance Coverage for Spouse	Life Insurance Coverage for Each Child
20-24	$50,000	$5,000
25-29	50,000	5,000
30-34	40,000	5,000
35-39	30,000	5,000
40-44	20,000	5,000
45-49	10,000	5,000
50-54	7,500	5,000
55-59	5,000	5,000
60-64	3,000	5,000
65-69	2,000	5,000
70-74	1,000	5,000

Between the ages of six months and 21 years, each child is provided $5,000 coverage. Children under 6 months are provided with $250 coverage once they are 15 days old and discharged from the hospital.

Upon attaining age 21, children covered under this group insurance program may, provided satisfactory evidence of insurability is submitted, request coverage (in most states) under a $10,000 permanent individual life insurance policy with guaranteed purchase options.

PLEASE RETAIN THIS MEDICAL INFORMATION BUREAU PRENOTIFICATION FOR YOUR RECORDS

Information regarding your insurability will be treated as confidential. United of Omaha Life Insurance Company may, however, make a brief report thereon to the Medical Information Bureau, a nonprofit membership organization of life insurance companies, which operates an information exchange on behalf of its members. If you apply to another Bureau member company for life or health insurance coverage, or a claim for benefits is submitted to such a company, the Bureau, upon request, will supply such company with information in its file.

Upon receipt of a request from you, the Bureau will arrange disclosure of any information it may have in your file. (Medical information will be disclosed only to your attending physician.) If you question the accuracy of information in the Bureau's file, you may contact the Bureau and seek a correction in accordance with the procedures set forth in the Federal Fair Credit Reporting Act. The address of the Bureau's information office is P.O. Box 105, Essex Station, Boston, Mass. 02112, Phone (617) 426-3660.

United of Omaha Life Insurance Company may release information in its file to other life insurance companies to whom you may apply for life or health insurance, or to whom a claim for benefits may be submitted.

APPLICATION FOR AFA
GROUP LIFE INSURANCE

Full name of member _____
Rank Last First Middle

Address _____
Number and Street City State ZIP Code

Date of Birth (Mo. Day Yr.)	Height	Weight	Social Security Number	Flying Status
				☐ Yes ☐ No

This insurance is available only to AFA members

☐ I enclose $21 for annual AFA membership dues (includes subscription ($18) to AIR FORCE Magazine).

☐ I am an AFA member.

Name and relationship of primary beneficiary _____

Name and relationship of contingent beneficiary _____

Please indicate below the Mode of Payment and the Plan you elect:

Mode of Payment	Plan of Insurance: Standard Plan		High Option Plan		High Option PLUS Plan	
	Member Only	Member and Dependents	Member Only	Member and Dependents	Member Only	Member and Dependents
Monthly government allotment (only for military personnel). I enclose 2 months premium to cover the necessary period for my allotment (payable to Air Force Association) to be established.	☐ $ 10.00	☐ $ 12.50	☐ $ 15.00	☐ $ 17.50	☐ $ 20.00	☐ $ 22.50
Quarterly. I enclose amount checked.	☐ $ 30.00	☐ $ 37.50	☐ $ 45.00	☐ $ 52.50	☐ $ 60.00	☐ $ 67.50
Semi-Annually. I enclose amount checked.	☐ $ 60.00	☐ $ 75.00	☐ $ 90.00	☐ $105.00	☐ $120.00	☐ $135.00
Annually. I enclose amount checked.	☐ $120.00	☐ $150.00	☐ $180.00	☐ $210.00	☐ $240.00	☐ $270.00

Names of Dependents To Be Insured	Relationship to Member	Dates of Birth (Mo. Day Yr.)	Height	Weight

Have you or any dependents for whom you are requesting insurance ever had or received advice or treatment for: kidney disease, cancer, diabetes, respiratory disease, epilepsy, arteriosclerosis, high blood pressure, heart disease or disorder, stroke, venereal disease or tuberculosis? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance been confined to any hospital, sanatorium, asylum or similar institution in the past 5 years? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance received medical attention or surgical advice or treatment in the past 5 years or are now under treatment or using medications for any disease or disorder? Yes ☐ No ☐

IF YOU ANSWERED "YES" TO ANY OF THE ABOVE QUESTIONS, EXPLAIN FULLY including date, name, degree of recovery and name and address of doctor. (Use additional sheet of paper if necessary.)

I apply to United of Omaha Life Insurance Company for insurance under the group plan issued to the First National Bank of Minneapolis as Trustee of the Air Force Association Group Insurance Trust. Information in this application, a copy of which shall be attached to and made a part of my certificate when issued, is given to obtain the plan requested and is true and complete to the best of my knowledge and belief. I agree that no insurance will be effective until a certificate has been issued and the initial premium paid.

I hereby authorize any licensed physician, medical practitioner, hospital, clinic or other medically related facility, insurance company, the Medical Information Bureau or other organization, institution or person, that has any records or knowledge of me or my health, to give to the United of Omaha Life Insurance Company any such information. A photographic copy of this authorization shall be as valid as the original. I hereby acknowledge that I have a copy of the Medical Information Bureau's prenotification information.

Date _____, 19 ____ _____
Member's Signature

Application must be accompanied by a check or money order. Send remittance to: Insurance Division, AFA, 1501 Lee Highway, Arlington, Virginia 22209-1198.

AFA Air Force Association

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Group Policy GLC-2625
United of Omaha Life Insurance Company
Home Office Omaha Nebraska

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NEW F-15E: KEY DUAL ROLE PLAYER ON THE USAF TEAM.

THE MISSION: BREAK THE ENEMY'S WILL BY STRIKING HIGH-VALUE AND MOBILE TARGETS FAR BEHIND ENEMY LINES.

Hostile forces are brought closer to defeat when denied the resources to continue. That's why the U.S. Air Force chose the F-15E for the deep interdiction mission. And that's why it's such great news that this newest Eagle is now in flight test at Edwards Air Force Base.

The F-15E is a tough, tenacious aircraft made to find its way and fight its way in *and out*, day or night, in any weather. It has the speed, the sensors, the countermeasures to penetrate. With the new Martin Marietta Lantirn system, it can pinpoint fixed or moving targets and it has the precision delivery system to put its payload on target.

The advanced technology provided in this Eagle will make it unmatched in *two* roles—air to air and air to ground. Its dual state-of-the-art cockpits have video displays to provide the F-15E crew with target, weapons, navigation and threat information in a useful format. The F-15E's new conformal fuel tanks increase range and permit efficient carriage of large weapon loads. For automatic terrain following, a new flight control system is coupled to terrain-following radar.

For a strong defense, America counts on the Air Force. And the Air Force is counting on the F-15E Eagle.

MCDONNELL DOUGLAS