

AUGUST 1989/\$2

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MAGAZINE



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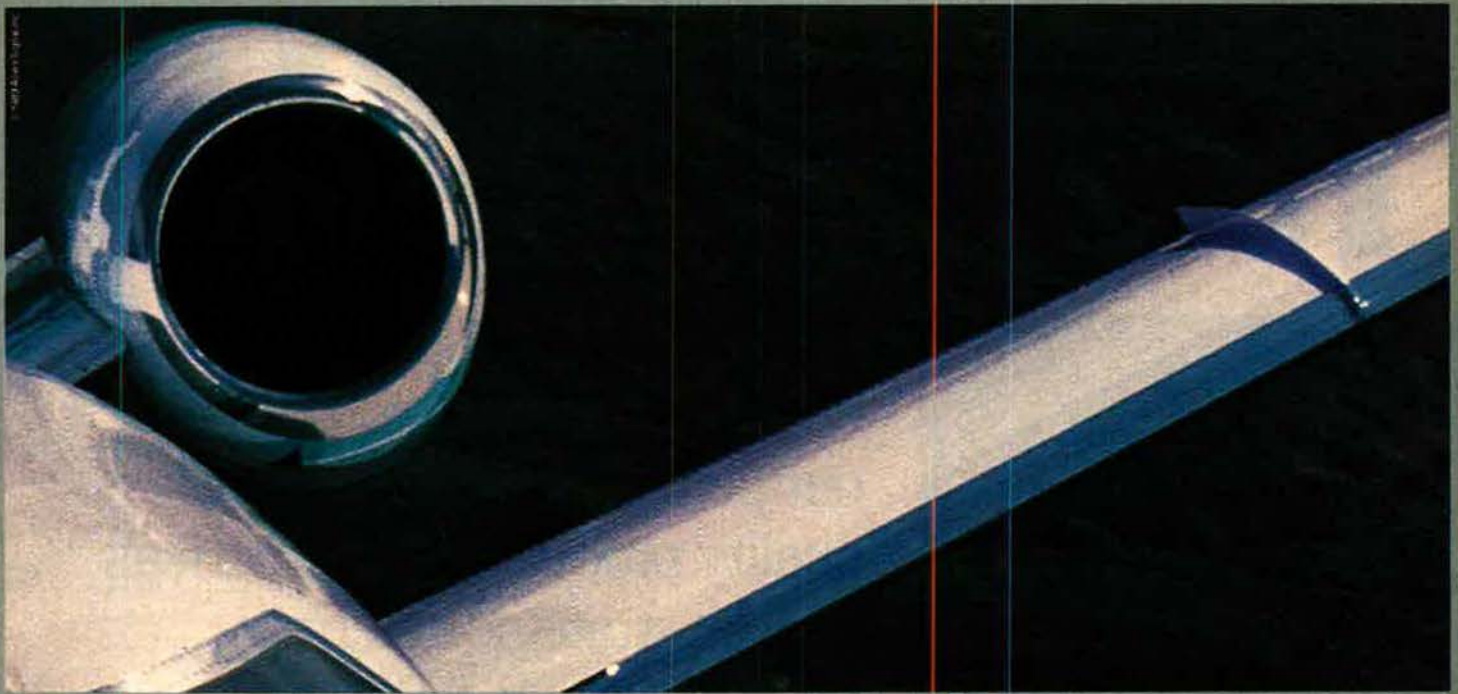
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Benign New World

By John T. Correll, EDITOR IN CHIEF

PENTAGON Needs a Few Good Enemies," sneered a headline in the *New York Daily News* June 21. The sarcasm expresses a view that is currently gathering steam. With the Soviet Union talking peace and promising massive reductions in its armed forces, what justification remains for a costly US defense program?

Some analysts have already begun their recomputation of defense requirements. William Kaufman of Harvard University, for example, speculates for *Copley News Service* that we could eliminate eleven Army divisions, three carrier battle groups, and twenty Air Force fighter wings and still have plenty left to meet our needs in the future.

Despite some doubt that Soviet General Secretary Mikhail Gorbachev can deliver on his promises, Americans today feel safer and more secure than they have in forty years. They seem inclined to believe that a more benign world is just around the corner. Tomorrow will certainly be different. Whether it is less threatening remains to be seen.

"For the next few years, familiar issues will predominate, but looming ahead will lie a different strategic world," the White House Commission on Long-Term Strategy predicts. "For the next decade, the basic situation is a world with two major, dominant powers and a larger number of medium-size small powers. Twenty years from now there will be three or four or possibly even five major powers."

An integrated Europe might be among the new powers. So might China and Japan. By 2010, the Chinese economy could be the world's second largest, overtaking both Japan and the Soviet Union. Other nations are projected to move up in the economic standings as well. India's GNP will approach that of France in 2010, for example, and Brazil's will roughly match the United Kingdom's.

The redistribution of political influence and the proliferation of weapons technology will lessen the ability of the great powers to intervene in regional conflicts. This in turn increases the danger that local wars may spread or escalate.

Even today, numerous Third World countries are too well armed to dismiss lightly. Twenty-two developing nations own ballistic missiles. A dozen field more than 1,000 tanks each. Many have chemical weapons and advanced electronics. By the next century, forty nations might possess nuclear weapons.

Latin America, Africa, the Middle East, and the Mediterranean rim are ripe locations for trouble. The greatest danger of all may be the smoldering unrest in Eastern Europe. The entire continent could be drawn into a conflict that began with violent breakup of the Warsaw Pact.

Such considerations alone should put a damper on premature celebrations about the Benign New World. Our main national security concern, however, is still Soviet military power. No matter what the optimists think, that danger has not melted away.

The international goodwill that Mr. Gorbachev enjoys was purchased on credit. As US Army Chief of Staff Carl E. Vuono says, "most of his promised military checks are still in the mail." The United States unilaterally reduced its defense program by eleven percent in the past four years. Mr. Gorbachev's reductions have not yet begun.

Moreover, Mr. Gorbachev's promises touch only the margins of Soviet military strength, Adm. William J. Crowe, Jr., Chairman of the Joint Chiefs of Staff, told the House Armed Services Committee in April testimony. "Even after reducing 500,000 troops, the USSR will end up with an active military establishment of about 4,600,000 personnel and the world's largest inventory of military hardware," Admiral Crowe said.

Soviet military spending rose by its usual increment last year, and Soviet industry continues to run full tilt on military production (see *Editorial, "The Embattled Soviet Economy," July 1989 issue*). Gen. John Galvin, Supreme Allied Commander in Europe, recently described how new production could affect the net result of the Soviet offer to withdraw 10,000 tanks from Europe.

"They are now producing about 3,000 tanks a year—far better tanks, by the way, than anything they are talking about removing," General Galvin said. "They say, and I agree after having studied it, that it will take them about two years to pull back the 10,000 tanks in an orderly fashion. By then, they will have added at least 6,000 newer ones."

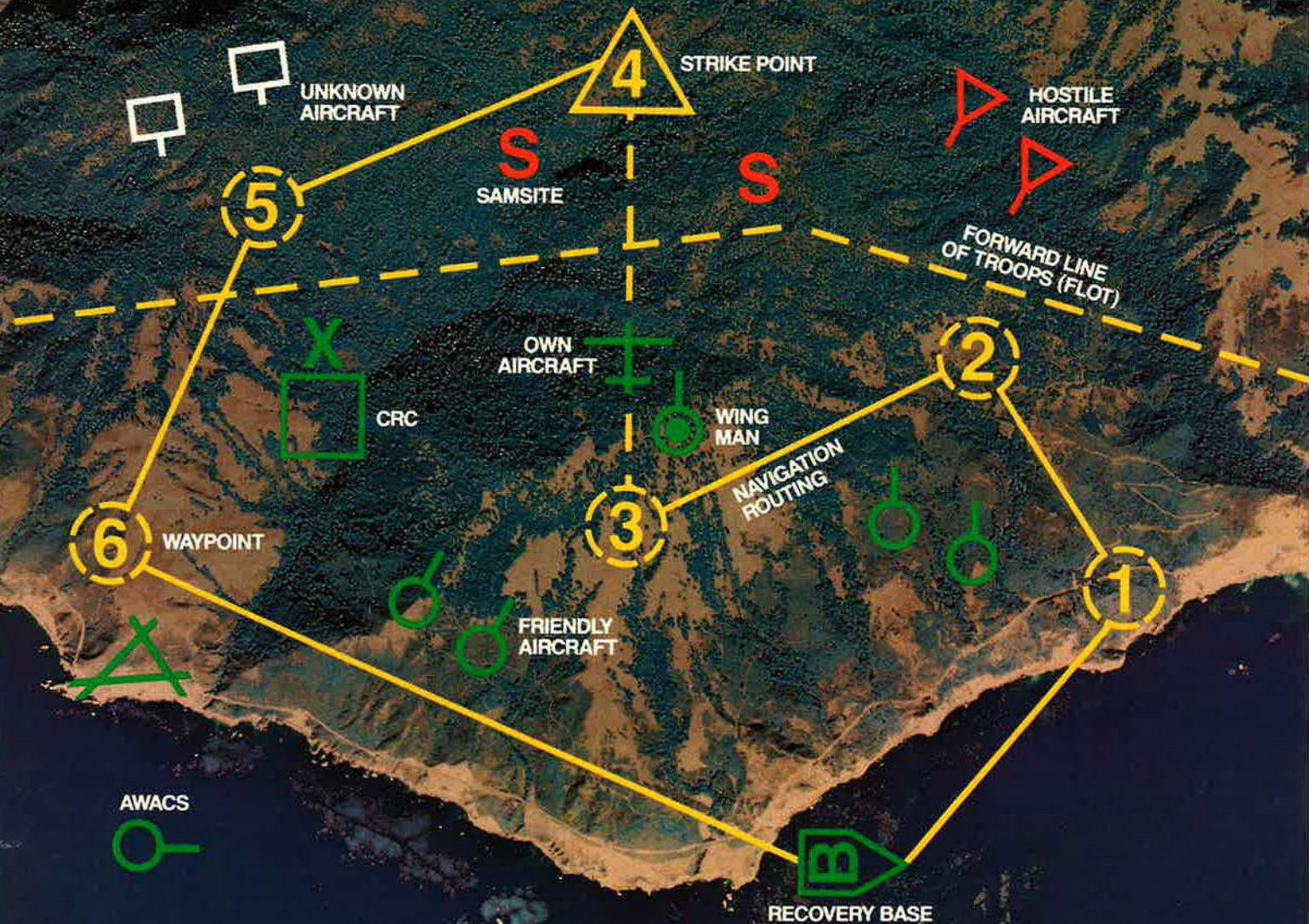
If Mr. Gorbachev succeeds in his reform program, that would not necessarily be good news for the Western world. All of his actions are consistent with building the Soviet Union into a more powerful adversary.

Mr. Gorbachev may give us more symbolism, which has worked well for him so far. It is conceivable that he will tear down the Berlin Wall. He might even give Lenin a decent burial. Such symbolism does not diminish his real power. What he will not do is willingly turn the Soviet Union into an inconsequential backwater.

But on what basis except military muscle can the Soviet Union be counted a great power? Trade? The Soviet economy is a basket case, and the poor quality of goods produced by Soviet factories has been a continuing disappointment to Mr. Gorbachev. Ideology? Even the Communists don't buy communism anymore. Population and geography? Perhaps, but Moscow's grip on the Soviet empire is not what it used to be. A huge military establishment is the Soviet Union's only real source of influence and power. Mr. Gorbachev will hold on to it if he can.

Almost everyone agrees that the global distribution of power is shifting. Change brings instability, which leads to all manner of dangerous circumstances. We had better think again before dumping those eleven divisions, three carrier battle groups, and twenty fighter wings. ■

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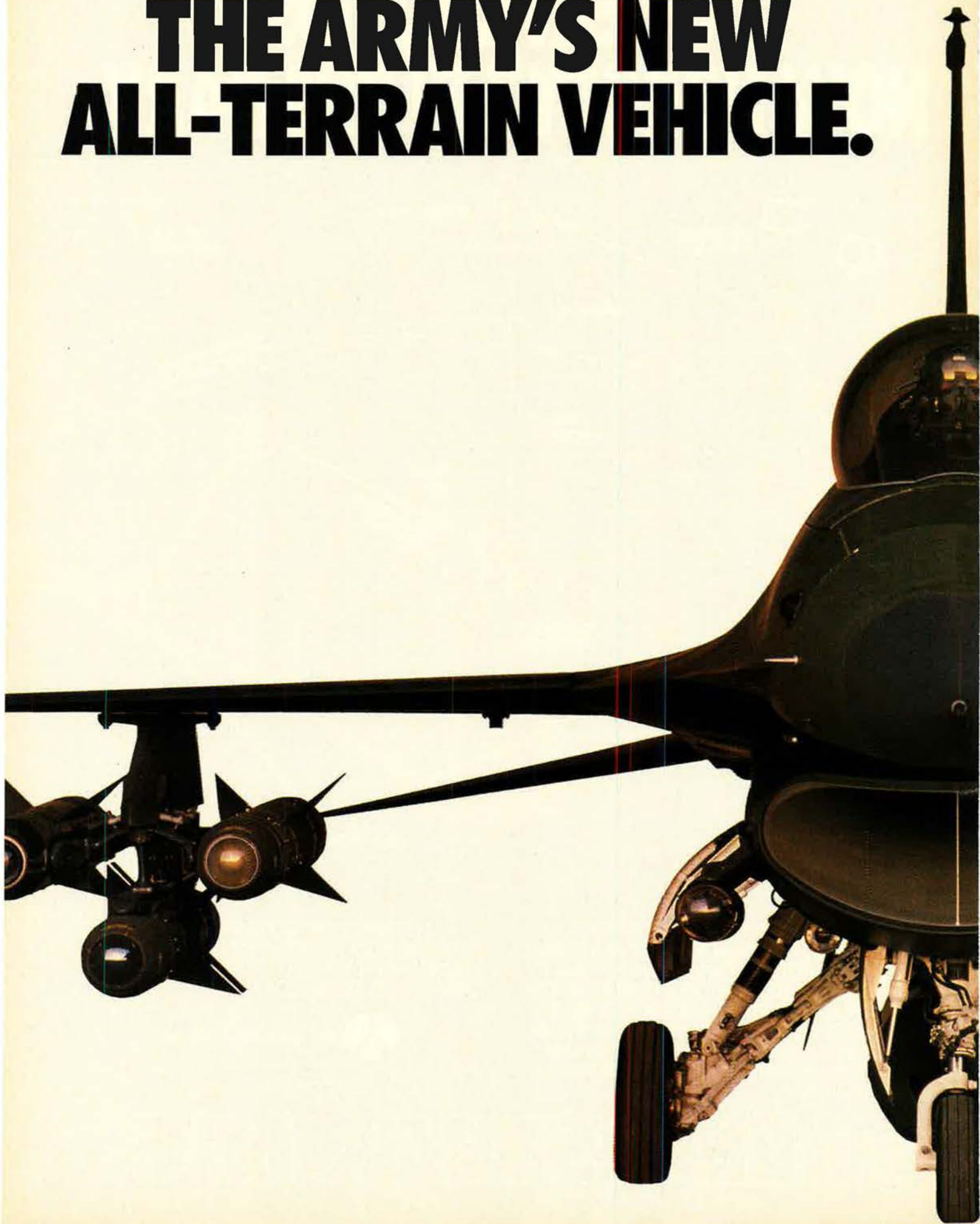
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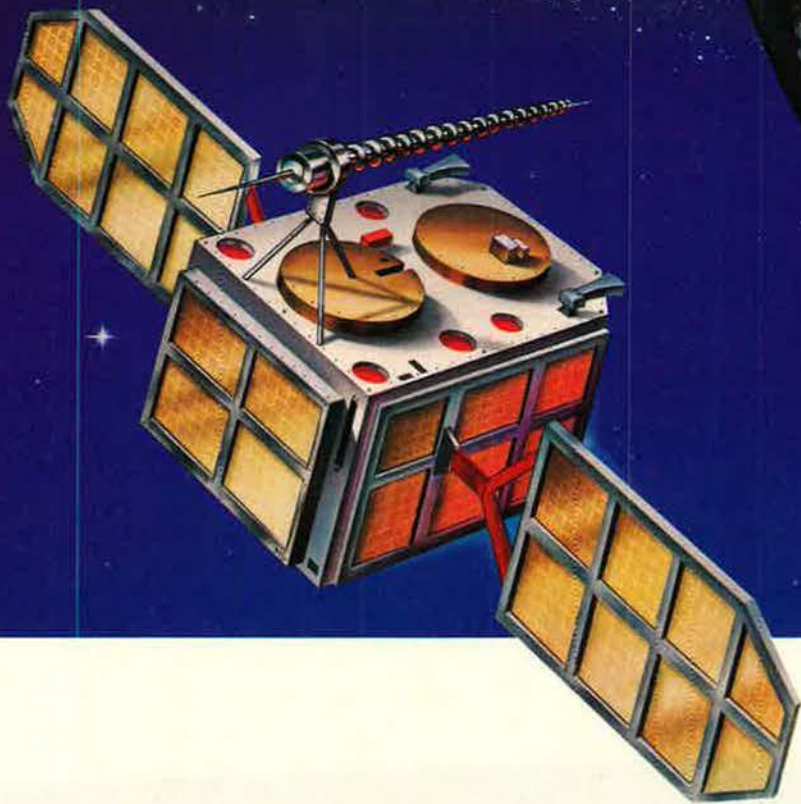
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Wings and Stripes

The article "Enlisted Pilots" by Bruce D. Callender in the June 1989 issue of AIR FORCE Magazine was long overdue. I enjoyed his report of the programs used by the United States to generate trained pilots and meet the high demands during wartime. I was, I am proud to say, there at the peak of the effort in World War II.

The paragraph covering the flight officer program that the Army Air Forces conducted during World War II was slightly in error. Applicants for aviation cadet training needed to be eighteen years of age, pass a written general knowledge exam, and be physically qualified for pilot duty. That's how young men like myself who were not yet graduates from high school became flight officer pilots during that era. The flight officer program lasted through the war years. Some of us, after serving as rated pilots, were discharged soon after V-J Day and returned to finish high school.

Brig. Gen. Paul E. Gardner,
USAF (Ret.)
Destin, Fla.

Your story on "Enlisted Pilots" was of particular interest. I believe I had an opportunity to see Master Sergeant Holmes in Base Operations at Brookley AFB, Ala., sometime in 1955.

Like many of my peers, I was aware the Army Air Forces had used enlisted pilots earlier in World War II, but I never expected to see one. Since he was in front of us with his clearance, we had an opportunity to watch the Operations Dispatcher's reaction. It was one of total disbelief. Master Sergeant Holmes seemed to take all this in a rather good-natured way, and to even be slightly amused. Under the circumstances, I'm not sure any of us would have maintained a like demeanor.

I only found one minor error, which did not detract from the story at all. This had to do with the manner in which flight officers came into the cadet program.

In my class (44-D) there were only four flight officers out of nearly 500

2d lieutenants (I was one of them). By the time we had been deployed to the CBI theater and several months had passed, replacement crews we got were almost all flight officers.

It has always been my understanding that from that point until the cadet program was shut down, the flight officer graduates represented almost seventy percent of the pilot population.

Stories of this nature are particularly interesting to me, and I suspect to lots of other people too. Do it again!

Col. William H. Ramsey,
USAF (Ret.)
N. Little Rock, Ark.

Bruce D. Callender's article in the June '89 issue on "Enlisted Pilots" was excellent, well researched, and long overdue. The WASPs (Women's Airforce Service Pilots) have finally had their contribution to our World War II victory recognized; the acknowledgment of this particular group of the "uncomfortably needed" was certainly appropriate. They earned and deserve their place in Air Force history.

One of those staff sergeant pilots, however, did find his way into aerial combat in Europe as a P-47 pilot before being commissioned. I was privileged to serve with him while stationed at the US Embassy in Rome, Italy, from 1952 to 1953. He was Everette L. Marcum, our Air Operations Officer, by then a major.

CMSgt. Lee R. Bishop,
USAF (Ret.)
San Antonio, Tex.

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 preferably typed. We are sorry we cannot acknowledge receipt of letters to "Airmail." We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Photographs cannot be used or returned.—THE EDITORS

Weasels and Ravens

Very timely, the article about Weasels and Ravens in the June 1989 issue [see "Slam 'Em and Jam 'Em," by Jeffrey P. Rhodes, p. 50], because it touches on a most troubling current situation, i.e., the pending closure of George AFB and the transfer of its fighter units to Mountain Home AFB.

There must be hundreds of fighter pilots and other essential souls out there who served at George and who think that the base must have gone to the dogs and is for some reason no longer important to the TAC mission.

Let me assure you all that George is a busy, well-equipped, and well-maintained base supporting two wings of F-4s and a detachment of OV-10s. It is a beautiful base, in better shape than it has ever been.

Since TAC's mission of continuation training for combat-ready forces and maintaining bases for rapid deployment of these forces hasn't changed, the importance of George AFB should not have changed.

George is still the only TAC base on the west coast. It still has an average of 360 good weather flying days per year. (Mountain Home has 220.) It is still located at the entrance of R-2508, the restricted area complex that covers 16,000 square miles of California desert including Death Valley and the Panamint Valley supersonic maneuvering area. It still has eight available weapons-delivery ranges including the finest EC ranges in the world. It still launches tacair support throughout the year for the National Training Center at Fort Irwin. It is still unhampered by civilian air traffic, and there is no reason to believe that will change. All the other good things you remember about George are still true, too.

Nothing against the good people of Mountain Home, and not to detract from the beauty of that country up there, but even after the Air Force has spent its \$130 million plus to prepare Mountain Home AFB for the arrival of the F-4s, it can never compare with what is already available at George.

Sounds crazy to close George, doesn't it? A group of retired fighter

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Airmail

pilots living near George thought so, too. So we obtained for analysis a copy of the report by the Base Realignment and Closure Commission. We found that every primary and secondary reason cited for closing George is false! They are false because the information supplied by the Air Force is wrong, and the Commission never visited George to verify it.

The only explanation is that there was high-level interference in a process that should have been highly objective. It's clear that TAC had to give up a base. It's also clear that military value and national security did not influence the choice. This errant decision should be challenged in every way possible—and we are doing just that.

Lt. Col. Vernon R. Lee,
USAF (Ret.)
Apple Valley, Calif.

Bravo to Jeffrey Rhodes [for his June '89 "Slam 'Em and Jam 'Em" article. The role of defense suppression cannot be overemphasized—a true force multiplier. There was one thing neglected in this article, though—Stealth.

I suspect much of the F-117A mission will be defense suppression to open a window of opportunity for the multipurpose forces. [Since it is] believed to carry four Mavericks or two Paveway III LGBs with BLU-109B warheads for hardened command centers, I wouldn't be surprised if it didn't have provisions for up to two GBU-15s with BLU-96 FAE warheads or an SUU-54 cluster warhead that could devastate an entire SAM site.

The follow-on Wild Weasel must be at least as high a priority as the ATF. It should, for maximum penetration and survivability, be a dedicated Stealth platform—the A-12 seems the best. Already penciled in as a Navy A-6 and Air Force F-111 replacement, an A-12 Wild Weasel should be an even higher priority.

The Navy is looking closely at an A-12 derivative to replace the EA-6B jammer aircraft. Perhaps a small dose of joint-project medicine could make it an EF-111 replacement, too.

One more possibility I would like to mention. I am a great believer in the synergy of the two major means of overcoming defenses, *i.e.*, outwitting them (with Stealth) and clubbing through them with brute force. As the B-52 force is being retained, I think they might be useful for the latter. With pylons for AMRAAMs and reengined with the very-high-bypass engines under development, equipped

with up to forty-seven (thirty internal) Tacit Rainbows or a mix with Have Naps and perhaps some operational version of the "Big Crow" superjammer, a B-52 would be a magnificent brute-force defense-suppressor—and be able to stand off and loiter for a long period.

Michael J. Sergeant, M.D.
Kankakee, Ill.

May Errata

In your story "The Choppy Course of the Helicopter" [see May '89 issue, p. 164], you stated that George de Bothezat tested a new helicopter at McCook Field (now Wright-Patterson AFB) in Ohio.

There seems to be some confusion contributing to the [mistaken notion that] the present-day site of Wright-Patterson AFB was once the site of McCook Field in Dayton.

The original McCook Field was approximately one mile N. E. of downtown Dayton, at the confluence of the Great Miami and Mad Rivers. It gave up its title as the world's major and largest experimental airfield a long time ago. It is now a major sports complex known as Kettering Field, named after the great inventor, Dayton son Charles F. Kettering. . . .

Wright-Patterson AFB is eight to thirteen miles from the center of downtown Dayton and in part encompasses Huffman Prairie. Huffman Prairie was used by Orville and Wilbur Wright before and immediately upon returning from Kitty Hawk. They used the ideally flat land for testing, practicing, modifying, experimenting, and assembling all of their earliest aircraft. It became known as Wright Field in 1904 because of these activities.

Huffman Prairie lies just to the south of the western end of runway 5L on Wright-Patterson. Today, there exists a National Historical monument in place of the buildings once used by the Wrights. Anyone flying into or out of Wright-Patterson must pass over these historical acres.

Ed Tritschler
Dayton, Ohio

On p. 161 of the May 1989 issue of AIR FORCE Magazine, "Guide to USAF's Minor Installations," the listing for Indian Springs Air Force Auxiliary Field, Nev., is incorrect.

In October 1987, the "Springs" went to civilian contract for services and support, while maintaining fire and security protection with DoD government-service employees. At the same time, the facility began opera-

tions under the control of the 554th Operations Support Wing and the 554th Range Group at Nellis AFB.

The new line entry for your Air Force Almanac should read, "Indian Springs Air Force Auxiliary Field, Nev., Nellis AFB, Nev. 89191-5000 (TAC), AUTOVON 682-0201."

Lt. Col. Phillip T. Finke,
USAF
Nellis AFB, Nev.

As a USAF Services Instructor, I found an error in your May issue. You have listed code sixty-one (supply services) 955 assigned and code sixty-two (food services) 6,055 assigned. The 611XO and 622XO career fields were merged to form the 623XO career field.

This conversion took place in April 1988. We are now Services Specialists whose duties include food service, billeting, linen exchange, and mortuary affairs. Our career field has an important mission in improving the welfare and morale of all US Air Force personnel.

SSgt. Scott A. Gannaway,
USAF
Denver, Colo.

There appears to be an error in the May 1989 issue in the caption on p. 71.

Did the new recruits devise a way to attach two ladders to one side of a T-37, or is it actually a T-38? I believe the latter.

Cory Lenger
Fort Worth, Tex.

Your magazine of May 1989 is in error on a couple of points. On p. 55, the ANG 184th TFG is not listed in the tail markings section.

On p. 123, the 184th TFG is not listed as having F-4Ds in addition to F-16A/Bs. The 184th TFG is the premier Guard unit in the nation and is also the largest. We take great pride in our mission and do not like to be left out of the total-force picture.

MSgt. Jerry L. Ferguson,
USAF
McConnell AFB, Kan.

In your May '89 issue "Gallery of USAF Weapons," you state that the supply of Atlas-E space launch vehicles has been exhausted. We on the Atlas launch team at Vandenberg AFB would like to set the record straight. We have eight boosters remaining and plan on launching two per year until they're all expended.

2d Lt. Jeffrey R. Lathrop,
USAF
Vandenberg AFB, Calif.

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FORCE Magazine is, as usual, an outstanding and unparalleled reference piece. In my years as a recruiter, I find it useful several times a week and generally keep the previous year's issue handy at home.

In the interest of accuracy, I offer the following newer data to keep our "humble listings" as current as possible. I hope you'll accept them in the spirit in which they're offered:

Page 123—ANG by Major Command Assignment, SAC/KC-135E. Should read: 101st Air Refueling

Wing, Bangor ANG Base, Me.

Pages 142-3—KC-135. You've pictured the KC-135A and the KC-135R. Couldn't the extremely cost-effective "E" have equal time? And since the "A" is on the way out, couldn't the "E" and "R" statistics be given in the '90 Almanac?

Page 161—Guide to ANG and AFRES Bases. Current listing should read: Bangor ANG Base, Me. 04401-099; 4 mi. NW of Bangor. Phone (207) 947-0571; AUTOVON 476-6210. 101st Air Refueling Wg. (ANG/SAC); 776th

Airmail

Radar Sqdn. (USAF/TAC); Det. 1, 158th Fighter Interceptor Gp. (ANG/TAC); 1911th Comm. Sqdn. (USAF/AFCC). Area 300 acres. Altitude 192 ft. Traditional Guard 571, Active Duty Military 406 (286 USAF, 120 ANG), technicians 235, civilians 46. Payroll \$21 million. Commissary, small BX (new BX scheduled to start construction in fall 1989), gymnasium, limited ARNG transient facilities near base.

MSgt. Michael P. Gleason,
USAF

Bangor ANGB, Me.

With reference to the May 1989 issue, a correction should be made for your records regarding the USAF Medal of Honor recipients.

On page 60, the home town for Lt. Col. William A. Jones III [is given as] Norfolk, Va. Please correct this to Warsaw, Va. Also, his rank at time of death was colonel.

Lois McG. Jones
(Mrs. William A. Jones III)
Falls Church, Va.

In the May '89 issue, the USAF Almanac completely omitted my base: The 850th Munitions Maintenance Squadron, Theater RAF Welford,

United Kingdom. Part of USAFE reporting directly to Third Air Force, we are the largest conventional munition depot in Europe. More than 140 personnel are assigned, commanded by Lt. Col. Nancy M. Van Duyne. We may be small, but we are proud to serve in this out-of-the-way base.

SMSgt. Gary L. Preston,
USAF
RAF Welford, UK

Loyalty to Allies

For a former Assistant Secretary of Defense for East Asian and Pacific Affairs, Dennis J. Doolin displays an astounding ignorance of the situation in South Vietnam in 1975 [see "Vietnam Lessons," April '89 "Airmail," p. 13].

He left office in 1974, before South Vietnam fell. I left Vietnam in 1970, but I did read up on 1975's events—a procedure I would recommend to Mr. Doolin.

Doolin's arrogant insulting of the Vietnamese people and armed forces is a common defensive reaction. Such smokescreens cannot hide our guilt: The US selfishly betrayed an ally on the battlefield.

South Vietnam's government and armed forces were not up to US stan-

dards, to be sure. . . . Yet the South Vietnamese were performing reasonably well, in the Vietnamese context, by the time we withdrew in 1972-73.

Their total collapse in 1975 was due to the logistical and morale effects of our cruel, cold-blooded, and stupid aid cuts in 1974. Those cuts left South Vietnam without medical supplies, radio batteries, and spare parts for weapons and with only a fraction of the ammunition and fuel they needed. Even the North Vietnamese commander who crushed them conceded that their mobility and firepower had been cut in half.

The best US troops would have performed miserably, too, under those conditions.

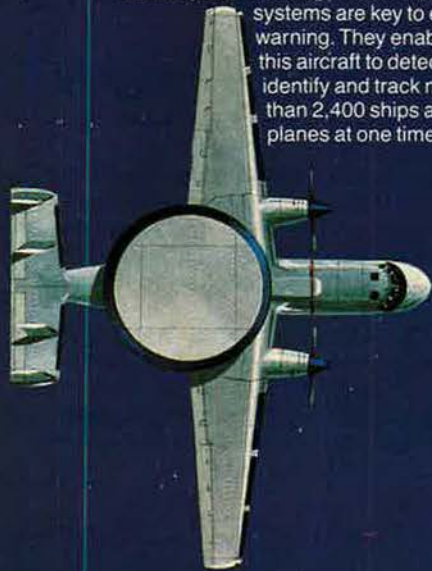
Nevertheless, South Vietnamese troops at Xuan Loc put up a defense as heroic as any in US military annals. That action culminated a war in which South Vietnamese forces—whom Doolin so contemptuously dismisses—lost over a quarter of a million dead. That's equivalent, in population terms, to roughly 2,500,000 American dead. They didn't die like that without fighting.

It is no reflection on South Vietnam that it needed our help. No nation on

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earth—not Israel, not North Vietnam, not any NATO nation—can fight a major war without US or Soviet help. Even South Korea needed supplies, and more, from us to survive (unlike South Vietnam, the Koreans got the needed help).

It is a reflection on us that we didn't come through.

Would South Vietnam have survived if we had kept up the supply flow? Perhaps. Perhaps not. We will never know. If we had done our part and they had failed, then we could say we had done our best and it was their fault. But we did not do our best, and we cannot blame them for the results.

The abandonment of South Vietnam is a black mark on our national character that will never be expunged. The all-too-common tendency to make excuses and point fingers at fallen allies who can no longer defend themselves is a sorry spectacle that only deepens America's shame.

Harry F. Noyes III
Fort Sam Houston, Tex.

Living Like Marines

I am unsure which Air Force Mr. Paul Madden is talking about when he states [that cost is added by] "officers' clubs, BXs, theater, family housing, etc. . . . There's no way an Air Force

officer is willing to live like a Marine." [See "AirLand Fighter Debate," June '89 "Airmail," p. 10.] He might want to check with a few of the United States Fourteenth Air Force veterans from World War II and those who served in North Africa in the early and mid-1950s about our living conditions. We considered tents luxurious—when we had them. In any future combat situations, I believe this would be duplicated. I suggest Mr. Madden is making some unwarranted assumptions.

Lt. Col. Wallace H. Little,
USAF (Ret.)
Memphis, Tenn.

Bite the Bullet on B-2

I am writing you concerning what seems to me to be the unreasonably high cost of the B-2 Stealth bomber. Col. Bud Hall, USAF (Ret.), had some very pointed comments concerning this [see "The B-2's Cost," June '89 "Airmail," p. 14]. I agree with him. All of the articles that I have read place the cost per plane at an estimated \$500 million. Did I misread the articles? I might have. But whatever the final estimated cost may be (and what about overruns?), it would become a very expensive weapon system—a system that I do not believe the United States can afford.

I have supported the Army Air Forces/United States Air Force . . . ever since I enlisted on December 12, 1942. . . . I flew as a pilot in World War II, Korea, and Vietnam, combat tours all. . . . I must break with the thinking that says we can afford such an expensive combat aircraft. . . . I wholeheartedly support the need for a follow-on aircraft to the B-52. From what I can understand, I believe the B-1 can fill that need once we work out any remaining bugs and get the new ECM equipment made, installed, and working.

With very good prospects for continued declining defense budgets, funds that are so hard to come by would indeed be better spent in other areas. I'd say cancel the program now. Bite the bullet and live with whatever sunk costs have occurred. Accept and utilize all the R&D that has been accomplished, but cut our losses and put the very best planners to work rethinking the strategy that called for the deployment of the B-2. . . .

Col. Peter D. Summer,
USAF (Ret.)
Montgomery, Ala.

Whisner's DSCs

Just finished reading the tribute to our late and distinguished ace, Gen.

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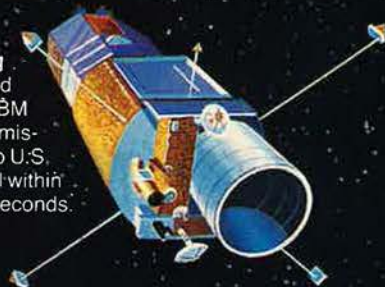
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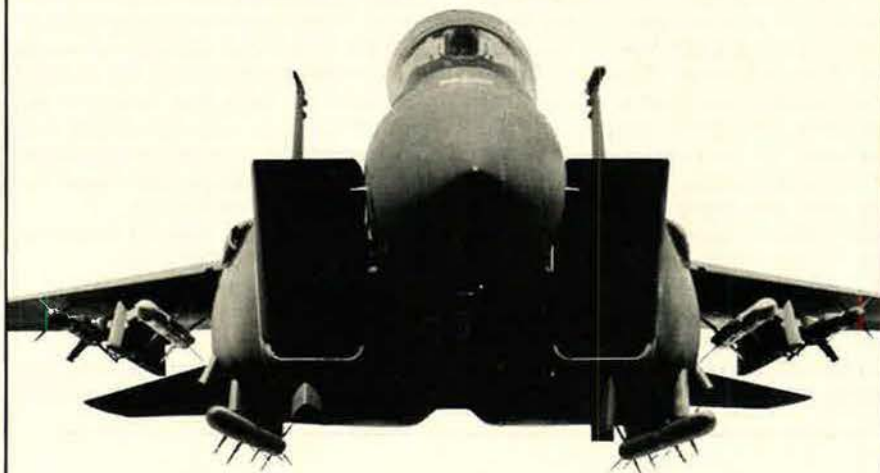
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MCDONNELL DOUGLAS

F-15E

READY NOW AND HERE FOR THE LONG RUN

Airmail

John C. Meyer, as written by John Frisbee. [See "Valor: Four-Star Ace," May '89 issue, p. 172.] I certainly would not want to take anything away from General Meyer's record, but I would like to point out that he was not the only Air Force officer to be awarded three Distinguished Service Crosses.

Col. William T. Whisner, who flew under General Meyer's command with the 352d Fighter Group of the Eighth Air Force, also earned three DSCs. The first was awarded Whisner for his action on November 21, 1944, when he destroyed five enemy aircraft in one combat. The second was awarded for an action on January 1, 1945, when Whisner, as part of a formation led by John Meyer, took off in the face of attacking German aircraft and downed four of the enemy fighters. The third DSC was awarded for an action on February 23, 1952, over Korea, when Whisner shot a MiG-15 off the tail of one of his fellow pilots although he was under attack himself.

I always enjoy the "Valor" column and am glad that AIR FORCE Magazine sees fit to preserve the deeds of outstanding Air Force personnel.

William N. Hess
Houston, Tex.

"Fiendish" F-16s

We recently received our April issue of your fine magazine and deeply appreciated the acknowledgment of the 36th Tactical Fighter Squadron's conversion to the F-16C/D fighters. [See "Aerospace World," p. 28.] However, we'd like to point out that the squadron never stopped flying and certainly wasn't inactivated. So it couldn't possibly have been "reactivated" on January 6. On that date, a "Conversion Ceremony" was conducted here at Osan. While it certainly marked a "rebirth," it in no way marked an activation or any other change for the squadron. The Flying Fiends continued to operate their F-4Es until the last one was transferred on February 23. The first F-16C arrived on August 20, 1988 and the squadron operated both types of aircraft until becoming exclusively an F-16 unit.

Again, thanks for remembering us out here in the Pacific.

MSgt. Christopher B. Scharping,
USAF
Osan AB, Korea

Mystery Tail Code

Shortly after receiving last year's Almanac Issue, I received a photo from a

friend in Seattle showing a two-place F-15 from McChord AFB bearing tail code "TC." This code was not in the listing of tail markings then.

Upon receipt of this year's Almanac Issue I checked again . . . and "TC" still is not listed. Even if this was a new outfit a year ago, I would think an updated Almanac would have included it in the listing of tail codes.

Could there be even more that have been overlooked? Even so, I find the Almanac Issue very informative and refer to it frequently throughout the year.

Alan E. Gruening
Apache Junction, Ariz.

● According to the folks at McChord, the 318th Fighter Interceptor Squadron there officially changed to the "TC" tail marking as of April 1989—

THE EDITORS

Of Nurses and House Calls

Letters in the "Airmail" section of the June 1989 issue concerned American flight nurses killed in the line of duty during World War II. [See "Nurses Remembered," p. 17.] Please note that Lt. Catherine Price and Lt. Christine Gasvoda, members of the 817th Air Evacuation Squadron, were both killed in the line of duty during the war.

Lieutenant Price was lost on a mission out of Iceland. I do not know the circumstances of Lieutenant Gasvoda's death.

An item in the "Aerospace World" section of the same issue [see p. 32] states that Maj. Antonia M. Scialdo was recently selected as Air Force nurse of the year. It further states that Major Scialdo made 3,600 house calls last year. Really? My entire USAF career was spent in the Nurse Corps. In all those years I don't recall ever seeing a nurse or a physician make house calls, although I'm sure some were made under unusual circumstances. Assuming that Major Scialdo took no leave last year and worked a full 260-day year, that is almost fourteen "house calls" a day, every day, for the entire year. I'm afraid I don't buy it, and I would certainly like to know who the recipients of these "house calls" were.

Maj. Charles C. Blanchard III,
USAF (Ret.)
Niceville, Fla.

Correction

● On p. 8 of the July '89 issue, Gen. James P. Mullins should have been identified as a former Commander of Air Force Logistics Command. We regret the error.—THE EDITORS

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MCDONNELL DOUGLAS

F-15E

READY NOW. AND HERE FOR THE LONG RUN.

By Brian Green, CONGRESSIONAL EDITOR

HASC Unit Approves Budget

The House Armed Services Committee (HASC) Subcommittee on Procurement and Military Nuclear Systems approved a resolution proposed by Chairman Rep. Les Aspin (D-Wis.) to adopt the military procurement budget as proposed by Secretary of Defense Dick Cheney. The subcommittee vote was ten to nine. Representative Aspin said he offered his unusual resolution, which had the effect of temporarily preventing any amendments by subcommittee members, to avoid detailed consideration of nearly \$7 billion in unaffordable add-ons requested by members and to reward Secretary Cheney for doing a good job in cutting the budget.

The HASC R&D Subcommittee approved an amendment that would add \$200 million back into the National Aerospace Plane (NASP) program and again makes the Air Force and NASA coexecutors of the program. The Cheney budget cut the NASP program from \$300 million to \$100 million and made NASA the sole executive agency. The NASP will be a hypersonic cruise, single-stage-to-orbit space vehicle.

B-2 Developments

Sen. John Glenn (D-Ohio), in a letter to Secretary Cheney, called for "the immediate suspension of low-rate initial production" of the B-2 Stealth bomber, pending sufficient test data to support continued production. Senator Glenn criticized excessive concurrency between R&D and production and said "no amount of wind-tunnel testing, computer simulations, or the 'maturity matrix' program . . . can replace empirical flight-test results in making a production decision." In earlier testimony, Air Force Chief of Staff Gen. Larry D. Welch and Secretary of the Air Force Donald Rice attributed cost increases to delays in full-rate production rather than to technical problems. The delays, they said, were due to budget constraints and "a desire to ensure that adequate flight-test results are available before commitment to high-rate production."

In separate testimony, General Welch noted that concurrency is "always a balance between confidence and cost." Each year the B-2 is delayed, he said, raises program costs \$3 billion. Any extended interruption for testing that results in a shutdown of the production facilities and dispersal of the production team would increase costs tremendously. He described B-2 as a lower-risk program, overall, than the B-1B, with a somewhat higher risk in engine and airframe design but much lower risk in defensive avionics.

General Welch also testified that the B-2, measured in terms of cost per warhead delivered on target, is almost the same cost as the B-1B bomber and about half that of an ICBM.

ICBMs on Track?

After a period of uncertainty, the Administration ICBM package may be back on track in the Senate. The compromise includes funding for rail-garrison deployment of fifty Peacekeeper ICBMs now based in silos, continued development of the Small ICBM, additional funding for development of the SICBM hard mobile launcher, and deployment of the SICBM starting in 1997. Sen. J. James Exon (D-Neb.), Chairman of the Senate Armed Services Committee (SASC) Subcommittee on Strategic Forces and Nuclear Deterrence, announced at a recent hearing that he would support the Administration package. Sen. Strom Thurmond (R-S. C.) said that he would also, contingent on robust funding for SDI. Both had previously opposed the Small ICBM.

The Air Force believes that sequencing the two systems—starting with the low-risk technology of rail-garrison basing—and cost reductions in the SICBM program will allow both programs to fit into the Air Force budget. Both mobile ICBMs rely on dispersal to achieve survivability. The Small ICBM will provide a hedge against a surprise, "bolt out of the blue" attack, because it requires only tactical warning to disperse. The mobile Peacekeeper, which requires strategic warning to disperse, will add

substantially to US deterrence in the midst of an extended crisis.

The Air Force is planning to reprogram \$100 million in FY '89 funds from the Peacekeeper rail-garrison program to the SICBM program. Secretary Cheney also informed congressional leaders that the Defense Department will be adding \$947 million to the SICBM program for Fiscal Years 1992 to 1994 to cover costs of developing the missile's launcher. Congress will have to approve both actions.

Reaction to Bush Proposal

Congressional reaction to President Bush's arms-control proposal put forth at the recent NATO summit has been generally positive. HASC Chairman Les Aspin noted that the Bush plan "hit all the right chords" in terms of NATO political needs. Sen. John Warner (R-Va.), ranking Republican on the Senate Armed Services Committee, believes that the proposals are a good political move. He has also indicated that clarification of some of the specifics is needed, including those that pertain to aircraft reduction, and that verification proposals should take priority over the short timetable for agreement set by President Bush.

COLA Actions

The congressional budget resolution for FY '90 provides for a full cost of living adjustment (COLA) for federal and military retirees and those receiving survivor benefits. The President's budget called for an FY '90 freeze. The COLA provision must still go through the authorization and appropriations processes before becoming law.

Retired pay has fallen more than seven percent behind inflation since the beginning of the decade, due to a combination of freezes, delays, and reductions in annual COLAs. If Congress accedes to the President's proposal to freeze benefits for a year and to reduce COLAs to the consumer price index minus one percent (CPI-1), the gap would almost double to thirteen percent by 1991. ■



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By Jeffrey P. Rhodes, AERONAUTICS EDITOR

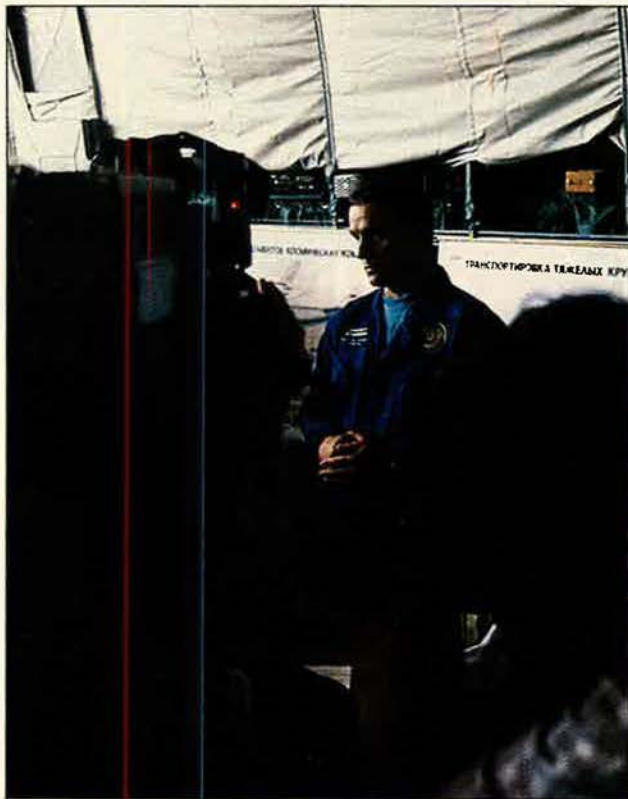
Washington, D. C.

★ The thirty-eighth Paris Air Show got off to an inauspicious start as a single-seat MiG-29 Fulcrum-A crashed during low-speed, low-altitude, high-angle-of-attack maneuvers on the first day of the show. The pilot, Mikoyan Design Bureau test pilot Anatoly Kvotchur, safely ejected and was taken, with only minor injuries, to a French hospital by helicopter.

Mr. Kvotchur had just finished executing a loop and was making a slow pass down the length of the runway at a height of just over 500 feet. As he went to afterburner to pull out of the nose-high attitude, the right engine stalled. With the left engine at maximum afterburner, the axisymmetric thrust rolled the airplane to the right and into a vertical dive.

Mr. Kvotchur said at a press conference (held in the cargo hold of the gigantic Antonov An-225 transport) five days after the accident that he first tried to restart the engine. When it was obvious that the engine would not relight, he stayed with the aircraft long enough to make sure it would not crash into the crowd on his right

Less than a week after his MiG-29 fighter crashed at the start of the Paris Air Show, Mikoyan Design Bureau test pilot Anatoly Kvotchur (through an interpreter) answered questions about the accident. The press conference was held in the cargo hold of the An-225 transport.



—Staff photo by Jeffrey P. Rhodes



Hamilton Standard machine operator Angel Rodriguez profiles the first spar for the prototype 15WF-5 propeller system, which the company is developing for the Lockheed P-7A antisubmarine warfare aircraft that will replace the P-3 Orion. The five-bladed propeller will be fitted to the General Electric GE38 engine for the P-7A.

or the buildings on his left. He ejected at about five degrees above the horizontal (just about the last possible instant), swung once under his partially deployed parachute, and hit the ground.

The MiG pilot (whose only visible injury at the press conference was a black eye) said that he thought the engine malfunction was caused by foreign-object damage, either from a bird in flight or from a stone blown into the intake prior to takeoff by another aircraft taxiing to the runway. The MiG-29's flight data recorder was recovered, and the mishap is under investigation by Soviet and French authorities. (For more on the Paris Air Show, see the "Aerospace World" Special starting on p. 51 of this issue.)

★ The C-130 crew representing the Royal Australian Air Force's 36 Squadron claimed top honors at Military Airlift Command's worldwide competition, Airlift Rodeo, held in

early June at Pope AFB, N. C. The Australians also took awards for Best C-130 Aircrew and Best Foreign Aircrew on their way to the overall team title.

Other events and winners included: Best C-130 Engine Running On/Off-load (ERO)—463d Tactical Airlift Wing, Dyess AFB, Tex.; Best C-130 Assault Landing—314th TAW, Little Rock AFB, Ark.; Best C-130 Maintenance and Best C-130 Post-Flight Inspection—911th Tactical Airlift Group (Reserve), Greater Pittsburgh IAP, Pa.; Best C-130 Preflight Inspection—LTG 63, Hahn AB, West Germany; and Best Joint Aerial Inspection Team—317th TAW, Pope AFB, N. C.

Best C-141 Aircrew, Best C-141 ERO, Best C-141 Spot Landing, and Best C-141 Maintenance—446th Military Airlift Wing (Reserve Associate), McChord AFB, Wash.; Best C-141 Preflight Inspection—437th MAW, Charleston AFB, S. C.; Best C-141 Post-Flight Inspection—438th MAW, McGuire AFB, N. J.; Best Security Police Team—1st Special Operations Wing, Hurlburt Field, Fla.; Best Combat Control Team—1723d Combat Control Squadron (Silver Team), Hurlburt Field, Fla.; and Best Aerial Port Combat Endurance Course—435th TAW, Rhein-Main AB, West Germany.

Two C-5 units participated in this year's Rodeo on an exhibition basis in several events. During the week, a C-5 crew from the 436th MAW at Dover

August Anniversaries

- **August 25, 1909:** Land for the first Signal Corps airfield is leased at College Park, Md.
- **August 25, 1914:** Stephan Banic, a coal miner in Greenville, Pa., is issued a patent for a workable parachute design.
- **August 2, 1924:** Now equipped with floats, the three Douglas World Cruisers (see April through July "Anniversaries") depart from Kirkwall, England, for Iceland. An oil-pump failure later forces the crew of *Boston*, Leigh Wade and Hank Ogden, to land in the North Atlantic. The aircraft capsizes and sinks during recovery efforts, but the crew survives. The *Chicago* and *New Orleans* crews leave Greenland on August 31.
- **August 27, 1939:** The world's first jet-powered aircraft, the Heinkel He-178, makes its first flight. *Flugkapitan* Erich Warsitz is the pilot.
- **August 4, 1944:** The first Aphrodite mission (a radio-controlled B-17 carrying 20,000 pounds of TNT) is flown against V-2 rocket sites in the Pas de Calais section of France.
- **August 9, 1949:** Navy Lt. J. L. Fruin makes the first emergency escape with an ejection seat in the US near Walterboro, S. C. His McDonnell F2H-1 Banshee was traveling at a speed of more than 500 knots at the time.
- **August 10, 1949:** President Harry S. Truman signs the National Security Act Amendments of 1949, which rename the National Military Establishment the Department of Defense.
- **August 23, 1954:** Lockheed pilots Stanley Betz and Roy Wimmer crew the first flight of the YC-130 Hercules at Burbank, Calif. Thirty-five years and some 1,900 aircraft later, the C-130 is still in production at Marietta, Ga., and will be through the 1990s.
- **August 26, 1954:** Maj. Arthur "Kit" Murray reaches a record height of 90,443 feet in the Bell X-1A after being released from a B-29. The flight takes place over Edwards AFB, Calif.
- **August 2, 1964:** The destroyer USS *Maddox* is attacked by North Vietnamese patrol boats in the Gulf of Tonkin. A second incident, involving the *Turner Joy*, reportedly occurs two days later. Congress passes the Gulf of Tonkin Resolution on August 7.
- **August 19, 1964:** The Hughes Syncom III satellite is launched by a Thor-Delta launch vehicle. After several weeks of maneuvers, it becomes the world's first geosynchronous satellite.
- **August 8, 1984:** 2d Lt. Alonzo Babers becomes the first Air Force Academy graduate to win an Olympic gold medal (in the 400-meter run) at Los Angeles, Calif. He was also on the winning 4x400-meter relay team.



—US Army photo by Spec. Brian Crumper

Military Airlift Command crews were busy earlier this year as additional troops and equipment were airlifted to Panama after violence erupted in that country. At left, one C-141B lands as another taxis in at Howard AFB, Panama. At right, two families head for the passenger terminal to be airlifted out. President Bush ordered Operation Nimrod Dancer (as the airlift was called) to ensure continued operation of the canal and to protect American personnel.



To augment the recently activated 301st Air Refueling Wing at Malmstrom AFB, Mont. the 12th Flying Training Wing at Randolph AFB, Tex., is sending an element of T-38As on rotational assignment to Malmstrom. Used in the Aviation Career Enhancement program, the Talons will give copilots on Malmstrom's KC-135R tankers opportunities to gain flying hours and practice as aircraft commanders.

Senior Staff Changes

RETIREMENTS: M/G David W. Forgan; B/G Floyd E. Hargrove; M/G Wayne O. Jefferson, Jr.; ANG B/G John F. McMerty; M/G Stanton R. Musser; B/G Wayne E. Schramm; B/G John F. Sievertson.

CHANGES: Col. (B/G selectee) Billy J. Bingham, from Dep. ACS/Intel., Hq. USAF, Washington, D. C., to Cmdr., AFIA, and Dep. ACS/Intel., Hq. USAF, Washington, D. C., replacing Col. George B. Lotz . . . B/G (M/G selectee) Stephen B. Croker, from DCS/P&P, Hq. SAC, Offutt AFB, Neb., to Dir., Strategic SOF and Airlift Prgms., Ass't Sec'y of the Air Force for Acq., OSAF, Washington, D. C., replacing retiring M/G Michael D. Hall . . . M/G Alexander K. Davidson, from Cmdr., 22d AF, MAC, Travis AFB, Calif., to Cmdr., AFISC, and Dep. IG, Inspection and Safety, Norton AFB, Calif., replacing retired M/G Stanton R. Musser . . . B/G Robert E. Dempsey, from DCS/Strategic Planning and Analysis, Hq. SAC; Dep. Dir., Force Employment Plans, JSTPS; and Dep. Dir., Strategic Planning and Analysis, STRACOS, Offutt AFB, Neb., to Vice Cmdr., 8th AF, SAC, Barksdale AFB, La., replacing M/G Martin J. Ryan, Jr. . . . B/G (M/G selectee) Howell M. Estes III, from Ass't DCS/P&P, Hq. SAC, Offutt AFB, Neb., to DCS/P&P, Hq. SAC, Offutt AFB, Neb., replacing B/G (M/G selectee) Stephen B. Croker . . . M/G Richard B. Goetze, Jr., from Vice Dir., Joint Staff, OJCS, Washington, D. C., to Spec. Ass't to Vice C/S, OJCS, Washington, D. C. . . . Col. (B/G selectee) James F. Hinkel, from Exec. Officer to C/S, Hq. USAF, Washington, D. C., to Cmdr., 834th Airlift Div., MAC, and DCS/Airlift Forces, Hq. PACAF, Hickam AFB, Hawaii, replacing B/G (M/G selectee) Vernon J. Kondra.

B/G (M/G selectee) Vernon J. Kondra, from Cmdr., 834th Airlift Div., MAC, and DCS/Airlift Forces, Hq. PACAF, Hickam AFB, Hawaii, to DCS/P&P, Hq. MAC, Scott AFB, Ill., replacing M/G Richard J. Trzaskoma . . . M/G Martin J. Ryan, Jr., from Vice Cmdr., 8th AF, SAC, Barksdale AFB, La., to Dep., USCINCLANT, and C/S, Hq. USLANTCOM, Norfolk, Va., replacing retiring M/G John J. Doran, Jr. . . . M/G Richard J. Trzaskoma, from DCS/P&P, Hq. MAC, Scott AFB, Ill., to Cmdr., 22d AF, MAC, Travis AFB, Calif., replacing M/G Alexander K. Davidson . . . B/G Lester J. Weber, from Ass't DCS/Plans, Hq. AFSPACECOM, Peterson AFB, Colo., to Cmdr., Computer Sys. Div., AFCC, Gunter AFB, Ala.

SENIOR ENLISTED ADVISOR (SEA) CHANGES: CMSgt. Willie A. Currie, to SEA, Hq. USAF, Ramstein AB, Germany . . . CMSgt. Michael Digregorio, to SEA, Hq. AFSC, Andrews AFB, Md. . . . CMSgt. Charles W. Franz, to SEA, Space Com. Div., Peterson AFB, Colo. . . . CMSgt. Richard G. Griffiss, to SEA, 81st TFW, RAF Bentwaters, UK . . . CMSgt. Kirby G. Harvey, to SEA, 432d TFW, Misawa AB, Japan . . . CMSgt. Richard K. Humphrey, to SEA, 39th SOW, Eglin AFB, Fla. . . . CMSgt. Delmar T. Jones, to SEA, Hq. Space Cmd., Peterson AFB, Colo.

CMSgt. Joseph S. Jones, to SEA, 401st TFW, Torrejon AB, Spain . . . CMSgt. Edwin H. Morgan, Jr., to SEA, 57th AD, Minot AFB, N. D. . . . CMSgt. John R. O'Halloran, to SEA, Lowry TTC, Lowry AFB, Colo. . . . CMSgt. Stephen W. Powers, to SEA, 509th Bomb Wg., Pease AFB, N. H. . . . CMSgt. Terry A. Savoie, to SEA, 51st TFW, Osan AB, Korea . . . CMSgt. Robert H. Taylor, to SEA, European Com. Div., Kapaun Adm. Annex, Germany . . . CMSgt. James P. Turner, to SEA, 39th Tac. Air Control Gp., Incirlik AB, Turkey . . . Ronald G. Wheelis, to SEA, 67th TRW, Bergstrom AFB, Tex. . . . CMSgt. Edward Winkelsmith, to SEA, 353d SOW, Clark AB, the Philippines. ■

AFB, Del., airdropped a world's record 190,346 pounds (four M551 Sheridan tanks and seventy-three paratroopers) on a drop zone at nearby Fort Bragg.

★ **HONORS**—Lt. Col. Craig P. Weston, a member of the graduating class at the USAF Air War College at Maxwell AFB, Ala., was awarded the 1989 Douhet-Mitchell International Airpower Trophy in ceremonies in late May. The award, presented annually to a student at the Air War College and a student from the Italian Air War College in Florence, Italy, recognizes the student from each school whose written work best demonstrates extraordinary vision or foresight into future military aerospace requirements of the US. The Italian winner will be named in the fall.

★ **PURCHASES**—Air Force Systems Command's Aeronautical Systems Division at Wright-Patterson AFB, Ohio, awarded Hughes Training Systems a \$28 million contract on May 25 to develop a C-141 Aircrew Training System (ATS). The C-141 ATS will include qualification, continuation, upgrade, and refresher crew training at the "schoolhouse" at Altus AFB, Okla., five main operating bases, and air reserve component locations. The contract will also include engine-run training for ground personnel. Contractor takeover of all C-141 training will be completed by the end of the year.

★ **MILESTONES**—The first Martin Marietta Titan IV heavy-lift space booster was successfully launched from Launch Complex 40 at Cape Canaveral AFS, Fla., on June 14. The booster, which stands nearly twenty stories high and can boost a payload of 10,200 pounds into geosynchro-



On May 13, the Royal Air Force celebrated the fortieth birthday of the English Electric Canberra (Martin B-57 in USAF service) at RAF Wyton. Retired Wing Cmdr. Roland "Bee" Beamont, the original test pilot in 1949, sat in the right seat for a reenactment of the first flight. Like this one, most of the seventy-five Canberras still in RAF service are used as target facilities aircraft.

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LTV has successfully test-launched two AGM-114A Hellfire antiarmor missiles (shown here), as well as twenty-two Hydra-70 antipersonnel rockets, from its Crossbow pedestal-mounted launcher in recent tests at the Yuma Proving Ground, Ariz. The trials were conducted for Naval Air Systems Command and Naval Sea Systems Command in preparation for a sea test of Crossbow scheduled for September.

nous orbit, carried a classified military payload. The Air Force has ordered a total of forty-one Titan IVs.

The **7th Missile Warning Squadron** at Beale AFB, Calif., **set a continuous performance record** of ninety-two days, nine hours, and fifty-six minutes without an unscheduled systems outage **on its Pave Paws phased-array early warning radar**. The 7th MWS broke the record of sixty-eight days set earlier this year.

The **second Grumman X-29A** forward-swept wing demonstrator **made its first flight** on May 23. The aircraft, identical to the first X-29 except for the addition of a tail-mounted parachute for spin recovery and some instrumentation changes, was flown by NASA pilot Stephen Ishmael on the fifty-three-minute flight. The second X-29 will be used for high-angle-of-attack research.

★ **NEWS NOTES**—The Air Force Museum, the National Air and Space Museum, and the Museum for Transportation and Technology in West Berlin are cooperating to restore





A wolf in sheep's clothing: The new Soviet Il-78 Midas tanker in the livery of the Soviet airline, Aeroflot. This photo was taken by a Royal Norwegian Air Force F-16 pilot as he escorted the Midas and its accompanying Tu-142 Bear bomber in international airspace off the northern coast of Norway.

four World War I Halberstadt ground-attack fighters. The aircraft will be restored in Berlin. When work is completed in 1991, the Air Force Museum and the National Air and Space Museum

will each get one aircraft, while the Museum for Transportation and Technology will keep the other two. Both of the US museums have a huge backlog of restoration work, so the

exchange works out well for all. Only seven Halberstadts are known to exist today.

★ **DIED**—**Ronald E. Bishop**, designer of the de Havilland Mosquito bomber in World War II and the Comet jetliner after the war, of unreported causes in London on June 11. He was eighty-six. He entered the aircraft industry as an eighteen-year-old apprentice; his Mosquito design was at first rejected by the Royal Air Force, but later went on to become one of the most versatile aircraft of the war. Built almost entirely out of wood, the Mosquito was used for photo reconnaissance by the US. The Comet was the world's first jet-powered commercial transport.

James H. "Ginger" Lacey, the top-scoring British ace during the Battle of Britain, of cancer at a hospital in Cottingham, England, on May 30. A sergeant during the Battle of Britain, he recorded fifteen victories during the summer of 1940 and was shot down nine times while flying Spitfires. He finished the war with twenty-eight victories, tied for eighth among the top RAF aces. He later ran an air freight business and taught flying. ■

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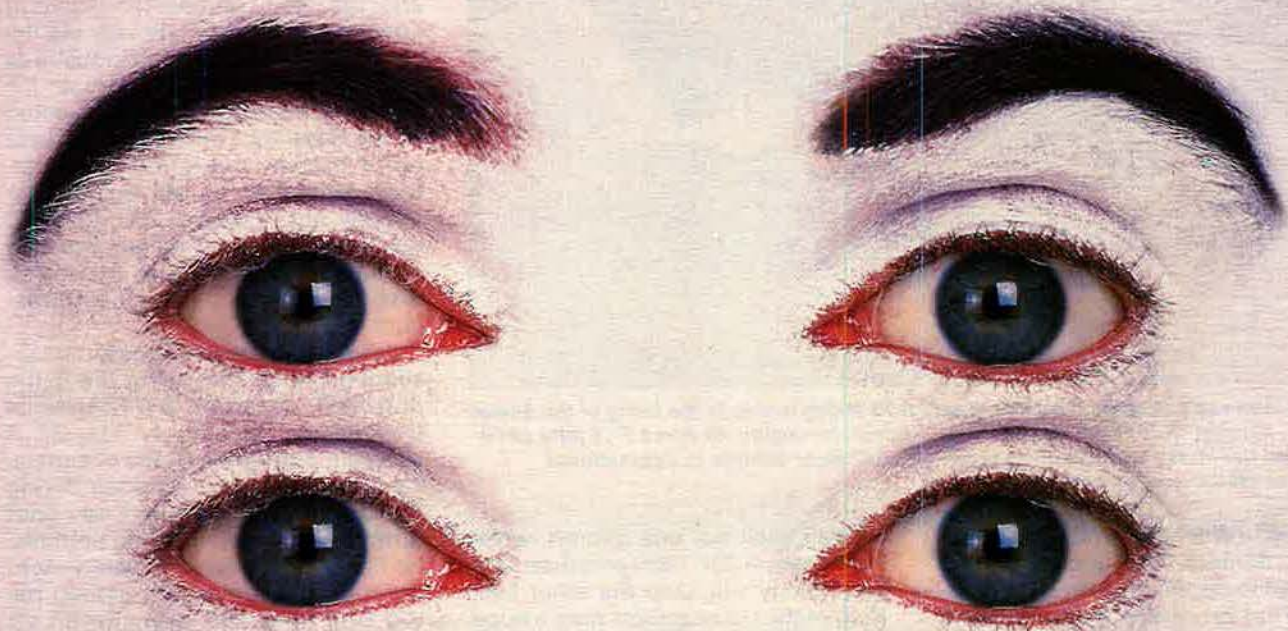
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The European experience says that centralized acquisition agencies are different—but not necessarily better.

A Choice of Roads to Procurement Reform

BY JOHN T. CORRELL
EDITOR IN CHIEF

CHARGING that the armed forces have failed to clean up their act in weapons procurement, the Congressional Military Reform Caucus says the time has come to strip them of that function altogether and turn it over to an independent corps of experts. Legislation now pending would create a centralized procurement agency for the Pentagon. It would be headed by the Under Secretary of Defense for Acquisition, the official that Congress has long sought to establish as an "acquisition czar."

The idea, says Sen. William Roth, Jr. (R-Del.), cochairman of the Reform Caucus, is to "take responsibility for weapons acquisition from the military and place it in the hands of professional men and women who spend their careers designing and buying arms."

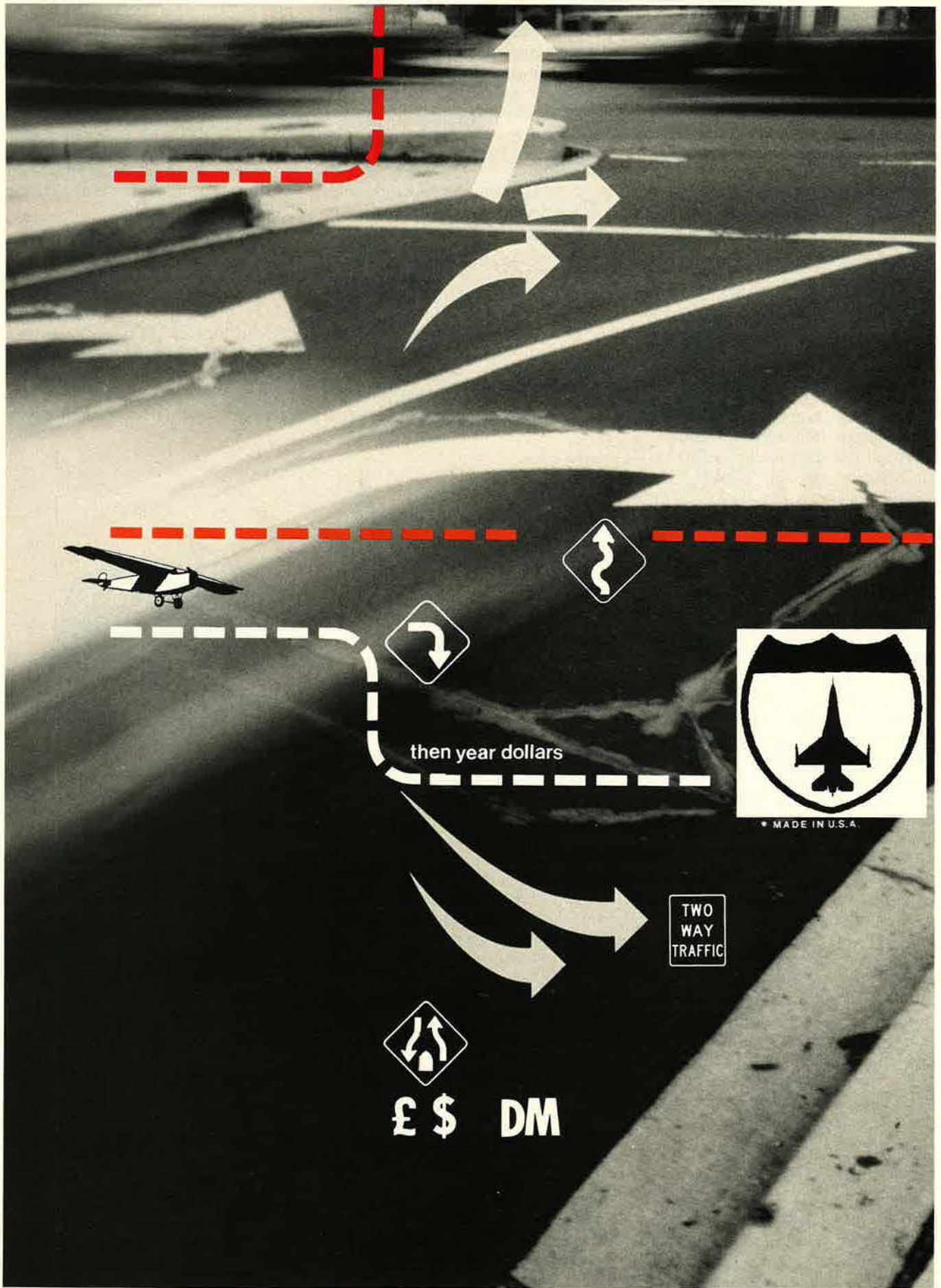
The reformers contend that the Department of Defense has made little progress since 1986, when the Packard Commission called for major action to rid the procurement process of waste and mismanagement. Senator Roth says that "while certain structural modifications have been made, there has been no

real change in the way DoD does business."

This accusation plays well with the public, which is inclined to think the worst about defense procurement, but many officials and analysts familiar with the process say the reformers are wrong. DoD response to the Packard report went far beyond minor "structural modifications." The services have cut headquarters manning, streamlined paperwork and reporting channels for program directors, increased the use of competition in contracting, eliminated most of the internal tinkering with program baselines, and improved the qualifications of acquisition personnel.

In Air Force Systems Command, for example, program managers now bypass AFSC headquarters on matters pertaining to their systems and report directly to the USAF acquisition executive, Assistant Secretary of the Air Force John J. Welch, Jr. Sixty-seven percent of the Command's contract dollars were awarded on the basis of competitive bid in 1988, compared to twenty-six percent in 1984.

For its part, Congress has not



acted on the reform proposals directed its way by the Packard Commission. Budgets are less stable than ever, congressional micro-management of programs has not decreased, and the laws governing procurement remain as numerous and confusing as they were before.

The European Model

These considerations aside, might an independent acquisition agency do a better job of providing weapons for US armed forces? A surprising answer emerged from an AFA symposium on acquisition and logistics in late April. The "European model" of centralized procurement is cited often as an alternative to the US approach. Until recently, such comparisons were subjective. No quantitative data were available.

To fill that gap, a leading analyst of defense procurement, Dr. Jacques S. Gansler (author of "How the Pentagon Buys Fruitcake," June '89 issue of AIR FORCE Magazine), and Charles Paul Henning examined the acquisition of fighter and attack aircraft by centralized agencies in Great Britain, France, West Germany, and Sweden and compared them statistically with acquisitions in the United States.

The study, Dr. Gansler told the symposium audience, does not necessarily settle the question of which process is better. The answer varies, depending on whether the criterion is cost, performance, or time elapsed between a program start and the fielding of the new system.

When the yardstick is time or performance, the US approach wins. American systems reach production and initial operational capability about two years faster than European systems do. Performance scores (derived from range, speed, maneuverability, payload, basing mode, target acquisition, and fire-control capability) show that US systems are, on the average, five years ahead of Soviet systems and ten years ahead of those developed by the Europeans.

The Footnote on Cost

As expected, raw measures of cost say that US systems are more expensive. That changes, however, when such considerations as relative performance and technology are factored in. It makes a big differ-

ence, Dr. Gansler said, if aircraft are based on existing technology rather than pushing the state of the art. American systems are more likely to use new technology. "If you think about the [multinational European] Tornado, it is basically [a US] F-111 ten years later," Dr. Gansler said.

The bottom line, Dr. Gansler said, must be the amount of performance achieved per dollar spent. When the study plotted cost curves against performance curves, US and European acquisition approaches achieved almost identical results.

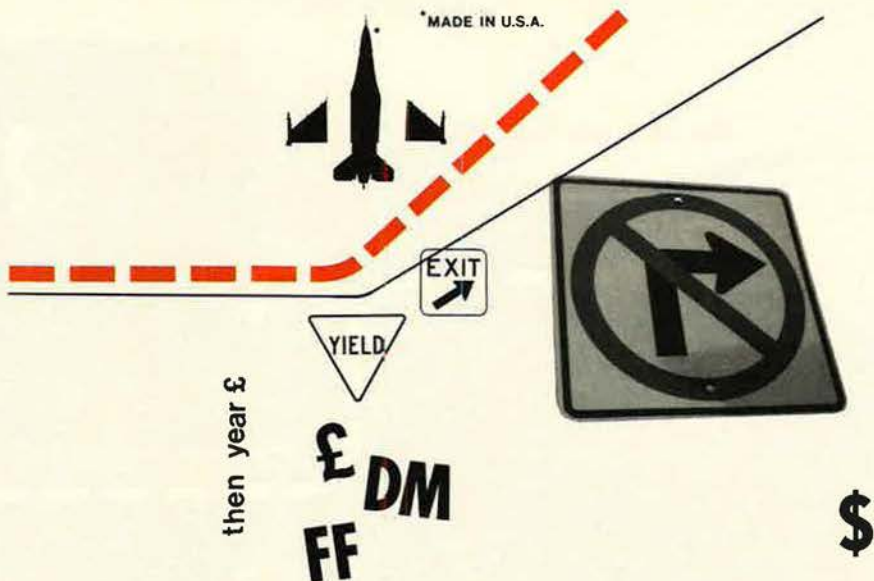
"The US was required to stress, we felt, technological superiority and getting [aircraft] into the field quickly, but our costs were dramatically higher," Dr. Gansler said. The Europeans emphasized "longer,

into the one-year [defense program] we're debating."

The bad news from both the US and European data, he added, is that "we're getting less performance per unit of cost increase. Costs are going up faster than performance is going up." He pronounced that trend "alarming" and a clear message that "we need to do something differently."

AFSC's "Cultural Change"

AFSC's Commander, Gen. Bernard P. Randolph, had already reached a similar conclusion and served notice that a "cultural change" was in order. Preaching a philosophy he calls "Total Quality Management," he hammers the message constantly to contractors



more stable schedules and significantly lower cost systems at the expense of lower performance. When they needed a higher performance system, they could get that by buying it from the US."

Dr. Gansler noted that parliaments in European countries are not as intensely involved as the US Congress is with details of the acquisition process. Unlike Congress, the parliaments generally confine themselves to a few long-term decisions at major milestones of an acquisition program. Their actions seldom cause large annual perturbations. The Europeans, he said, "use multiyear fiscal plans. They have an annual debate on the budget, but it's the sixth year of the plan they're debating. We're usually six months

and program managers alike that they must do better on cost, schedule, and performance.

In recent months, General Randolph has concentrated his ire on electronic countermeasures ("a disaster") and software schedules ("We've never made one on time"), but these are not his only areas of concern. An AFSC study on aircraft engine bearings, for example, found that the cost of scrap, rework, and repair in US firms was about fifteen percent of sales, compared to less than three percent of sales for foreign producers.

"There is only one thing that's going to solve the acquisition problem, and that is getting discipline into the system," General Randolph told the symposium audience.

General Randolph has told program managers in no uncertain terms that their job is to manage acquisitions, not to carry the flag for the systems being acquired. Advocacy, he says, is up to the using commands and the Pentagon.

Systems Command will concentrate its energies on such problems as the development and maintenance of software, which General Randolph identifies as "one of the greatest challenges the Air Force faces for the 1990s." Advancements in computer processing speed have increased the demand for software, but productivity in software development has not kept pace.

The requirements are astounding. Counting support software, the Advanced Tactical Fighter will need between 4,000,000 and 6,000,000 lines of code—more than forty times the software in the F-16A when it went operational in 1981. "The B-2 has 200 computers on board, more lines of code than the space shuttle, and it's the most complex airborne local area network in the world," General Randolph said at the symposium.

By 1990, he said, the Air Force will be spending nearly \$30 billion a year for embedded software—a ten-fold jump since 1980. Quality and defining the job correctly the first time will be critical. "Software support costs over a fifteen-year cycle can be as high as eighty percent of the original full-scale software development," General Randolph said. "It costs thirty-six times more money to rid software of errors during operation than during design, and eighty percent of errors are due to misunderstanding and miscommunicating of users' requirements."

Sharing the Blame

"Our number-one problem today is poor contractor performance," Lt. Gen. Mike Loh, Commander of the Aeronautical Systems Division, told the symposium. "There's hardly a program out there where we're delivering on schedule, at cost, and meeting our performance specifications."

This, he said, is not the fault of the contractors alone. "We all share the blame. We are the ones who put industry on contract." Consequently, ASD is trying to instill Total Quality Management internally to ensure that specifications, re-

quests for proposals, contracts, and change orders are properly executed the first time.

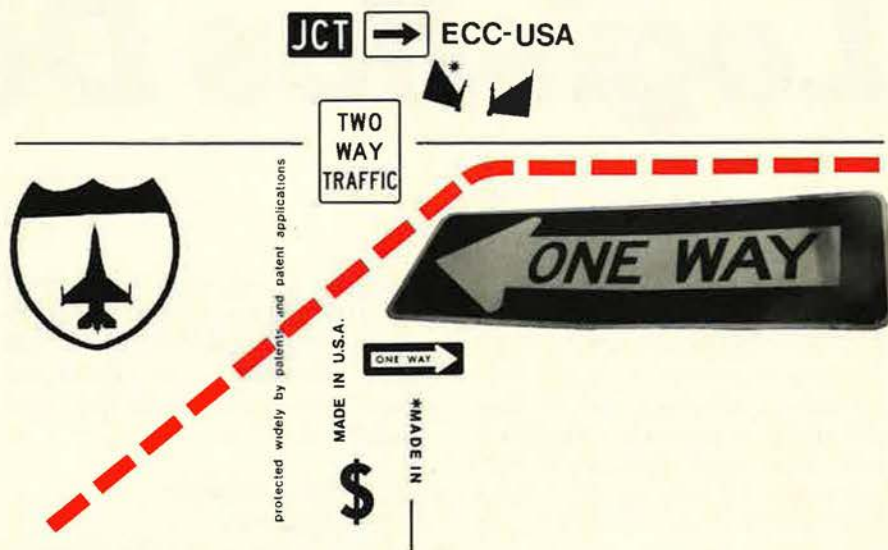
Systems Command has consistently refused to give industry a precise definition of what it means by Total Quality Management, preferring that each company decide for itself how to improve productivity and quality. It has, however, established a procedure to score contractors' results. Systems Command has compiled Contractor Performance Assessment Reports (CPARs) on fifty firms so far.

In six recent source selections at ASD, General Loh said, "contractor past performance was a significant factor in all but two, and they were early on, when we didn't have enough CPARs written."

come "critical and primary" in deciding which contractor is chosen.

"[For] as long as I can remember, the Air Force has had the best qualified acquisition personnel and the best acquisition system in the Department of Defense," Mr. Welch said at the symposium.

Systems Command has established four levels of certification for its military and civilian acquisition force. Level Four certification means that an individual is eligible to manage a major program if selected to do so by a board consisting of AFSC's product division commanders. Certification at that level generally means the person has a master's degree, operational experience, headquarters experience, and program experience at a lower level.



Profit on the Table

Mr. Welch, who sees all of the Air Force's major procurement action in his role as acquisition executive, chose "radical" as the best term to describe the scope of changes that have taken place since the Packard Commission report.

Acquisition responsibility has been consolidated at the headquarters level, with direct lines of authority and communication between program managers—more than 300 of them—said Mr. Welch. Operating and using commands now develop requirements for weaponry and are the advocates for the systems they say they need. Competition in contracting has increased sharply, and, according to Mr. Welch, past performance has be-

The capstone of professional development is study at the Defense Systems Management College.

Improved management is essential to make systems less expensive, Mr. Welch said, because "if you divide unit prices into available dollars, we don't get what we need." Better management is also in the interests of contractors that often fail to qualify for incentive awards they could earn on Air Force contracts. "A lot of people are leaving a lot of profit on the table because they aren't performing," he said.

On the proposal for a centralized acquisition corps, Mr. Welch said flatly, "I'm against it. I haven't found a single thing to support it, whether I've looked domestically or internationally." ■

More than one-third of a system's life-cycle cost is maintenance. AFLC aims to get that job done better, cheaper, and faster.

Squeezing More From the Logistics Dollar

BY PETER GRIER

THE C-141 StarLifter's secondary exhaust nozzle is a major Air Force logistics headache. This crucial part is based on twenty-five-year-old technology, and its high rate of corrosion and cracking gives it the dubious honor of being the top consumer of maintenance man-hours on the C-141's TF33-P-7A engine.

When the nozzles cannot be repaired in the field, they are sent to Warner Robins Air Logistics Center, Ga. Crews there will fix eighty-two nozzles this year, at an average cost of \$37,415 each. That comes to \$3 million, so it is not surprising that Warner Robins has been seeking a long-term solution to the problem.

In October 1987, officials displayed the cantankerous nozzle at a technology fair. An enterprising contractor seeking new business said that, with modern materials and manufacturing processes, he could build one ten times more reliable. A development contract was let. Now USAF is anticipating the day a decade hence when each C-141 will be fitted with highly reliable secondary exhaust nozzles.

"It'll take us a while, but with this

[new nozzle] we're going to fix a long-standing problem," Warner Robins Commander Maj. Gen. Dick Gillis told an AFA acquisition and logistics symposium held last April in Arlington, Va.

Lower Cost, Higher Sophistication

This change in nozzles exemplifies many of the actions that Air Force leaders at the symposium said they must take to squeeze more return out of logistics dollars in years ahead. USAF's logistics infrastructure will have to become more innovative and responsive in the way it does business, maintained Gen. Alfred G. Hansen, Commander of Air Force Logistics Command (AFLC). USAF technology fairs, such as the one that sparked the nozzle contract, are an attempt to manage better and generate ideas at lower cost.

In addition, the General asserts, Air Force logistics will have to become more technically sophisticated. State-of-the-art materials and processes must be adapted to support today's weapon systems. In the future, reliability and ease of main-

AFLC is implementing new programs to get the most from every available asset. Efficiency, responsiveness, and long-term sustainability cost savings have all been boosted. Here, maintenance personnel from the 410th Bomb Wing, K. I. Sawyer AFB, Mich., spend a Saturday afternoon squeezing a little more from a wing B-52.



tenance must be designed into new systems from the outset.

"We have had to take a deep look at ourselves and those things that could be better organized and more efficient," claims General Hansen, "because we recognized that budget funding had gone down and was going to continue to go down."

One of the AFLC Commander's prime goals at the outset of 1989 was to make his command pay more attention to customers. Traditionally AFLC had not seemed particularly user-friendly, believing that its role was merely to keep spare-parts bins full. Thinking of Strategic Air Command, Tactical Air Command, and other users as "customers" in the commercial sense may have been something of a cognitive leap.

Quality is another area of emphasis. General Hansen says AFLC is embracing the Zen-like approach to quality control that Ford Motor Co. and other US corporations have used to help turn their businesses around. AFLC production workers now have a Quality Bill of Rights that permits them to challenge "business as usual" and to place the pursuit of quality above production.

This is not just window-dressing. Already, three AFLC workers have been able to shut down production lines because they were seeing products of dubious quality. What's more, claims General Hansen, "we made those three people heroes."

Competitive Contract Changes

Congressionally mandated changes in procurement are altering the way AFLC does business. A case in point is AFLC's attempt to increase use of competitive contracts. Over the last decade, AFLC use of competition has approximately doubled.

At Warner Robins, competitive contracting has increased by fifteen percent during the past year, says General Gillis. Today, some forty percent of dollars spent annually by the Center are let in competitive contracts. The overall figure remains lower than it might otherwise be, says General Gillis, because much of the electronic warfare equipment he needs is so complex that it can be bought from only one contractor.

Changes in USAF force structure have brought about dramatic plan-

ning problems. Only a few years ago, AFLC was expecting to support forty tactical fighter wings; then the figure was lowered to thirty-seven; then it dropped again, to thirty-five. This has led to parts being bought to support planes that won't arrive.

"I have got one hell of a problem trying to plan logistics support for a phantom outfit that is here today and gone tomorrow," says General Hansen.

Cuts in AFLC's own budget cause greatest concern. No longer can AFLC count on purchasing large quantities of parts to ease supply problems. Parts availability peaked in 1987 and has been sliding downhill since. In general, AFLC is buying only peacetime spares. War reserve materiel isn't getting funded.

"If we don't have those massive piles of spares, we have to look in other areas to make sure there is combat capability," says General Hansen.

For logisticians, USAF officials maintain, smarter acquisition practices will become critical. The case of the C-141 nozzle was one example cited by General Gillis of acquisitions that could help ease logistics tasks. Among others:

- A new 60,000-pound loader. This vehicle and 25,000-pound and 40,000-pound variants are crucial tools for Military Airlift Command. In days gone by, they were purchased from the lowest bidder, period. But the smaller models have not lived up to expectations, so AFLC is taking a new approach for the 60,000-pound loader. In September, two contractors will be picked to build two prototype loaders apiece. MAC will test them to see which version it prefers. Once a winner is picked, a second competition will be held, this one for a contractor to produce the winning design.

"This is a long-term operation," notes General Gillis, "but we're going to get a loader that is workable, and with a mean time between failures so far in excess of what we have that MAC is going to have a warfighting weapon."

- LANTIRN. The Low-Altitude Navigation and Targeting Infrared for Night pod system will be repaired and maintained in a new, paperless automated depot. When the depot is complete, Robins will have

in-house capability for fixing some 300 repairable pod parts.

LANTIRN tech data will be digitized on a computer database. Training will be done by video. Material handling and storage will be automated. The depot computer will track individual parts by serial number and will collect failure data from the field.

"We will virtually eliminate all paper associated with the LANTIRN project," says General Gillis.

Modernizing Management Tools

Acquisition strategies aren't the only means being studied by AFLC to wring more logistics out of the budget. General Hansen listed three other primary changes that he is pursuing at AFLC: improving efficiency of the logistics infrastructure, improving responsiveness, and cutting costs of longer-term sustainability.

Modernization of AFLC management tools is viewed as a key means for improving the command's efficiency, according to General Hansen. Currently, AFLC is developing perhaps the largest military support data system in the world, with nine core systems that will each contain 3,000,000 to 4,000,000 lines of software code.

In the stock control and distribution data system, for instance, a part-tracking task that previously might have taken seventy-two hours will take perhaps as little as twelve seconds. "We can tell a director of maintenance somewhere whether or not that part is going to arrive, at what hour, and what the mode of transportation is," says General Hansen.

AFLC is studying automated warehousing systems for its \$28 billion inventory and is restructuring inventories where possible to achieve Japanese-style "just-in-time" deliveries. It has set up a joint working team with AFSC to study ways of getting new weapon systems off contractor support and into full in-house depot maintenance as fast as possible.

A final efficiency change is a deceptively simple one: AFLC is focusing its repair operations on problems that can actually ground an airplane, rather than trying to fix absolutely every problem, large or small. Setting priorities in this man-

ner, notes General Hansen, has already increased the mission-capable rate of the F-16 fleet by eight percent.

Restructuring AFLC

To help make the AFLC bureaucracy more responsive to user problems, General Hansen has restructured large portions of his sprawling command, moving 18,000 workers to different slots.

A large part of this change revolves around an increase in the power of the AFLC system program manager. In the past, system program managers were figureheads, says General Hansen, with few workers and small budgets under their direct control.

nization focuses on logistics for space. In the past, most space system support has been carried out by contractors and has been marked by miscommunication and Air Force loss of control over system configuration. The Air Force is now moving to "normalize" space logistics, in General Hansen's phrase, and will put space support under AFLC's purview.

One result is the appearance of a budding AFLC space depot in Colorado Springs. Plans call for the depot, which employs 330 workers today, to grow to 1,200 workers over the next five years. It will have total responsibility for supporting NORAD's Cheyenne Mountain Complex and is planning to bring satellites

the whole thing the air of an adults' science fair. In some instances, says General Hansen, "we'll go ahead and write a contract right there" if a contractor proffers a workable idea.

A carrot-and-stick approach is being adopted at AFLC for improving contractor performance on certain stock items. The carrot is a "Blue-Ribbon Contractor" designation for firms that deliver on time, with good quality. Such recognition, officials say, can lead to more business. That is because, on applicable contracts, AFLC is authorized to pay up to twenty percent higher than the lowest bid in order to do business with a proven, Blue-Ribbon contractor. All 241 stock-item classes carried at Warner Robins are open to Blue-Ribbon competition.

The stick is the Contractor Responsibility Review Program (CRRP), which rates company performance on a kind of report card used by AFLC managers in determining purchase decisions. The CRRP isn't perfect. "We got a nastygram the other day from a guy we said was sixty percent delinquent on two of his contracts," says General Gillis of Warner Robins. "He wrote and said, 'Your data is screwed up. I never delivered anything late in my life.' He was right."

Even so, the report cards are going to be a fact of life, claims General Gillis. CRRP will be one of his main tools to raise on-time delivery rates, which currently hover in the fifty percent range rather than the AFLC goal of eighty-five percent. Warns the General: "If a contractor consistently fails to deliver on time, we will not award future contracts to him, period."

New Technology in Old Systems

Weapon master plans are another means of addressing the cost of sustainability. They lay out the expected logistics expenses over the service life of an aircraft or other system, showing effects of modifications on the support budget. As a result, decision-makers will be better informed about the costs of updating a weapon. "We're actually working on a ten-year projection on an airplane, cradle to grave," says General Hansen. "It's the first time we've done that."

The most promising way to cut

A final efficiency change is deceptively simple: AFLC is focusing its repair operations on problems that can actually ground an airplane, rather than trying to fix absolutely every problem, large or small.

Now item managers and buyers have been placed under the system manager's authority. "For the first time, we have the people who are making the requirements and the people who are buying the things talking together," says General Hansen. "We're finding out that we're able to process our purchase requests much faster. Quality has gone up on our purchase requests."

Seven hundred new AFLC process action teams—basically suggestion and quality-control groups—are now at work. Recently, such a team at the San Antonio Air Logistics Center devised a new coating for the augmentor on the back end of the F100 engine. AFLC maintains that the new process will extend the life of the typical augmentor by two and a half years.

Another recent AFLC reorga-

and other space systems under its logistics authority.

Contractors and Sustainability

Squeezing the most out of the AFLC budget will also require cutting sustainability costs. Revamping the AFLC infrastructure can solve only part of the problem. The command will have to work with contractors to make sure that weapons in the future need less maintenance and supply.

General Hansen points to wider use of the technology trade fair as one answer to this long-term need. These gatherings, held at logistics centers across the country and advertised in *Commerce Business Daily*, feature parts that are causing trouble, whether they involve avionics or engine components. The parts are laid out on tables, giving

sustainability costs is the use of new technology. In the past, scientific advances tended to pass AFLC by; now the command has a chief scientist to provide an AFLC liaison to the scientific community. The idea is to ease the logistics burden by inserting new technology in old systems.

Example: the F-111D digital signal transfer unit. At present, two particularly complex circuit boards in the unit each cost \$24,000 and sustain a mean time between failures of forty hours. These units can be replaced by a single board at a cost of \$3,000 and a mean time between failures of 5,000 hours. The secret? The new board has one Very-High-Speed Integrated Circuit

are giving a quick logistics payoff in the short term, even bigger savings can be achieved by giving attention to the support needs of a weapon in its design. That is the job of the Acquisition Logistics Center.

The potential importance of such an approach can be seen in a just-completed Air Force study of a High Reliability Fighter concept. The study took a baseline aircraft—representing capabilities from the F-16, the F-15, and other existing planes—and concluded that, in a thirty-day campaign, it could kill about 5,000 targets. Then, using technologies that are now available or will be available by the year 2000, the study rated a hypothetical fighter whose reliability and ease of

Logistics Applications (MITLA) program is one high-tech effort to make AFLC inventory efforts more efficient. It uses “smart cards”—small memory/logic devices carrying a silicon chip—to mark and track Air Force parts and workers. For personnel, smart cards can store all service records, replacing paper files that must be moved on reassignment. For parts, the smart cards will be able to transmit information, such as remaining product shelf life, over data networks back to AFLC headquarters.

Another experimental effort is the Micro Miniature Time Stress Measurement Device, known as the Micro TSMD. This device is like a tiny weather station, a combination of microchip and miniature sensor placed in a weapon to record temperatures, G-forces, and other environmental parameters to which equipment is subjected. Data are tapped by diagnostic tools.

First test of the Micro TSMD will be on the electronic warfare system of the F-4G Wild Weasel. Eventually it could become a partner in logistics with MITLA. “A MITLA tag can identify and record that a failure has occurred and track the maintenance actions required to fix it,” explains General Spiers. “The Micro TSMD gives the details as to why the failure occurred.”

Even computer-created cartoons are being enlisted to improve logistics. “Crew Chief” is an experimental, computer-graphics simulation of a maintenance technician. Engineers designing weapons with computer-aided systems now can plug Crew Chief into their workstations and find out how hard it might be for a real person to maintain the new system. Crew Chief shows whether a human can reach all bolts, whether he can see in tight spots, and whether he’s strong enough to remove a module.

“It actually simulates maintenance actions,” says General Spiers. Someday, Crew Chief might finally put an end to one of the favorite imprecations of real chiefs experiencing problems getting something off of or into a plane: “The guy who designed this should have to do it himself.” ■

The amount of money saved by designing for better logistics could be great. According to one estimate, maintenance accounts for about thirty-five percent of the life-cycle cost of military systems.

(VHSIC), a cutting-edge microchip that packs an unprecedented amount of processing power into a tiny space.

The Seek Igloo radar system, located at remote sites in Alaska, also will benefit from a VHSIC retrofit. Currently, Seek Igloo signal-processing units fail once every twenty-nine days, on average. With new VHSIC technology and a modular architecture, mean time between failures is being lengthened to seven months, and the size of the processing unit is shrinking. Life-cycle cost savings are estimated at \$315 million.

“With these kinds of results, we need to get VHSIC into more of our systems,” says Maj. Gen. Joseph Spiers, Commander of the Air Force Acquisition Logistics Center. While upgrades to existing weapons

maintenance had been maximized. Target-kill capability rose to 9,000.

The amount of money saved by designing for better logistics could be great. According to one estimate, maintenance accounts for about thirty-five percent of the life-cycle cost of military systems.

High-Tech Inventory Control

Use of new technology in other areas also could save big bucks. AFLC stocks an inventory of 2,000,000 items worth \$25 billion. Keeping track of this inventory and moving it worldwide is an intricate and expensive task, and any improvement in efficiency could have a big payoff.

The Microcircuit Technology in

Peter Grier is a Washington-based defense correspondent for the Christian Science Monitor. This is his first article for AIR FORCE Magazine.

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As with any maintenance program, the bulk of the time spent on a down plane is spent in diagnosis.

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The Air Force's reach exceeded its grasp when it tried to take on the entire electromagnetic spectrum.

—Staff photo by Guy Aceto

How Electronic Countermeasures Went Wrong

BY JAMES W. CANAN
SENIOR EDITOR

EIGHT years ago, the Defense Department began thinking bigger than it ever had about electronic warfare (EW). Soviet tactical weapons, radars, and other sensors were becoming more sophisticated and harder to counter at every turn. They threatened to overwhelm the US EW systems then in service. So DoD set out to design and build new EW systems of unprecedented potency and versatility, systems capable of coping with the threats of the moment and for a long time to come.

The idea was sound, but the systems that sprang from it were not. The Air Force sank into an EW morass from which it is just now extricating itself. The story of how this happened goes back many years and is complicated. The stakes could hardly be higher.

To the Air Force, no task is more urgent than seeing its combat aircraft safely through or around enemy air and ground radar networks and enabling the planes to defend themselves against highly sophisticated, hard-to-jam SAMs, anti-aircraft guns, and air-launched missiles. Airborne EW systems de-

vised to detect and jam, or otherwise foil, such radars and missiles could well mean the difference between victory and defeat in the electromagnetic milieu of modern warfare.

Unfortunately for USAF, its development of EW systems through this decade has been, for the most part, dismal. Many new EW systems, most notoriously the defensive avionics suite aboard the B-1B bomber, fall short of performance expectations, cost too much, are taking far too long to get into operation—or suffer from all such faults.

Chronic problems with the B-1B's electronic countermeasures (ECM) have claimed the most attention, but are by no means the only ones besetting the Air Force's EW community. New ECM systems for other combat aircraft seem to have gone sour all over the place. Air Force leaders have taken to criticizing the service's EW scheme of things quite openly.

Not long ago, for example, Gen. Bernard P. Randolph, Commander of Air Force Systems Command, singled out the ECM scene for a tongue-lashing, calling it "a disas-

The B-1B's tail section houses the main elements of the bomber's chronically troublesome ALQ-161 defensive avionics system. Too many ambitious programs for developing such EW systems have turned sour for the Air Force in recent years.



ter." With everything to lose as a result of ECM deficiencies, Gen. Robert D. Russ, Commander of Tactical Air Command, has on occasion been just about as harsh.

Now the Air Force is moving to set things right. It seems determined to stick with several problem systems and make them work as well as possible. The B-1B defensive avionics system is one. There are signs of progress in USAF's program-by-program perseverance and signs of hope for the future in its adoption of a more realistic attitude toward EW across the board.

Less Ambitious, More Feasible

USAF is taking a wholly different approach to designing and developing EW systems, one that it sees as less ambitious than its approach of recent years, in which its reach often exceeded its grasp.

Brig. Gen. Noah E. Loy, the director of acquisition for electronic combat programs in the Office of the Secretary of the Air Force, explains. "The Air Force has decided to take an approach to EW that is more doable. We're in the process of refining our EW requirements. We want to make our systems simpler, not more complex. In the past, we have confused some of our goals and strategies with what we thought would be possible in terms of technical solutions. We had a tendency to think we needed a [EW] system in our aircraft that was capable of taking on everything in the electromagnetic environment. We are getting away from that."

The "think big" approach that USAF is turning away from originated in a well-intentioned directive that Richard D. DeLauer, then Under Secretary of Defense for Research and Engineering, sent to the military services in 1981.

In it, Dr. DeLauer noted that the services were in the habit of pursuing "only those EW programs designed against hostile equipment that is already deployed or is well along in development" and that "therefore we are well behind the emerging threat before we start."

He continued: "Using current practices, there is no possibility that we can field the EW capability needed—in time—to counter the changes in the Soviet threat during the next ten years." He advised the

services, in planning for EW systems, to begin taking into account "the projected threat, approved by the Defense Intelligence Agency, of estimated future enemy capabilities based on intelligence, extrapolation of existing enemy weapon designs, and anticipated enemy technological advances."

To help do this, the Defense Department forthwith enlisted the services of experts in the US electronics industry. Given access to DIA "threat documents" on Soviet electronic combat capabilities and tendencies, fifty or so key executives of electronics companies joined with top military and civilian EW officials in the defense establishment to form the DoD Electronic Warfare Technical Study Committee.

Nice Try, Little Payoff

The EWTSC bent to analyzing and forecasting Soviet sensor and signal processing technologies and systems—with much emphasis on the radars and infrared guidance systems of Soviet SAMs and air-launched missiles. Meeting at least monthly, its several specialized subcommittees also studied US needs and prospects for EW technologies and systems to counter advances anticipated in Soviet electronic combat capabilities.

This was a highly unusual endeavor. It meant that each company represented on the committee was put in the position of sharing, by virtue of its contribution to the common cause, at least some information about its own electronics technologies. On the other side of the coin, all the companies stood to benefit from the boom times in EW contracting that could be anticipated—and that happened—as a result of the DoD effort.

No one disputes that the EWTSC made a nice try. To this day, industry executives who served on the committee claim that it served a useful purpose. For example, one such executive, Sanders Associates President John Kriek, says the committee's reports "did a great deal to broaden the perspective" of the US EW community on the threat and on the technological possibilities for countering it.

Dr. Kriek also recalls that the EWTSC's assessments of Soviet

technology and systems trends were fairly accurate and that its conclusions and recommendations, all of which remain highly classified, were pretty much on the mark.

The committee's work helped to promote the concept of integrating all EW elements in future fighters around a common, high-speed signal processor, a concept that is expected to become reality in the integrated electronic warfare system (INEWS) of USAF's Advanced Tactical Fighter.

For all the committee's sound insights and suggestions, though, the actual payoff from its work has been, to all appearances, disappointing. Programs for new and upgraded jammers, radar-warning receivers, and chaff dispensers across the spectrum of combat aircraft have not panned out or have wound up well in arrears of existing threats by the time they go into the field.

As General Loy explains: "After we changed our way of doing business in 1981, we set a whole bunch of programs in motion. A lot of them were for developing new types of hardware we could build, such as antennas to increase our sensitivity, and expanding RF [radio frequency] bandwidths in the electromagnetic spectrum for detecting threats.

"We were also looking at microchips that could give us the signal-processing capability that we needed to move into a software-intensive environment—to design [digital computer] hardware with enough flexibility to handle the software changes that the threat would impose on us in the future."

It didn't work out. "We ran into troubles," General Loy recalls. The computer hardware developed for new and updated EW systems was not flexible enough, at first, to accommodate the required software. When the hardware began coming around, the software lagged.

"Our software-writing capability did not keep up with the development of the chips," explains General Loy. "The problem with software development basically was that we outpaced the capability of industry and society to produce software people to do the job."

He sums up: "So Dr. DeLauer's memo instituted a cultural change—away from taking specific approaches to countering particular

threats, to looking at the enemy on a broader scale and trying to develop a more generic systems-engineering approach to countering the threat on that scale.

"We were not able to accomplish that."

A major reason was the fallacy of an assumption that the Pentagon and industry made about the advances to be expected in Soviet signal processors. The expectation was that the Soviet military would sooner or later emulate the US military by switching altogether from analog signal processors to digital signal processors in their radars.

This mirror-imaging of projected Soviet systems led to conclusions that those systems would be susceptible to the same jamming techniques and technologies that US systems needed to be protected against.

It didn't turn out that way. The Soviets either were incapable of fully exploiting digital computer technologies or chose not to do so. Although they incorporated some digital technologies, they continued to rely mainly on analog processors, which lend themselves to the incorporation of robust counter-countermeasures.

The upshot was that the hardy analog electronics of Soviet signal processors and ECCM confounded US EW devices and "denied us access into the internal workings of those systems," General Loy explains.

By staying the course with analog processors, the Soviet military also made it virtually impossible for the US electronics industry, which left off developing analog technologies a long time ago, to simulate Soviet systems. This was also a major setback for realism in the testing of US EW equipment and for confidence in validating such equipment as being truly capable of performing as advertised in combat.

Behind the Curve

Capabilities of individual systems aside, the central reason for difficulty in electronic warfare is the very nature of the beast.

Robert W. Selden, Chief Scientist of the Air Force, provides this perspective: "We're operating in a world where the amount of electromagnetic energy is increasing at just an unbelievable rate. In any of the

standard scenarios of conflict in central Europe, for example, there are electromagnetic radiations from hundreds if not thousands of radars, thousands of communications systems—radios and other things, even lasers to some extent.

"The sophistication of these systems has increased dramatically. . . . If you want to interfere with any of them you have to build [electronic] machinery that listens, figures out what's going on, and decides what to do about it, all in real time. If anybody wonders why we have trouble today with electronic

radars controlling the missiles, rather than the radio-frequency waves from the antennas of those radars.

In theory there was nothing wrong with that DoD aspiration to "jam behind the faceplates" of enemy weapon systems. Neutralizing a missile before it is launched by jamming its fire-control computer is safer than waiting until after it is launched to try jamming its target-homing seeker.

Says General Loy: "We were trying to deny missile launch, because we knew if the missile never came

A Westinghouse ALQ-131 ECM pod is checked out by a company technician. The ALQ-131 is the jammer for a variety of combat aircraft and has been upgraded to meet the contemporary threat.



combat, that ought to explain it."

Dr. Selden adds, "The technology in computing and in the electronic systems that generate these signals and receive them is changing faster than we can put systems into production. . . . If we start today, we're going to have equipment in the field that is responding to a technical capability of a couple of generations ago, maybe more."

This behind-the-curve characteristic of EW equipment is exactly what the Defense Department tried to correct in the forward-looking approach that it adopted in 1981. The built-in resistance of Soviet systems to electronic invasion has been a major frustration for that approach.

A DoD top-priority goal was to design jammers that would be "smart" enough to disrupt electromagnetic emissions in the innards of enemy electronic systems—emissions from signal processors of the

off the rail, it could never hit us. Now we're going back to the way we used to do it, manipulating the emissions that are radiated from the antenna. But that makes us do something else—create enough 'miss distance' between our aircraft and [enemy] missiles once they're launched. This requirement makes our ATF [Advanced Tactical Fighter] all the more important."

Overoptimism, System Deficiencies

Technical reasons for the woes of US EW systems through this decade are classified as to details. But other reasons abound.

A study conducted for AFSC's Aeronautical Systems Division a few years ago cited Air Force and industry overoptimism about technologies as probably the chief culprit. Among other problems detailed in the study were rampant deficiencies of system integration,

adversarial relations between the Air Force EW R&D community and its contractors, unrealistic cost ceilings, and debilitating cost/performance tradeoffs.

In one way or another, over-optimism may well have contributed to all the others. At any rate, the findings of the study apparently were a major reason for the subsequent reorganization of ASD's EW shop at Wright-Patterson AFB, Ohio, and the start of something new there.

Last year, the Air Force Electronic Combat Office went into business at Wright-Patterson. A prime goal of AFECO is consistency and balance in the business of developing and acquiring EW systems. Not long ago, an AFECO official was quoted as saying that the Air Force is "trying to do a better job of defining an executable program" in EW and that its previous inability to do so was "one of the common denominators of a failure we've seen in the past."

For whatever reason, all manner of Air Force EW programs fell by the wayside or limped along through this decade. Each was seen as necessary to counter the threat that now looms in the European theater, to say nothing of the threat that may be in store there. The threat is building elsewhere, too. Sophisticated radar and infrared weapons built by the US, the Soviet Union, and their respective allies have been on the rise in the Third World for quite some time. A recent example was Libya's purchase of late-model Soviet fighters with topnotch radars and ECM.

Among unclassified Air Force programs that were devised to meet the threat but that got the axe were those for an "advanced capability" jamming pod and a multipurpose EW Area Reprogramming Capability. Also canceled were the Precision Location Strike System (PLSS), the F/FB-111 internal jammer upgrade program, and directional receiver antenna signal processors for F-4G Wild Weasel aircraft.

Radar warning receivers for fighters and attack aircraft seem to have fared better, by and large, than jammers. New RWRs for the F-15 and the F-111 are finally looking good for production, their bugs having been worked out, but a new, much-coveted RWR for the F-16 is on hold.

Plagued by Delays

Delays have plagued two highly important EW endeavors: strengthening and broadening the EF-111A Raven's area-jamming system by means of a more powerful radar and communications jammer and bringing to fruition the long-coveted Airborne Self-Protection Jammer (ASPJ). One program made out better than the other.

The EF-111A update program fell two to three years off the pace and was finally called off. Its demise probably did as much as anything else to raise the ire of the Air Force leadership about the service's EW state of affairs. The reasons are that the ECCM systems of Warsaw Pact forces have become alarmingly powerful and that the radars of those forces now sport such jammer-daunting features as single-pulse, or "monopulse," radars operating at extremely dense pulse rates, or frequencies.

The possibility that the Raven's EW prowess won't be enough in the clutch is very worrisome. In combat, the Raven could be the franchise for US forces. It could be called on to screen US and allied penetrating attack aircraft by jamming enemy ground control intercept radars and SAM and AAA gun radars from standoff range; to penetrate alongside bombers and fighter-bombers and jam the early-warning and acquisition radars seeking them out; to fly near battlefronts and shield close air support aircraft from anti-aircraft radars while the planes go after tanks; and to screen aircraft that are forming up or doing radar-surveillance missions in friendly—but potentially perilous—skies.

The ASPJ was once seen as jamming just about all things for all aircraft. But that was a while ago. The jammer has been so long in the making that it may be past its prime against today's threats even as it enters the field.

As far back as 1978, the Defense Department asked companies with expertise in electronic warfare to propose designs for the ASPJ. It will be yet another couple of years before the system goes operational in significant numbers.

Destined for deployment on Air Force and Navy fighters, the ASPJ was seen in the beginning as the first

ECM system to take full advantage of the technological revolution in microelectronics. It was designed to embody multiple, programmable microprocessors to make it capable of countering an unprecedented variety of anticipated threats from SAMs and air-to-air missiles. Extra capacity was built into it to enable it to accommodate new technological features as time went by.

Compactness was a major aim. The ASPJ was designed to combine a number of ECM technologies into one miniaturized system of microprocessors, receiver, amplifier, and wide-band and narrow-band transmitters that would take up only 2.3 cubic feet inside an aircraft.

The Pentagon's high hopes for the ASPJ in the late 1970s as a first-rate now-and-future jammer marked the beginnings of the starry-eyed EW policy that DoD would put in place in 1981.

The Westinghouse-ITT team of prime contractors for the ASPJ has done a good job, by all accounts. But the jammer has been slow in coming for a number of reasons—some of them, such as funding fluctuations, beyond the control of its contractors—and is only now on the verge of low-rate production.

Given its long gestation and growing pains, will the ASPJ be capable of standing up to the Soviet ECCMs and jamming the Soviet weapons that have come into play since it was designed? "I think ASPJ will do the major things we need it to do against the threat it was designed against," says General Loy. "We're finding there are some shortcomings in the [ASPJ] system as the threat changes. However, we expect to fix the shortcomings through a product-improvement program."

B-1 Shortcomings

There are shortcomings galore in yet another major EW system that USAF seems stuck with—the defensive avionics suite on the B-1B bomber. The Air Force will do its best to bring that ALQ-161 system up to snuff, but admits that it will probably never be as good as it ought to be.

The ALQ-161 got off to an uncertain start in the mid-1970s, marked time after the original B-1 bomber program was called off in 1977, and was caught short on technology

when the bomber was revived as the B-1B in 1981. It was designed to meet the Soviet threat as sized up by DIA in 1974, and it was the first defensive avionics system ever designed to be totally integrated aboard an aircraft.

The ALQ-161's merits began to look dubious as the Soviet threat rapidly worsened and the integration of the system became ever more challenging. To make matters worse, the capability of the system was cut back to compensate for architectural problems and unexpectedly high development costs.

In 1981, the Air Force moved to upgrade the ALQ-161 to bring it abreast of the threat and orient it to future threats. The system's receiver architecture was revised to accommodate new techniques and hardware components that USAF decided it had to have. That decision was based on the results of USAF's manned bomber penetrativity evaluation of the late 1970s and 1980.

In the MBPE, pulsed-Doppler radar developed for USAF's F-15 fighter—and thought to be in the works for Soviet fighters, too—was “flown” against ALQ-161 architecture, which was found wanting. For this and other reasons, USAF drastically raised the “sensitivity requirements” of the system's receiver.

“So we added new [EW] techniques and the hardware needed to produce those techniques on top of the old architecture that had never been fully developed,” General Loy explains.

“We felt we could do that, given new computer technology. We also added a new computer and put a new high-order software language into the system.

“The bottom line is that we added a lot of new stuff on top of an old system and tried to complete the development as a total system. We have not been able to develop that system to the full goal that we set down.”

The computer-oriented system's major problem is one of hardware, not of software. Says General Loy, “Software cannot fix the hardware deficiencies and limitations built into the system from a previous design. The basic receiver was designed from 1974 through 1978, and

we assumed it was good—even though we never had completely developed or tested its architecture—when we added the new capabilities that were required.”

Problems brought on by such additions “plague all our systems in some ways, although not as much as they do that one [the ALQ-161],” General Loy says. The reason is that the other systems—for example, jammers on the F-15, F-111, and B-52—had been more thoroughly developed before undergoing modifications.

“All of them were designed to

threat. But defeating the threat may no longer be the name of the game in electronic warfare.

Right along, EW is becoming synonymous with avoiding the threat instead, through tactics and by means of such stealth technologies and platforms as the F-117A fighter now in service in limited numbers, the Advanced Cruise Missile, the B-2 bomber, and, later on, the ATF and USAF's variant of the Navy's stealthy A-12 attack aircraft.

“We've had a tendency to think that defeating the threat is the only capability we should be pursuing in

An EF-111A Raven EW aircraft is groomed for an area-jamming mission. Failure of the vital Raven upgrade program has evoked harsh criticism of USAF's whole EW scene.



—Staff photo by Guy Aceto

handle basically the same kinds of older threats dating back to 1970. What we tried to do was elevate them to meet the new threat capabilities,” General Loy explains.

Avoiding or Defeating the Threat?

Notwithstanding arms-control measures and negotiations, those threats are getting worse all the time. In this decade alone, Warsaw Pact forces have put into the field ten new SAM systems. Those forces are now said to have deployed more than 700 EW aircraft, 10,000 intercept radars, 4,000 fighter/interceptor aircraft, 12,000 radar-controlled AAA systems, and 13,000 SAM systems.

Despite its disappointments in EW, the Air Force will keep working on new jammers and new weapons, such as antiradiation missiles and the Tacit Rainbow radar-homing drone and others, to defeat the

electronic warfare,” says General Loy. “There are other capabilities that will let us get in there. The avoidance capability, with stealth, is a major one. And once we get into stealth in numbers, we can never go back. We will have changed the playing field permanently.”

As an admittedly disastrous decade in electronic warfare comes to a close, the biggest challenge before the Air Force may well be its urgent need to decide on the best blends of weapons and other systems for defeating, degrading, and avoiding the enemy threat. This, says General Loy, is “why it is so important for us now to get hold of our requirements process,” wherein USAF makes just such decisions.

The heavy betting is that the Air Force will more and more come down in favor of stealthy systems, such as the ATF, that can do all those things to one degree or another. ■

How AFLC uses magnetic rubber, eddy currents, X-rays, and other unusual techniques to keep USAF's aging aircraft safe and battleworthy.

More Mileage from Older Warplanes

A STAFF REPORT

ONE need only watch routine flight operations to see the triumphs and potential troubles of a graying Air Force fleet.

Aged fighters groan under the stress of six-G turns. Vietnam-era transports rattle over primitive strips. Thirty-year-old bombers shudder and shake on treetop runs to target.

Clearly, older airplanes still are capable of stellar performance. Cracks and other old-age weaknesses, monitored by USAF's Aircraft Structural Integrity Program (ASIP), are being held at bay.

But dangers are equally obvious. With many planes beyond their planned service lives and some flying in ways never intended, concerns about structural failure are ever-present.

Moreover, ASIP workers are facing a fleet of 6,000 planes whose average age, 15.8 years, is sure to rise. This trend, made inevitable by years of slack plane production, will compel ASIP's inspectors to exercise even greater vigilance.

That reality is clearly recognized by ASIP's corps of inspection and analysis technicians, managed by

Air Force Logistics Command, headquartered at Wright-Patterson AFB, Ohio.

The problem—"tired" metal—is best explained by analogy. Just as bending a paper clip back and forth creates microscopic cracks that weaken it, so too does the stress of flying weaken aircraft parts.

Early discovery of weaknesses, whether to prevent disastrous failure or to permit life-extending updates, is the essence of the thirty-year-old mission that ASIP performs with mounting sophistication.

Once, says Bernie Nasal of AFLC's Materiel Management Dep-
utate, ASIP used a fairly primitive analytical model to predict when cracks would appear. This approach was abandoned, he explains, when ASIP found "big differences" between predicted failure times and when those failures actually occurred.

Since 1970, ASIP has been pursuing a new two-track effort—based on safety and long-term durability—that employs more extensive use of reliable, hands-on inspection as well as advanced predictive mod-

els. The change has proven to be a major success, if the record of aircraft longevity is any guide.

Still Going Strong

Hundreds of C-135 aircraft, the first of which was delivered in 1955 with a projected service life of 10,000 flying hours, are still going strong and are headed toward 36,000 hours. The fleet of T-37B primary trainers and T-38 advanced trainers, introduced three decades ago, is expected to stay in service past the year 2000.

Long-range B-52 bombers—G models dating from 1958 and H models from 1961—long ago passed their original service-life goals of 5,000 flying hours, and some will stay in action for another decade. Twenty-five-year-old C-141 transport craft continue to provide a great chunk of US long-range airlift. F-111 fighters produced between 1966 and 1976 and F/FB-111 bombers produced between 1967 and 1970 will remain in USAF's inventory well into the next decade.

The heart of the structural-integrity effort lies in ASIP's Individual Aircraft Tracking Program, a systematic recording of flight histories for all USAF aircraft, whether they be at the end of decades of service or newly arrived on the flight line.

Even those in patently good

health are treated like patients in a hospital, with all vital signs monitored and scrutinized.

A multitude of specialized sensors, hooked to an aircraft like emergency-room equipment hooked to a patient, produces information on such invisible stress as deflection of metal between two points, while other devices monitor and record factors such as airspeeds and G-force experience.

So important are the data to the prediction of structural problems that ASIP has devised a wide variety of techniques to do the job:

- Counting accelerometers (used on smaller aircraft) record each instance in which an aircraft exceeds certain gravitational limits.

- Mechanical strain recorders bolted onto all F-16A/B fighters and a few T-38s and F-5s identify unusual structural movement between two points by producing etchings on foil-like tapes.

- Vgh (aircraft speed, vertical acceleration, and height) recorders, installed on ten percent of older F-4s and T-38s, record these aspects of a flight.

- Multichannel recorders, sampling aircraft performance up to 240 times per second, keep track of twenty-six individual flight parameters.

- Specialized monitors on large

aircraft record fuel and cargo weights and numbers of takeoffs and landings.

Useful for all planes, tracking is critical for air machines flown in ways unforeseen by their designers. The B-52, to cite but one example, has been transformed over the years from a high-altitude to a very-low-altitude machine. The change places unplanned-for stresses on critical components throughout the bomber.

Hunting for Flaws

Careful recording of stressful operations to predict structural damage is but one facet of ASIP's work. The accuracy of these types of projections is vigorously tested—and at times disproven—by frequent, direct examinations of actual aircraft components.

In such "Stress Spectra Surveys," carried out at air logistics centers across the US, maintenance workers use a variety of ASIP tools and techniques to hunt for unanticipated flaws.

Testing methods cover a wide spectrum. They might be as simple as tapping a coin on an aircraft's surface to detect changes of tone or using the naked eye to inspect fasteners. Most of the time, searches are more technologically advanced.

One technique, known as the

C-141s undergo depot maintenance and modification at Warner-Robins Air Logistics Center, Ga. The C-141 transport, which first entered service in 1964, still provides much of USAF's long-range airlift.





At the Sacramento Air Logistics Center, McClellan AFB, Calif., a quality assurance technician inspects a section of aircraft for structural weaknesses. AFLC "Stress Spectra Surveys" monitor strain on aircraft through a variety of tests.

"eddy current," creates an electromagnetic field within a specified part; structural imperfection shows up as a glaring deviation in the pattern of the field.

To detect damage hidden inside a component, ultrasound devices are used in order to project sound waves through material, paint a "picture" of the subsurface, and reveal voids and gaps in the part.

X rays, N rays, and other extremely-short-wavelength energy forms can be radiated through a suspect part to detect advanced corrosion in metallic fabrications, welds, and castings.

The "Magnetic Rubber" Method

Then there is the so-called "magnetic rubber" method. In this process, liquefied rubber, laced with metal filings, is applied to a magnetized part. Attraction of the metal to a particular area indicates the presence of a crack or fissure, one that might otherwise be too small to see. Application of fluorescent penetrants, specialized liquids that glow under black light, produces similar results.

Armed with detailed data yielded by the tracking and inspection programs, analysts located at AFLC's Aircraft Structural Integrity Management Information System begin the laborious task of reviewing the

results and putting them into usable form.

Delmar Teet manages the system, which is based at Oklahoma City Air Logistics Center, Tinker AFB, Okla. He maintains that, after his computers and analysts digest the raw data, they can provide logistics managers with the kind of information they need both to determine the proper uses of older aircraft and to prescribe future maintenance procedures to prolong the aircraft's lives.

Report summaries tell managers how a particular aircraft is being used and, based on that record, how much damage the structure of the aircraft may have received. That information is used to advise commands when airplanes are reaching critical stress limits or when certain operations could have dangerous consequences.

For an idea of the importance of this service, one need only see the ages of some workhorse USAF aircraft. They average twenty-eight years for all 262 B-52s, 17.9 years for all sixty-two F/FB-111s, fifteen years for forty C-5As, 19.8 years for all 365 C-130s, and 17.9 years for all 949 F-4s. Even among USAF's new-

er aircraft, there are pockets of age. Now at least nine years old are 116 A-10s, twenty E-3 Airborne Warning and Control System aircraft, and 298 F-15 fighters.

Planning Aircraft Modifications

Equally useful is another product of AFLC's computerized analyses: detailed advice on when, where, and how to modify older air vehicles in order to maximize the number of flying hours the Air Force gets from its original investment.

Projections are made about how much longer certain structures will last under certain flight conditions. With this information, USAF officers can decide when to replace wings and other key structures on entire fleets of aircraft. Such ASIP information has been used, for example, to plan the orderly wing-reskinning and reengining of the KC-135 aerial refueler, rewinging and structural strengthening of the B-52, and wing modifications to the C-141 airlifter.

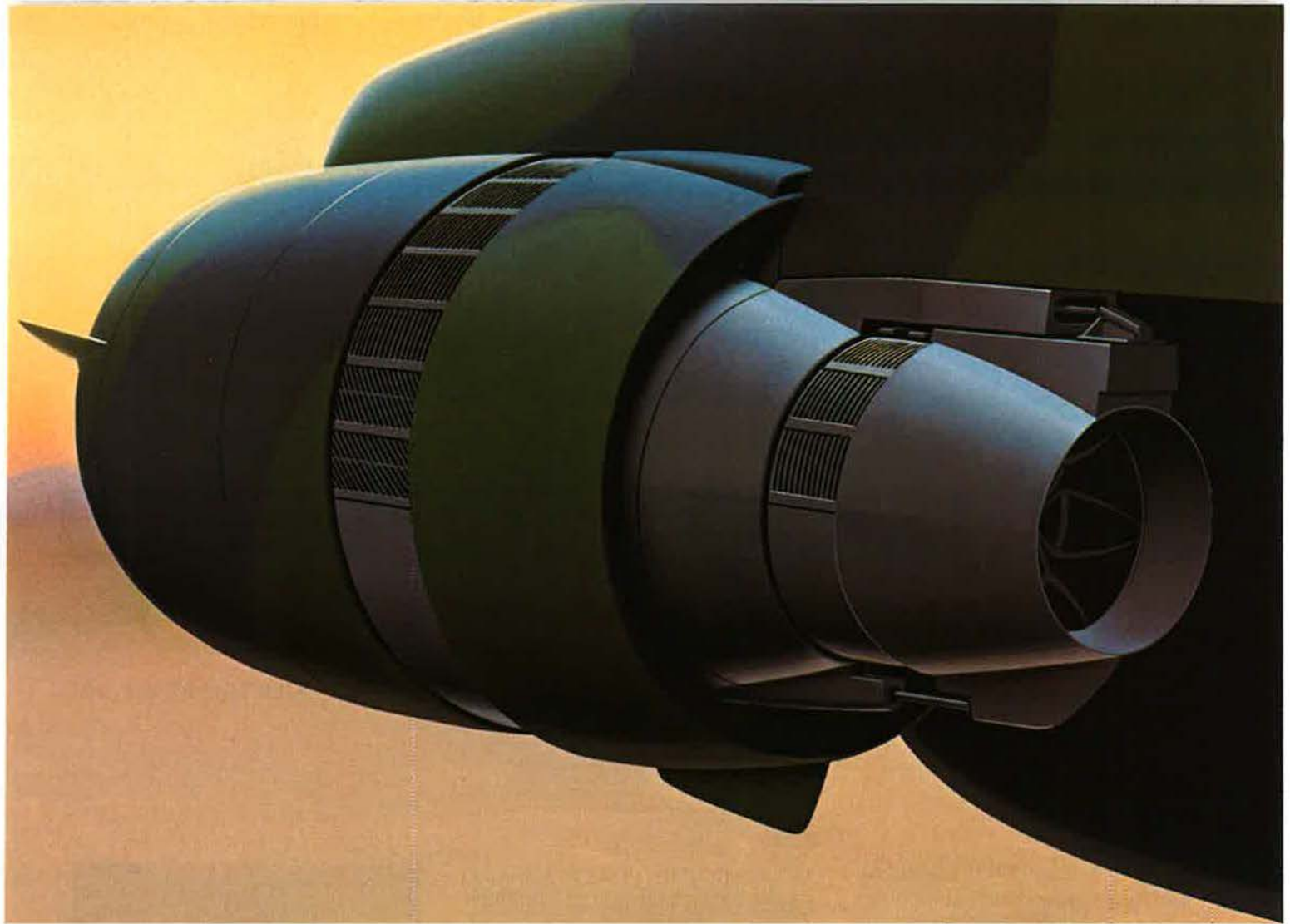
USAF is not the only beneficiary. Friendly nations flying US-built military aircraft—Turkey, Greece, Norway, and Egypt, to name a few—also receive and use ASIP data.

Today, a structural integrity master plan is prepared for each aircraft that enters the inventory. The plan undergoes continuous refinement during an aircraft's service life. The first version of the master plan is included in manufacturers' bid packages. From there, it is updated as engineers develop durability and damage-tolerance analysis procedures.

Early production models are subjected to rigorous vibration, flutter, durability, and damage-tolerance tests both on the ground and in the air. These test data are compared against projections developed during the design phase of the aircraft.

For ASIP workers, the crucial task for the last twenty years has been to make certain that the aging aircraft on hand remain safe to fly and ready to perform their mission. While the program has enjoyed remarkable success, all signs are that there will be no early letup in the challenge. ■

The foregoing article is based on reporting by Kenneth Perrotte, Chief of Media Relations at Air Force Logistics Command headquarters, Wright-Patterson AFB, Ohio, and on magazine staff reports.



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prime contractor capabilities in a support role.*

When LTV Aircraft Products signed on to produce the nacelles, tail sections and refueling receptacles for the C-17, we brought capabilities to the job that no subcontractor in America could offer.

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Our innovative manufacturing technologies are setting new standards in quality and productivity; we're logging productivity increases as high as 5-to-1, on systems that we developed.

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Aircraft Products Group

Military Aircraft Division

L T V : L O O K I N G A H E A D

After forty-five years, automation is finally on the way to replace paper charts and stubby pencils.

New Tools for Mission Planners

BY F. CLIFTON BERRY, JR.

SCENE 1: Late 1944, Eighth Air Force bomber and fighter bases in England, shortly before a mission to Germany.

Action: Aircrew members plan the mission. Their tools: fragmentary operations orders, target data, and intelligence on the enemy from higher headquarters; aeronautical charts for the route to Germany and back; aircraft performance charts and tables with weapons load factors; pencils, lined tablets, E-6B circular slide rules; and lots of hot coffee.

Scene 2: Early 1953, Far East Air Forces bases in South Korea, before a strike against Chinese forces and installations in North Korea.

Action: Aircrews plan the mission. Tools: same as 1944.

Scene 3: Mid-1960s through 1972, Seventh Air Force bases in Thailand, before strikes against enemy targets in North Vietnam.

Action: Aircrews plan the missions. Tools: same as 1944 and 1953.

Even for the USAF air strike against Libyan targets in April 1986, aircrews' planning tools were about the same as in 1944.

Between 1944 and the mid-1980s,

the technology of airpower cascaded through several generations. Military aircraft advanced from pistons to jets, and the speed of air warfare leaped from 150 knots to Mach 2. Man leaped from the earth to the moon. Sensors of many kinds vastly expanded the volume of information on friend and foe. High-speed computers transformed information processing, navigation, and communications.

Yet through all these advances, the tools for mission planning didn't keep pace. Aircrews of the Air Force and sister services were able to fly faster and farther and to fight better. The tools for mission execution advanced with technology. But the tools given the crews to plan missions for the 1980s were those used in the 1930s and 1940s.

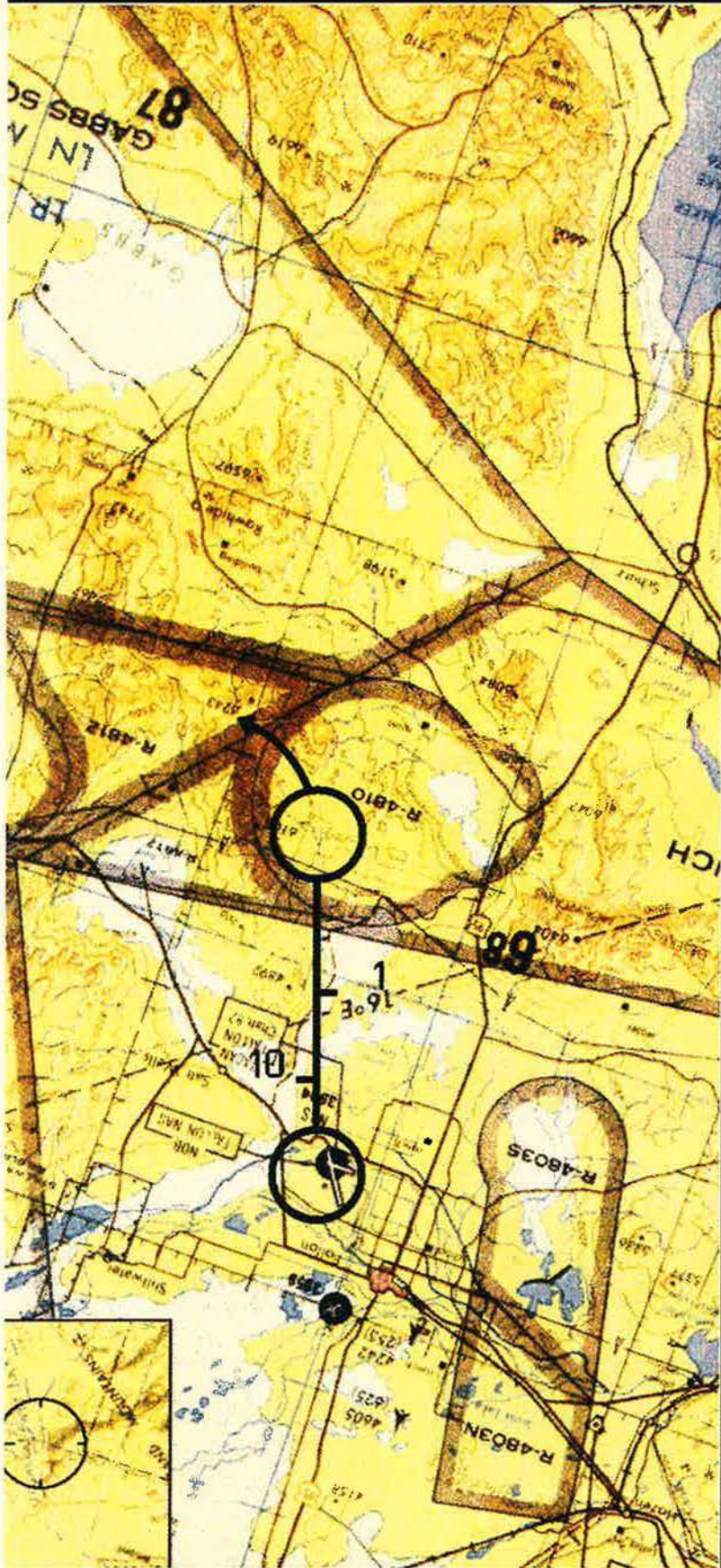
Visits to reconnaissance and fighter wings in the early 1980s verified that reality. In the squadron ready rooms before a mission, aircrew members cut aeronautical charts into strips and pasted them together with rubber cement. They calculated their headings and times for waypoints along the flight route by using slide rules and handheld



New devices such as the Mission Support System II (above) are bringing about startling change in USAF mission planning. Computers, optical disk storage techniques, fiber optics, and other high technologies integrate vast amounts of data in usable form such as map printouts (right). With MSS II, complex strike missions can be planned in minutes rather than days, as in the past.

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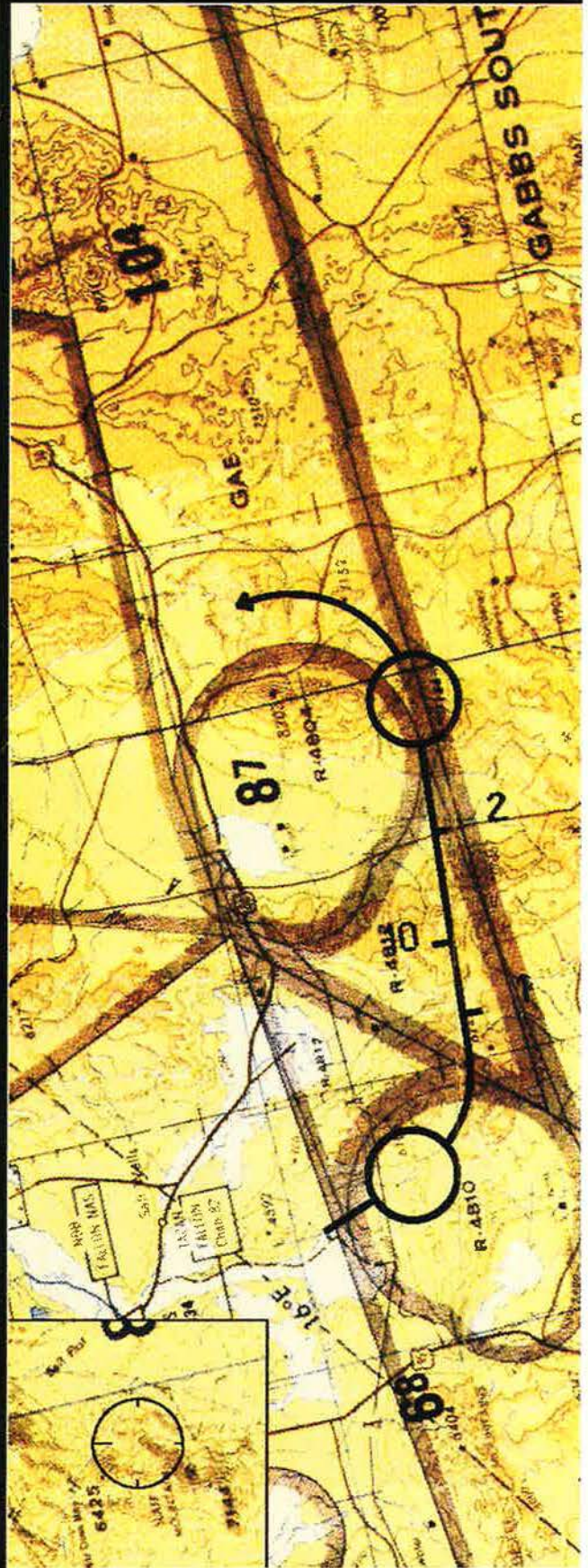
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calculators. They transferred route information to charts by hand with colored pens. They filled out mission cards with vital information and then were ready to go.

Using such methods, mission planning took a long time. It could range from an hour or so for a simple mission up to ninety-six hours to prepare a single Strategic Air Command mission folder. Planning for El Dorado Canyon, the 1986 strike on Libya, took many days.

Given its multiple missions, scarce resources, and requirements for fast action worldwide, the Air Force of the late 1980s and early 1990s finds that it can no longer tolerate use of such antiquated mission planning systems, if pencils and pasted charts can be dignified with the title "systems."

Making Up for Lost Time

Well before El Dorado Canyon, aircrews and commanders throughout the Air Force knew that something better was needed for mission planning. They knew, for example, that personal computers could do

the job at the crew level and that they were available. Thanks to technology, the Defense Mapping Agency was able to convert maps of most of the world's topography to a digital format and maintain databases in that form. Plenty of information about the locations and characteristics of enemy weapons was available. But the Air Force as an institution had done very little to pull together the technologies and operational aircrew requirements into affordable systems capable of automated mission planning.

Within the tactical air forces, Hq. TAC/DRI was tasked to be the single focal point for mission planning. One of the many stimuli to improve automated mission planning came chiefly from US Air Forces in Europe (USAFE), then commanded by Gen. Charles L. Donnelly, Jr. In 1984 and 1985, General Donnelly and his Deputy Chief of Staff for Operations, Maj. Gen. William L. Kirk (later CINCUSAFE), heeded calls from aircrews for something better and began pushing the system to respond.

The awesome and onerous task of planning El Dorado Canyon early in 1986 brought matters to a head. General Donnelly, now retired, remembers shuttling C-12 courier aircraft from USAFE and other locations in Germany to bases in the UK in the weeks before the mission. They ferried load after load of aeronautical charts, intelligence estimates, aerial photos, and other types of imagery to flying units for use in their mission planning.

After the Libya strike, it became obvious at all levels of the tactical, strategic, and airlift forces that improvement was needed fast. To begin the process, a review group of USAF leaders convened at headquarters in Washington, D. C., to focus automation at the unit level with emphasis on automated mission planning. Its title: Squadron Operations Automation Review Group (SOARG).

This special group worked from June 1986 to February 1987. It found that USAF squadrons had plenty of computers; indeed, it concluded that they probably had too many. Each of the major commands had recognized the need and had begun its own fix, as had USAFE. Commands were acquiring computers for everything, mission planning included. The SOARG review found that a single squadron might be fitted with up to forty-four separate computer systems, each for a different purpose, and that virtually all of the systems ran on different operating systems that couldn't talk to one another.

This was chaos with a capital C. The central SOARG recommendation was intended to bring some order. It was simple: The Air Force should address computer-assisted mission planning with a single voice. It should and could do this even while recognizing that different commands might have vastly different requirements or find different applications in executing their particular missions.

Maj. Jim "Snake" Clark was involved in SOARG work and continues to serve as the chief of USAF mission planning systems on the Air Staff (USAF/XOOOE). He told a mid-1989 conference on automated mission planning, sponsored by the Aerospace Education Foundation-New Jersey (see box), what hap-



Armed with advanced equipment, planners will soon be able to inspect a mission area from the perspective of different altitudes, as shown in the photo above. This and other types of information will help determine optimum routes to the target, waypoints, navigational aids, target locations, where and when to expect SAM attacks, and best return routes.

New Jersey Spreads the Word

In mid-May, the Aerospace Education Foundation-New Jersey conducted a symposium on Automated Mission Planning (AMP). Gen. W. L. Kirk, USAF (Ret.), was the keynote speaker. General Kirk, who had retired as Commander in Chief of USAFE only a few weeks before, began by saying, "Automated Mission Planning and this symposium are both long overdue."

He has been advocating progress in AMP for years, first in the mid-1980s as USAFE Deputy Chief of Staff for Operations with Gen. Charles L. Donnelly, Jr., and later as Commander of TAC's Ninth Air Force and as USAFE Commander in Chief from May 1987 to April 1989.

The AEF-NJ symposium, he continued, was especially useful because it brought together representatives from several groups with a stake in the issue. They included users from the major commands; developers from Air Force Systems Command, Electronic Systems Division, and its laboratories; planners and acquisition specialists from the Air Staff and the secretariat; and representatives of domestic and foreign industry.

More than 260 persons attended the three-day symposium. The Air Force advanced its ideas in automated mission planning. Industry gained a clearer understanding of USAF needs and requirements.

Brig. Gen. James E. Young, USAF (Ret.), trustee of AEF-NJ, explained that the New Jersey foundation advances aerospace education in five major ways: by providing funds for Doolittle and Eaker fellowships, by supporting Air Force ROTC programs with cash awards to outstanding junior and senior cadets, by providing funds to New Jersey chapters of AFA that take part in the President's Partners in Education programs, by working with the New Jersey Department of Education on programs of merit, and by donating funds to CAP's flight-training program.

—F.C.B.

pened next. The Air Force initiated a survey of USAF systems and found a number of prototypes, such as one the wizards at the Electronic Warfare Center had developed—an "improved many on many" model using off-the-shelf computers, software, and interconnections. Meanwhile, a rational strategy was developed.

What emerged was a three-track approach to the challenge. First came immediate action to get a system out to the field as soon as possible, though of limited capabilities and in minimal numbers. The second track was use of that limited system to provide hands-on experience for aircrews and thus promote feedback to permit quick reprogramming and identification of operational and support problems. This led to the third track: long-term acquisition. Experience on the first two tracks permitted the Air Staff, working with users, to define long-term requirements and work out an acquisition strategy to integrate automated mission planning into USAF force structure.

Formalizing the Effort

The three-track approach worked and began to produce practical results. A program element manager (at first, Lt. Col. Rich LeClaire and now Lt. Col. Jim Wisneski) was established in USAF's acquisition

secretariat in the Pentagon. That step ensured that mission planning requirements could be validated and compete for funds within the acquisition process.

Air Force Systems Command established a systems program office (SPO) for automated mission planning, independent of any particular aircraft and dedicated to meeting the users' needs quickly and at a reasonable cost. The SPO for Automated Mission Planning (AMP), established within Aeronautical Systems Division in March 1988, relocated to Electronic Systems Division six months later to incorporate mission planning into the Air Force battle management program. It is now the focus of USAF developments in automated mission planning and the point of contact for industry.

While organizational changes were under way, USAF also imported operational commands to make their true needs known. They fell into four major areas: tactical, strategic, airlift, and special operations. When those commands compiled and forwarded their requirements, the senior USAF structure had the raw materials it needed to orchestrate a cohesive effort.

There was much to orchestrate. The tactical air forces alone, for example, identified and justified approximately sixty requirements.

Meanwhile, the first mission planning systems began moving into the field for the required hands-on experience and feedback. The first sixty-five units of the system, called Mission Support System I (MSS I), were delivered in late 1987 and early 1988.

Even as these first-generation systems were being delivered, early lessons from their development were incorporated into Mission Support System II (MSS II). A contract for MSS II systems went to Fairchild Industries. Between October 1988 and December 1989, Fairchild is to produce 138 of the systems and also provide maintenance and support during their service lives.

Field users of MSS I and MSS II have been quick to respond with recommendations drawn from operational use. At the same time, developmental work by USAF laboratories and contractors has produced additional progress. Promising applications are available for the next generation of mission support systems, known as MSS III.

The request for proposals (RFP) for MSS III will call for 560 systems. ESD is expected to issue the RFP this fall. MSS III will be the baseline system for the future, a logical upgrade of earlier systems that will incorporate new technologies. Intense competition is sought and expected. At present, the acquisition strategy is on schedule and within budget.

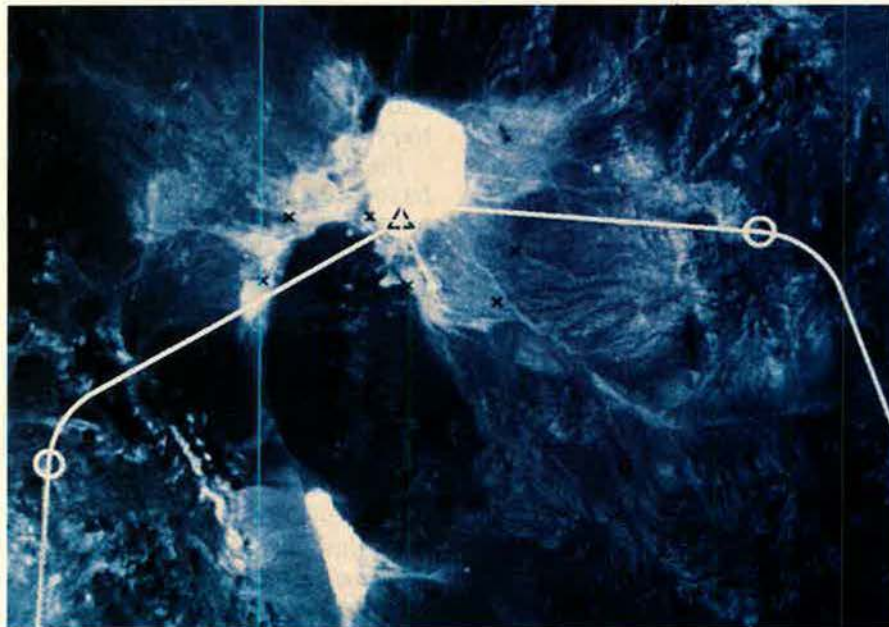
The goals for automated mission planning systems are simple, yet can yield significant beneficial results in utility, cost, and in the application of new technologies. One key goal is to fashion a system that can meet the needs of the several different types of potential users, all the while using databases that are both common and interoperable. Other goals are simplicity, sensible conception and execution, upward compatibility, an open-form system architecture, and redundancy in combat use.

Using the Systems

Even now, the difference between old ways of mission planning and the methods made possible by the development of MSS II is nothing short of startling. Planning for a complicated F-16 strike mission, for

instance, can be completed in minutes rather than the full day that it traditionally has taken. SAC mission folders can be updated in two hours instead of the usual ninety-six.

Much like the first time one saw a television broadcast or watched the operation of a Polaroid camera, witnessing the MSS II system in action makes a deep and lasting impression. The interrelated workings of numerous technologies create the illusion of sorcery.



Proposed mission route superimposed on a satellite image of local terrain. Once ready to fly, the aircraft crew can enter essential information in a special data transfer module, plug it into the craft's computer system, and call it up for use during flight. Information can be updated en route to target.

First is computing power, taking advantage of existing capabilities. Next is the capability for linking computers in networks and transmitting data via paths such as satellites, wires, and fiber optic cables. Also included is massive memory capacity, taking advantage of optical disk storage media. Color graphics displays and color printers round out the ensemble. The conductor of this multidisciplinary orchestra can be found in the integrated software that has been made portable and interoperable with other software.

Contemplate, for a moment, all of the variables that must be considered, processed, and displayed to be useful to a crew about to set out on a mission.

First and foremost are the aircraft characteristics and weapons load

for the mission. Then come parameters such as takeoff roll, fuel consumption, and optimum airspeed. They now have been recorded on hard or floppy disks at the squadron center.

Routes to and from the target must be considered. Data on starting points, waypoints, navigational aids, target locations, and return routes are essential. Once the crew would have been issued paper aeronautical charts that would cover the route. Now the Defense Mapping

Agency has converted those charts and their data to digital form on high-capacity, portable memory means, such as optical disks.

A massive amount of intelligence about the enemy must be considered. Again, that is either on a storage medium (such as a disk) in the squadron, or instantly available from a central data source. Information includes target data, location of defenses along the route and in the target area, and their lethality.

Because all of this information is available and can be manipulated, crews can plan their missions faster and more prudently. They can examine tradeoffs between fuel consumption and exposure to enemy radar or SAMs, for example. It is the "what if?" of civilian financial planning spreadsheets carried to life-and-death considerations. The aircrew can speculate, "What if we dropped 200 feet lower at this point? What would be the added safety from SAMs and increased hazards from terrain?"

Even better, thanks to the marriage of simulators and digital images from the automated mission planning systems, aircrews can "rehearse" missions before flying them. This procedure can be especially useful for special operations crews.

Finally, the warriors can take the knowledge along for the ride. Once ready to fly, the crew can enter essential information into a data transfer module, take it to the aircraft, and plug into the aircraft's computers and other systems. Information for navigation, communication, threat avoidance, and other mission-essential functions is readily available for use during the mission. Such information can be updated during the mission, as the situation changes and as new information is communicated to the crew.

The upshot is that, however belatedly, high technology is now being thrown against a problem that has bedeviled air-combat operations for decades. Dollar amounts expended seem puny when compared to those spent on such glamorous weapon systems as the B-1B and B-2 bombers. Those weapons of the 1990s cannot be employed effectively with the planning technology of the 1940s. Money spent now on automated mission planning could well make the difference between success and failure in the air combat of tomorrow. ■

F. Clifton Berry, Jr., is a former Editor in Chief of AIR FORCE Magazine. 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. His most recent article for AIR FORCE Magazine was "It's Time to Worry About Technical Manpower" in the July '89 issue. The author extends special thanks to Maj. Jim "Snake" Clark, USAF, who assisted in the preparation of this article and who is a spark plug and catalyst in automated mission planning.

Progress on the Wing

BY JEFFREY P. RHODES, AERONAUTICS EDITOR

THE Soviet policy of *glasnost* extended to the thirty-eighth Paris Air Show in an expansive way. The ramp at Le Bourget Airport was filled with nine civil and military aircraft and two helicopters from the USSR during the eleven-day show in early June.

The Soviets gave the concept of "aluminum overcast" a new meaning with their static display of the An-225 transport/*Buran* space shuttle combination. The West also got its first look at the Mil Mi-28 Havoc attack helicopter, the Sukhoi Su-25 Frogfoot ground attack plane, and, most impressively, the Sukhoi Su-27 Flanker air-superiority fighter.

The Su-27, a counterpart to the US Air Force's F-15, is only three feet shorter than USAF's F-111 and has a wingspan six feet shorter than that of an A-10. A look in the cockpit revealed the aircraft's standard instruments with no multifunction displays. However, the aircraft put on an impressive flight display, hanging vertically in midair for a couple of seconds before falling out of the stall. Only the single-seat fighter flew, but the Su-27UB two-

seat operational trainer also was on display.

The Su-27 looked to be better constructed (panel fit, etc.) than its F-16-class cousin, the MiG-29 Fulcrum. The Fulcrum, while not shabbily constructed, seems designed for rapid mass-production, whereas the Flanker appears to involve a little more craftsmanship. A MiG-29UB two-seat operational trainer took the place of the single-seat aircraft in the flying display after the crash on the first day of the show.

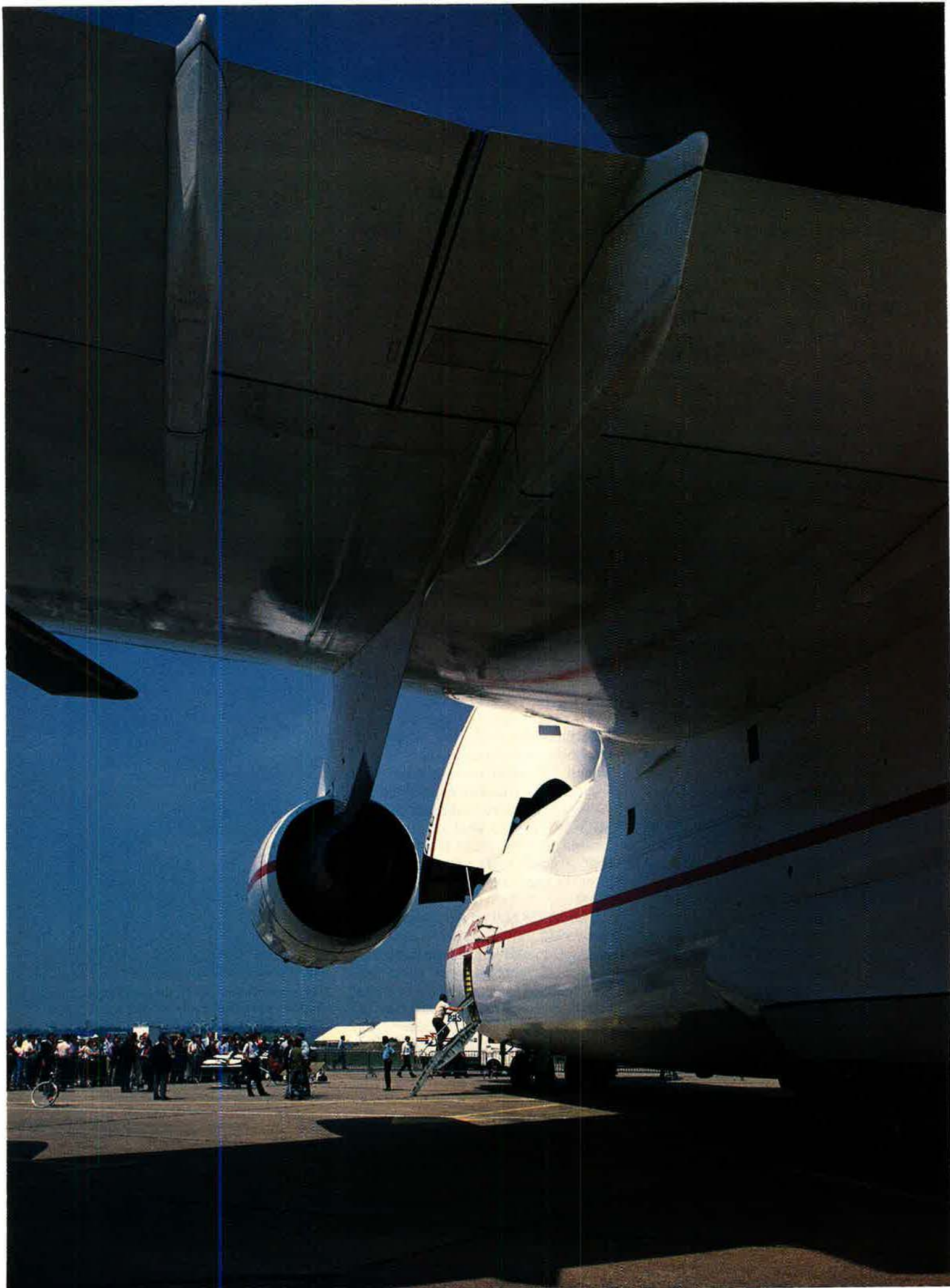
The Mi-28 Havoc has been flying since 1982, but is only now entering production and will be available for export. Slightly larger than the McDonnell Douglas AH-64 Apache attack helicopter and similar in function, the Havoc is powered by twin turboshaft engines with unusual, downward-canted, heat-diffusing baffles on the exhaust. It has a chin-mounted 30-mm gun and four stub-wing weapons pylons. Although they were on static display across from each other, neither the Apache nor the Havoc flew during the show.

Size comparisons of the An-225



© Erik Simonsen

The Soviet Union put on an impressive display at the 38th Paris Air Show, not least of which was the arrival of the An-225 transport with the *Buran* space shuttle attached. The size of the *Mriya*/*Buran* combination can be gauged by the Antonov technician entering the crew door of the An-225 (next page).





The Soviets gave the West its first look at the Sukhoi Su-27 air-superiority fighter, and the Flanker's daily flying display was spectacular. The Su-27 is a good bit larger than the Air Force's F-15 Eagle—and its engines produced more smoke.

with almost anything else are meaningless—the size of *Mriya* stretches belief. Here are the numbers: The aircraft has a gross takeoff weight of more than 1,000,000 pounds, a wingspan nearly as long as a football field, and a length nearly equal to its wingspan. The six-engine, twin-tail aircraft's cargo hold does not have a rear ramp (there are no plans to add one) and features a ten-ton, two-hook overhead crane. Access to the cargo hold is through a visor-type, upward-hinged nose. The aircraft can also kneel on its twin nosewheels.

John W. R. Taylor, Editor in Chief of *Jane's All the World's Aircraft*, talked with Soviet officials and the crew, and he noted that *Mriya's* cockpit is almost identical to that of the An-124 Condor. The crew said that the first time the plane flew with *Buran* on its back, the combination was such a delight to fly that the crew stayed aloft for thirteen hours. The Soviets plan to build only five or six of the An-225s to transport *Buran* and Energiya booster components.

The American military aircraft industry was represented in the flying display by a Turkish-built F-16C (flown by a General Dynamics test pilot), a McDonnell Douglas CF-18A (flown by an active-duty Canadian pilot), and a British Aerospace/McDonnell Douglas Harrier GR.5. All of these aircraft ably demonstrated their capabilities, but their display lacked the panache of the Soviets' aircraft.

What stole the show, however, was the departure of the Lockheed SR-71A on June 12. The aircraft, rotationally assigned to the 9th Strategic Reconnaissance Wing's Detachment 4 at RAF Mildenhall, England, used most of the runway to take off, made a leisurely bank to turn around, then flew the length of the runway at an altitude 250 feet at a speed of about Mach .5. While the plane was still picking up speed, the crew of Maj. Jim Greenwood and Capt. Steven Grzebiniak banked around off the other end of the runway, flew back down the runway at a speed of about Mach .8, pulled the nose up, made a steep climb, and, for all intents and purposes, disappeared. Quite a performance for an aircraft that is nearly thirty years old.

The Burgeoning Commercial Market

While military aircraft programs around the world are increasingly coming up against budget pres-

ures, the commercial market is in an era of unprecedented growth. In fact, growth in the commercial sector for this year is expected to be larger than the entire commercial market in 1960. Here is a rundown of what some of the major firms are doing:

Boeing Commercial Airplanes has a backlog of 1,522 jetliners, or enough work to see the company into the late 1990s. The company just introduced the latest member of the family, the 108-passenger 737-500 that will replace aging 727 and 737-200 aircraft. The -500 features the same General Electric/SNECMA CFM56-3 turbofan engines as the 737-300 (128 passengers) and the 737-400 (146 passengers) and offers a twenty percent improvement in fuel consumption over the -200.

Boeing's other jetliners are also doing quite well. There are now four versions of the 767 in production: -200 and -200ER (174 passengers) and -300 and -300ER (204 passengers). The 747, the world's first wide-body jetliner, is now in its thirteenth version, the 747-400. This model has extended wings and six-foot-tall winglets and can carry 412 passengers. The 757 is only being offered in one version, with seating for 186.

McDonnell Douglas's commercial aircraft builder, Douglas Aircraft, has recently gone through a massive leadership reorganization, but



The commercial side of the airplane business is becoming increasingly dominant at shows like the one at Le Bourget last June. A number of jetliners, including the Soviet Il-96, were flown daily. Here, an Airbus A320 performs maneuvers that few passengers would like to experience.

things are moving forward smartly. The company is now assembling the first MD-11 wide-body trijet, and the first flight is scheduled for later this year.

The MD-11, a follow-on to the DC-10, is being offered in three versions, and twenty-eight customers have already placed orders for 295 aircraft. The MD-11, which will also have winglets, will seat 323 people.

range models, the four-engine A340 (295 passengers) and the twin-engine A330 (335 passengers), are in development. An A320 flew daily at Le Bourget.

Sales of the **British Aerospace** BAe-146 regional jet continue at a brisk pace, but the real comer in the regional market is the **Fokker Model 100**. Fokker, which builds F-16s under license for the Netherlands, ex-

ternational. Spain has not expressed a preference.

Aside from the radar, the Eurofighter's development is progressing. Each partner's workshare has been established (thirty-three percent to both England and Germany, twenty-one percent to Italy, and thirteen percent to Spain), the aircraft's configuration has been frozen, one-third of the subcontractors have been chosen, wind-tunnel testing of the final configuration has begun, and detailed design work is progressing. Messerschmitt-Bölkow-Blohm, British Aerospace, Aeritalia, and CASA are the EFA prime contractors.

The Eurojet EJ200 engine for EFA lags somewhat behind the airframe in its development. Three of the 20,000-pound-thrust engines, built by the consortium of Rolls-Royce, MTU, Fiat, and Sener, are currently being tested in three locations. The fully modular engine is expected to achieve a thrust-to-weight ratio approaching 10:1.

The first EFA prototype is scheduled to fly in 1991, and the aircraft is scheduled to enter service in 1996. Both Germany and Britain have a requirement for 250 aircraft, while production for Italy will total 165 EFAs, and Spain will need 100 of the optimized air-to-air fighters. The aircraft, which will have a single 27-mm Mauser cannon and will be both AMRAAM- and ASRAAM-capable, have a target flyaway cost of DM50 million (\$25 million) each.

Tornado Going Strong

The three-nation Panavia consortium celebrated its twentieth anniversary earlier this year, and the Tornado program is still doing well. The company has orders for nearly 1,000 aircraft in three versions on the books, including 120 aircraft for export (mostly to Saudi Arabia).

Since entering service in 1979, Tornado squadrons have accumulated more than 560,000 hours of flight time. At the end of May, the *Kriegsmarine's* MFG-1 became the first Tornado squadron to pass the 50,000-hour flight plateau. The Turbounion (a partnership of Rolls-Royce, MTU, and Fiat) RB199 engines have passed the 1,120,000-hour mark, and 2,100 of the 2,400 engines on order have been delivered.

Eurofighter Heating Up

The last major stumbling block for the four-nation European Fighter Aircraft (EFA) program—the fighter's radar—has been virtually cleared away, NATO European Fighter Management Agency (NEFMA) officials said in Paris. The dispute, which has raged for nearly five months, centers on Germany's desire to use the MSD-2000, a version of the Hughes APG-65 radar to be built by an AEG-led team, while Britain and Italy want the ECR-90 radar built by Ferranti In-



Several companies are producing turboprop commuter transports for the commercial sector and regional jets like this British Aerospace BAe-146 STA (STOL Transport Aircraft) with side-loading cargo door and in-flight refueling probe.

The Air Force has expressed only superficial interest in a tanker version of the MD-11.

Although the company has completed testing with both Pratt & Whitney and General Electric propfans, there seems to be little commercial interest in the MD-90 family of airliners, mainly because the price of jet fuel is running at a relatively modest sixty cents a gallon. Interest in the ultraefficient propfans could pick up if the price of Jet-A goes over \$1 a gallon. The jet-powered MD-80 family, however, continues to sell well (1,548 aircraft).

Airbus Industrie, the four-nation (France, Britain, Germany, and Spain) consortium, has become one of the largest commercial transport concerns in the world. Airbus, which is government-subsidized, has total sales of 1,060 aircraft and a backlog into 1994.

Airbus has three main models (A300, A310, and A320), available in six versions. These twin-turbofan aircraft have seating for between 218 and 267 people. Two other long-

The RB199, which can ingest a six-pound bird and sustain little damage, will be installed in the EFA prototypes for the first round of flight tests. Turbounion has done some company-funded studies and thinks an RB199 without afterburner would be a good candidate to reengine the Air Force A-10s, should that program be revived.

Panavia and Rockwell International have teamed to offer a version of the ECR (Electronic Combat and Reconnaissance) Tornado to the US Air Force as a Follow-On Wild Weasel (FOWW) platform. The aircraft would have to be assembled in the US, and several other changes would have to be made to meet the "Made in America" Act before the Air Force could buy it. The ECR Tornado is now in development for Germany and Italy, and much of its avionics suite is made by Texas Instruments. (The FOWW program is currently on hold. Should the program be revived, the Tornado's major rivals are a derivative of the McDonnell Douglas F-15E and the General Dynamics F-16D.)

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TTTS Contenders in View

Most of the serious contenders for the Air Force's Tanker/Transport Training System (TTTS) displayed their aircraft at the show. The TTTS program calls for the purchase of 211 mostly off-the-shelf business jets (there are some specific avionics and airframe requirements the contenders must have) along with associated simulators, training devices, and a contractor-run logistics system.

The TTTS system will be used in the Air Force's dual-track pilot training program for pilot candidates going to the multiengine tank-

er the Navy as T-47 radar intercept officer (RIO) trainers. The Citation has been in production since 1972, and data are available on costs, safety, and reliability.

The team of **FlightSafety International, Learjet, and Allied-Signal** is entering the Learjet Model 31 in the competition. The Model 31 features unique delta fins under the fuselage for increased directional stability and winglets for better wing efficiency. The Model 31, a relatively new aircraft, has a good bit of commonality with the Model 35, which is the C-21A in Air Force service.

The team of **McDonnell Douglas and Beechcraft** is submitting the Beechjet 400A as its TTTS entrant. The Beechjet, designed and originally built in Japan by Mitsubishi, was certified in the early 1980s. Production was moved to the US in 1988, and the first totally US-built Beechjet is scheduled to fly this fall. The 400A offers a significantly larger cabin than either the Learjet or the Citation. There is no military equivalent to the Beechjet.

The team of **Rockwell and British Aerospace** had a parting of the ways with its erstwhile teammate, Reflection, and is currently looking for another partner to handle the simulators for its TTTS entry. The BAe 125-800 will be the aircraft for the Rockwell-BAe bid. The 125-800 is the largest of the TTTS aircraft, with a span and a length of more than fifty-one feet. Six 125-800s will be in use with the Air Force as the C-29A, which will be detailed for airways inspection.

Israel Aircraft Industries had its Astrajet on display at Paris and is paired with Hughes in the competition. **Sabreliner**, which is entering its Model 65 in the competition, was not present in Paris.

Airshow Notes

Flight Refuelling Ltd. of England reports that the pylon for its wingtip-mounted Mk. 32 refueling pod on USAF KC-10A tankers is affecting the drag characteristics of the drogue in tests. This seems to be more of a teething problem than anything else, and the program has not been delayed. The company has already delivered six of the forty shipsets the Air Force requires. Flight Refuelling will also begin testing wing-mounted refueling



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The Dassault-Breguet Rafale-A is a preproduction version of France's new tactical fighter for land-based (Rafale-D) and maritime (Rafale-M) use. The Rafale-A was put through its paces daily at Le Bourget.

To acquaint Air Force officials with the Tornado, two German IDS (Interdictor Strike) Tornados and their crews were scheduled to fly from Goose Bay, Newfoundland (where they were doing low-level training), to Langley AFB, Va., at the end of July. The crews will then perform a series of demonstrations at Tactical Air Command headquarters.

ers and transports. The formal request for proposals will go out in September, and a contract award is expected to come in the early part of 1990.

The team of **General Dynamics, Cessna, and CAE-Link** is basing its TTTS bid on the Cessna Citation S/II aircraft. The Citation has a non-life-limited airframe, and fifteen of the aircraft are currently in use with





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Pods on a USAF KC-135 near the end of the year. Although this is only a test program, equipping KC-135s with the podded drogue equipment would allow the tankers to refuel NATO and Navy aircraft without having to change the refueling gear.

Texas Instruments has begun deliveries of its Aircraft Launch Interface Computer (ALIC) that will allow USAF F-16s to fire the AGM-88 High-speed Antiradiation Missile (HARM). Begun as a company-funded effort in 1979, the launcher has all of its avionics in the aft end of the pylon. It essentially fools the F-16 into thinking that there is an AGM-65 Maverick missile on the pylon, so all of the cockpit displays can be used with HARM. This is an interim solution. Later, the interface board will be changed, and the computer will be able to do HARM-targeting itself. TI is scheduled to deliver 250 of the pylons.

Fábrica Argentina de Materiales Aeroespaciales (FAMA) announced that the Argentine Air Force has exercised its option to purchase an additional fifty IA 63 Pampa jet trainers, bringing the country's total order to 100 aircraft. FAMA will also produce another 100 aircraft for export, although there are no other customers so far for the single-engine, high-wing trainer. The company recently completed an IA 63 demonstration tour in Israel. The IA 63 was one of the daily airshow performers. (For more on the Pampa, see "Aerospace World," January 1989 issue.)

Northrop and the Air Force announced the third successful test of the AGM-136A Tacit Rainbow loitering antiradiation missile during the show. The May 31 test was the most strenuous to date, as the missile's mission profile was reprogrammed while the missile was in the launching B-52's bomb bay en route to the target at the Naval Weapons Center at China Lake, Calif. The missile was launched at a very low altitude, initiated engine start, and engaged a target. The emitter was then turned off, so the AGM-136 acquired and attacked a second target. This was the second successful test in two weeks (the other test was on May 17) and the third of twenty-five planned operational test and evaluation launches. Tacit Rainbow is launched from a

specially built rotary launcher in the B-52 that can carry thirty AGM-136s.

Officials at **Saab-Scania** have determined that the cause of the crash of the prototype JAS-39 Gripen lightweight fighter on February 2 was in the plane's flight-control system software for pitch control at low speed. The accident and software redesign have now pushed delivery

borne sensors, and it will be fitted with a AN/TPS-63 radar for the test. The YEZ-3A program, which has been shifted to the Defense Advanced Research Projects Agency but is still managed by Naval Air Systems Command, has been slowed considerably, but Westinghouse says that the production airship (which will contain 2.4 million cubic feet of helium) could be ready



While not as flashy as the Soviets, US manufacturers more than demonstrated the capabilities of their aircraft at Le Bourget. This Royal Norwegian Air Force F-16A displays the flags of countries currently operating the General Dynamics jet.

of operational Gripens to Sweden back a year, to 1993. Tests of the JAS-39's radar are progressing in a modified Saab JA-37 Viggen. The company has ordered long-lead materials for the first thirty aircraft and will soon order materials for the 110 option aircraft. Saab has also started development work on the two-seat JAS-39B basic and tactical training version. The Gripen, which is powered by a modified General Electric F404 engine, will replace both the Viggen and the Saab J-35 Draken in the air-to-air, air-to-ground, and reconnaissance roles.

The team of **Westinghouse and Airship Industries** leased a Skyship 600 blimp, fitted with a forward-looking infrared and other sensors, to the French government for crowd control during the country's bicentennial celebration in July. The Westinghouse/Airship team is also building a one-half-scale model of the gondola planned for the Navy's YEZ-3A early warning blimp for demonstration purposes. The company-funded effort is designed to prove the effectiveness of blimp-

thirty months after construction go-ahead. The YEZ-3A will be used for over-the-horizon surveillance.

The US Army now has the French **Thomson-CSF** Romeo II radar in test at Fort Belvoir, Va. The Romeo II mixes infrared and millimeter-wave radar technology to improve flight safety for helicopters, especially at low levels and at night. The radar works on a frequency of 94 GHz (little work has been done in this range before) to provide a high detection capability for small targets (such as power lines). In the Army tests, the Romeo II is mounted on the nose of an AH-1 helicopter, and the radar is not in its final configuration. The radar can move through ninety degrees of azimuth and thirty degrees of elevation. It has a range of 1,000 meters and can pan through its range in three seconds. Thomson is working with Texas Instruments to improve the pilot/radar interface. The current display is an engineering model. The Army will be testing the radar through the end of the year.



IBM displayed a working model of its Advanced Automation System (AAS) terminal that is one of the main parts of the Federal Aviation Administration's plan to upgrade the US's air traffic control system. Last fall, Hughes protested the contract award to IBM, but the protest was denied, and IBM is now proceeding with full-scale development of the system. The first complete AAS system (which also includes the IBM-developed Host Computer System) will be delivered to the FAA Tech Center in Atlantic City, N. J., during the first half of 1991 for

ITT Gilfillan has completed development work and has successfully tested its new AN/MPN-14K mobile air traffic control radar for the Air Force. The MPN-14K provides a complete tactical radar and communications facility that has the capability for full-instrument-flight-rules air traffic control operations. The two-trailer system is fully transportable in a C-130. Deliveries are to begin this summer.

IPTN (Industri Pesawat Terbang Nusantara), the Indonesian company that is building parts for General Dynamics F-16s, unveiled the design for its first indigenous aircraft, the fifty-passenger, twin-turboprop N250 regional airliner. IPTN has gone from building CASA 212 transports and Messerschmitt-Bölkow-Blohm BO-105 helicopters under license to the CN-235 transport, a codesign and coproduction effort with CASA, to designing its own aircraft in just three years. The company now has 15,000 employees, up from 750 in the late 1970s. IPTN hopes to have the N250 certified by 1994.

1992. The price of the Gulfjet is approximately \$2 million.

Pratt & Whitney and General Electric both had milestones to report at the show. P&W was scheduled to deliver its 5,000th J52 turbojet engine in July. The J52, which powers Grumman A/EA-6 and Douglas A-4 aircraft (and which also powered the Air Force's AGM-28 Hound Dog missile), has been in production for more than thirty years—the longest of any Pratt & Whitney engine model. June saw the first flight of a General Electric engine in an F-15. The F110-GE-129-powered F-15E was scheduled to make several flights at the McDonnell Douglas plant in St. Louis, Mo., before continuing tests at Edwards AFB, Calif.

Rockwell International notes that several production milestones are scheduled to occur on *Endeavour*, the replacement space shuttle, before the end of the year. In September, wiring checkout of the crew module is scheduled to be finished, with wiring checkout on the mid-fuselage to be completed in November. Also in November, the payload doors will be shipped from Rockwell's Tulsa, Okla., facility to Palmdale, Calif., where the orbiter is being assembled, and the upper forward fuselage will be shipped from Downey, Calif., to Palmdale.

The team of Bell Helicopter Textron and Boeing Helicopters highlighted its international marketing efforts for the V-22 Osprey tilt-rotor at the show. Three European partners (British Aerospace, Dornier, and Aeritalia) have been lined up for joint assessment of potential NATO military requirements for each host nation, as well as assessing the market potential for a civil tilt-rotor. Bell-Boeing has also reached agreement with two Japanese firms (C. Itoh and Mitsui) to assess the potential military requirements of the Japanese Defense Agency only. Although the V-22 is in budgetary hot water in the US, interest around the world in both military and civil applications of tilt-rotor technology is high. The V-22 test program is continuing, and the first transition from helicopter to airplane mode is expected to come by the end of the summer. The remaining five prototype V-22s are expected to be flying by the end of the year. ■



The Sukhoi Su-25 Frogfoot ground attack aircraft (top) and the Mil Mi-28 Havoc attack helicopter (above) were newcomers to the show. The Su-25's engine-mounted chaff and flare dispenser is evidence of hard lessons learned in Afghanistan.

system verification. After nine to twelve months of tests, the first operational system will be installed in the en-route center in Seattle, Wash., during the first half of 1992. The AAS system will be run in parallel with the existing system at each of the en-route centers until the new system is up and running. Installation of the entire system is expected to be completed in 2001.

Gulfstream Aerospace introduced its new six-to-eight-passenger business jet with a motorized mockup at the show. The new airplane, called the Gulfjet, features two Williams/Rolls-Royce FJ44 turbofan engines that will give the forty-two-foot-long plane a cruise speed of more than 500 mph and a range of 2,300 statute miles. Deliveries of the aircraft are expected to begin by early

—Staff photos by Jeffrey P. Rhodes

It's a new world of simulation. This prototype links the individual nodes so the entire team can train together.

Planet Simnet

BY JOHN RHEA

WELCOME to the planet Simnet. But stay alert, because this has to be one of the more dangerous places known to man.

War rages interminably. The terrain is covered with tanks and armored personnel carriers, many of them engulfed in flames. Close air support (CAS) aircraft, both rotary and fixed-wing, pop up from behind trees and scream down to engage in missile duels with ground forces.

The frenzied chatter of troops under stress fills the radio waves. The incessant booming of artillery reverberates throughout this nightmare world. Danger of death is ever-present.

This is not a real world, though it is frighteningly realistic to Army and Air Force personnel who go there to learn the art of war. Planet Simnet exists in a prototype simulator network—whence its name—put together by the Defense Advanced Research Projects Agency (DARPA). The purpose of Simnet is to apply state-of-the-art electronics technology to the demanding task of training forces in combined-arms warfare.

Maintaining force-readiness lev-

els is a constant challenge, one not likely to get any easier in an era of stagnant defense budgets and qualitative upgrading of hostile forces. Traditional training methods, principally field exercises and instruction on individual weapon simulators, cannot keep pace for two reasons. First, these techniques cannot duplicate the totality of tactical warfare. Second, they are too expensive to be used frequently.

Air Force Col. Jack Thorpe, the Simnet program manager at DARPA, is convinced he has a better idea. He has been pursuing it relentlessly for ten years. He proposes to use new technologies of microprocessors, high-speed data links (including fiber optics), and computer-generated imagery to create a new type of total warfare simulator.

Many Workstations, One Battle

Not a replica of a single weapon system built around a central computer, these new simulators are modular workstations linked in a network based on distributed architecture. Workstations can easily be added or removed without forcing a total reconfiguration of the system.

In Washington, D. C., DARPA Program Director Col. Jack Thorpe (left) and Lt. Col. James Schifflet (right) use their "Flying Carpet"—the BBN "Stealth" vehicle—to gather information on a simulated battle in progress on the Simnet system. Simnet allows a simulated battle to be evaluated by stealthy observers in several locations.



For the purpose of training, the main advantage of this approach is simple and compelling: All of the participants in an exercise—and there could be thousands of them in advanced versions of Simnet—are fighting the same battle.

Furthermore, these troops fight as teams, and they fight other teams of humans, not computers. Colonel Thorpe compares Simnet workstations to Alice's looking glass. They are entry points into an electronically created world of strife. The battle continues without interruption as trainees enter and exit this world.

Simple to Operate

In a military environment of high tech, "mil-spec'd" equipment, Simnet workstations are built around Apple Macintosh computers available at any computer store. One main reason is that these processors are inexpensive and simple to operate. Another is that Simnet's modular architecture doesn't care what kind of computer is used. Even simpler and cheaper personal computers can be substituted.

"We can pick and choose and mix and match," Colonel Thorpe says, thus avoiding the situation of being locked into a single system contractor.

Planet Simnet is rent-free, devoid of political or ecological constraints, can be made identical to anyplace on planet Earth (from Fort Knox to the Fulda Gap or even Red Square), and is nonlethal to its temporary inhabitants, who can blaze away at each other with the weapons of their choice.

Today, Simnet is a test-bed network of workstations located on two continents, all simulating ground and air vehicles. In the continental US, there is one star configuration having a central node at Fort Knox, Ky., and six outlying nodes. They are found at Fort Leavenworth, Kan.; Fort Hood, Tex.; Fort Rucker, Ala.; Fort Benning, Ga.; Mississippi National Guard headquarters at Camp McCain; DARPA headquarters in Arlington, Va.; and the Cambridge, Mass., offices of associate prime contractor Bolt Beranek and Newman (BBN). In Europe, three West German sites at Schweinfurt, Friedberg, and Fulda are tied into a central node at Grafenwoehr.

All the nodes can "talk" to each

other over standard AT&T 56,000-bits-per-second long-haul communications lines. Internal communications at each location use Ethernet or other local area networks with data rates of 10,000,000 bits per second.

Each workstation for an M1 Abrams tank or an M2/3 Bradley Fighting Vehicle costs \$250,000. The tab is \$500,000 for one that simulates a generic CAS aircraft (it could represent an A-10 or an A-16, so Colonel Thorpe calls it an "A-13"). Prices represent only a small fraction of the cost of genuine articles.

Comparable savings are found in operations. Simnet's phone and electric bills are far lower than costs of gasoline and jet fuel. Colonel Thorpe estimates the total cost of the Simnet test-bed at about \$60 million, of which DARPA put up \$20 million. The Army will pay the remainder.

Red Flag in a Laboratory

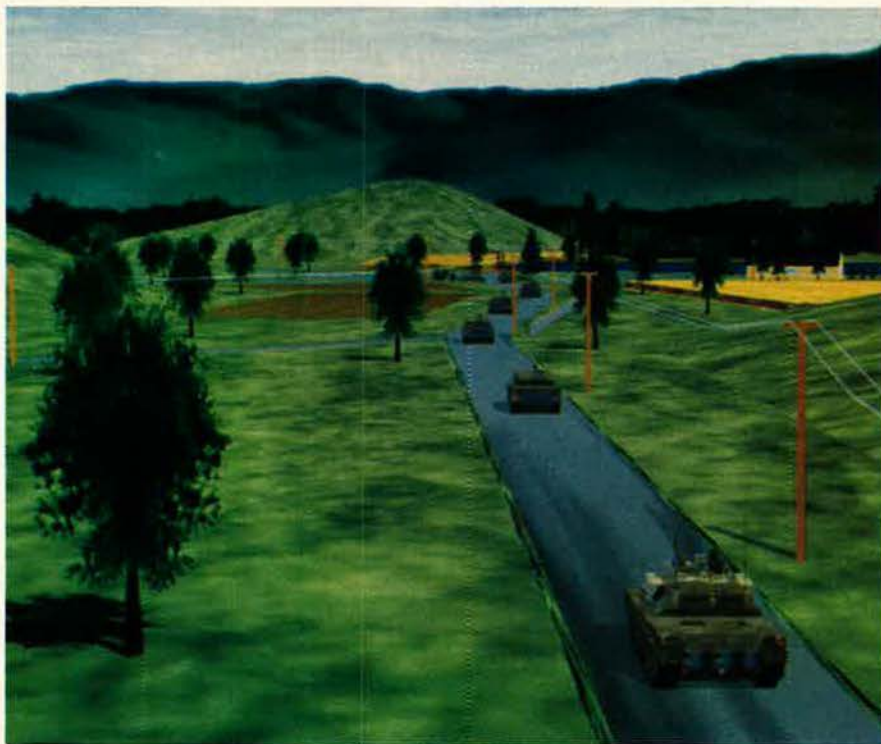
"Simnet is like the National Training Center [the Army's major field exercise site at Fort Irwin, Calif.] or Red Flag [the Air Force exercises at Nellis AFB, Nev.] in a laboratory," Colonel Thorpe says. But

there is a difference: In this electronic world, participants can do things they'd never dare to do in the real world.

The infantry can call in artillery support close to their positions. At Fort Irwin this distance is limited to one kilometer; in combat conditions it is 100 meters. The CAS pilots can learn how to dodge surface-to-air missiles (SAMs). Perhaps best of all, tanks don't cause traffic jams or tear up farmers' fields. This has been a problem in past Reforger exercises in West Germany, and the growing mood of pacifism there could seriously impair future readiness exercises.

Colonel Thorpe, holder of a Ph.D. in industrial psychology from Bowling Green State University, Ohio, first tackled the simulation problem in 1978, when he was a captain assigned to the Air Force Office of Scientific Research. At first, the idea was to examine what simulators could do that couldn't be done in aircraft. USAF was understandably cool to the idea because it threatened to reduce flying hours. "No wonder people hated us," recalls Colonel Thorpe.

But he persisted and expanded the scope of his studies to include



A networked warrior's view of the planet Simnet: An anonymous low-level NOE (nap-of-the-earth) scene is displayed in the early stage of a battle. The GE Compu-Scene® IV Visual Simulation System can depict terrain identical to anyplace on planet Earth, from Fort Knox to Red Square.

the Army after he was assigned to DARPA in 1981. Although today Colonel Thorpe customarily wears his Air Force fatigues and mirror-bright combat boots in a building where the civilians wear suits and officers wear dress uniforms, he confesses that at first he wasn't sure what an Army battalion was. (It typically comprises a headquarters company and four infantry companies or four artillery batteries, totaling about 700 soldiers.)

By January 1985, DARPA had built a plywood mockup tank simulator, but it was based on a canned, seven-minute videotape scenario and was by no means an interactive system. By October 1985, Colonel Thorpe's group was able to display a full simulator with crude interactive graphics at the annual Association of the US Army convention, and the program took off. The first two pre-production units were installed at Fort Knox in May 1986, and the tankers began serious training in tactics.

Sweeping the Competition

What put Simnet on the map was its success in preparing US teams for the Canadian Army Trophy competition in June of 1987. This is the top contest among NATO armored units, and the United States had suffered a string of embarrassingly poor finishes. That spring, US entrants used Simnet to recreate the Grafenwoehr range, going on to sweep the competition. One M1 platoon from the 8th Armored Cavalry achieved a record score among twenty-four participating platoons, and another finished third. "That got everybody's attention," Colonel Thorpe notes.

An early application of Simnet came in the Army's source selection from among two competitors for the Forward Area Air Defense System/Line of Sight-Heavy (FAADS/LOS-H) system. Trials were held at the artillery school at Fort Sill, Okla. "They needed somebody to shoot at," Colonel Thorpe says, so Simnet was expanded to include generic fixed- and rotary-wing CAS aircraft. Almost by default, this put Simnet in the thick of the Army's AirLand Battle concept of combined arms.

Today the system has been expanded throughout Army sites in



Simnet uses BBN's real-time computer image generation system to simulate the view from many types of vehicles. Using depth buffers, the computer stores data relating to factors such as perspective and speed and adjusts them to produce appropriate visual images. Here, a helicopter simulation is being developed.

CONUS and West Germany, but the principal installation is at the armored school at Fort Knox. It can train an entire battalion at a time. Expecting that Simnet will soon move from development to operational use, the Army's program manager for training devices (PM-TRADE) is circulating a draft request for proposals aimed at an initial procurement next year.

Colonel Thorpe estimates that the Army itself might want to procure as many as 5,000 of the \$250,000-per-copy workstations, making it a potential billion-dollar program.

Colonel Thorpe concedes that his own service has shown scant interest in Simnet, though he contends that Simnet-type systems would be valuable in training pilots for high-flying reconnaissance aircraft and special missions such as those of the E-3 Airborne Warning and Control System (AWACS). Tactical air units, he adds, could also benefit. "They may find," he says, "that artillery is their best wing man because it takes out air defense."

The Navy, meanwhile, plans to join the Army in joint exercises this fall, says Colonel Thorpe. The idea is to use Simnet to "build an ocean" useful in training those conducting

shore bombardment from ships or flying carrier aircraft on attack missions.

Some technical issues remain to be resolved. Simnet graphics are still crude, Colonel Thorpe concedes, much like looking through a dirty window or encountering bad weather. Another question concerns long-haul communications to link participants on a global basis. It would be cheaper and more efficient to train the CONUS-based and forward-deployed units together electronically rather than to move them to a single site. The question is whether performance will be degraded by the delays inherent in satellite communications. An alternative may be to use transatlantic fiber optic cables currently being installed. That, however, raises security questions.

Virtually Unbeatable Aggressors

As in all training of this type, there is the problem of the "red" aggressor forces. They do their work so often and thereby build up their warfighting expertise to such a high level that they become virtually unbeatable. It is generally agreed that training US forces in the



The "tank" simulated here may be the quarry of the "helicopter" shown in the previous photo, even though the users may be at Simnet terminals hundreds of miles apart. Besides the actions of networked "enemy" forces, users must contend with random vehicle failures and other realistic hazards.

tactics of the enemy is desirable, but what if those tactics suddenly change?

These are some of the issues that were addressed during a proof-of-principle exercise conducted last March. Fort Knox provided a battalion-sized mechanized infantry task force, and Fort Rucker furnished helicopters as the blue team. USAF joined the competition for the first time with four A-10 pilots: Maj. Frank Countryman and Capt. Mark Lampe from the 45th Tactical Fighter Squadron, Grissom AFB, Ind.; Capt. James Cobb from the 355th TFS, Myrtle Beach, S. C.; and Capt. Jeff Miller from the 23d Tactical Fighter Wing, England AFB, La. BBN personnel in Cambridge were the red team. Additional support was provided by the other Simnet associate prime contractor, Perceptronics of California.

The battlefield was a fifty-by-seventy-five-kilometer piece of terrain at Fort Knox, complete with forests, streams, hills, buildings, and roads (an "Autobahn"). The area normally is used for real training exercises. The participants sat in mockups of crew stations that provide realistic sound (but no motion) and have all controls neces-

sary for maneuvering and fighting. They communicated with each other via standard forty-channel FM radios.

As everybody fought the same battles, the intensity level escalated—and little wonder. Because there is no "reset" button on Simnet, a tank that gets hit is a tank that goes out of the competition. If an airfield is pocked, an A-10 pilot has to find another place to land. If a tank tries to cross an unfordable stream, it stays there until a simulated tow vehicle can pull it out. If it runs out of ammunition, it stops firing until another simulated vehicle resupplies it.

Random failures are built into the system to occur at the rate normally encountered in combat. A vehicle's transmission failure can put it out of operation for an hour, for example; a faulty battery or alternator can be replaced in thirty minutes.

Though active participants can see only that part of the battle observable from the windows of their vehicles (three and a half kilometers

for the ground vehicles and seven kilometers for the CAS aircraft), the DARPA monitors can unobtrusively move anywhere on the battlefield to see how everybody is doing. Colonel Thorpe calls this his electronic "magic carpet," and he can hitch it to any vehicle or even to an incoming missile. Despite the crude graphics, the observer is quickly swept into the emotion of combat. Colonel Thorpe jokes that he has increased his vocabulary of profanity in this way.

Refining Combat Skills

Each exercise is videotaped as the fighting proceeds so it can be played back later for instruction in tactics. However, this system is not intended to teach anybody how to drive a tank or fly an airplane. All the participants are expected to know the basics already; they are supposed to use Simnet to refine their combat skills. Nor is Simnet intended to replace Reforgers or Red Flags, but rather to help personnel prepare for them.

"In order to fight, we have to be able to do the things we know we will have to do on the first day of a war," Colonel Thorpe says. "But nobody, anywhere, is able to practice them." On the electronic planet of Simnet, however, warriors can practice those skills every day.

The payoff could be great. All military training, whether in the field or in DARPA's glamorous new video arcade, is aimed at countering what many view as the single greatest challenge of warfare: overcoming uncertainty. As the German military philosopher Karl von Clausewitz put it in his landmark work, *On War*: "War is the province of uncertainty: Three-fourths of those things upon which action in war must be calculated are hidden more or less in the clouds of great uncertainty."

The purpose of Simnet is to help warriors prepare to cope with that uncertainty—with a bonus for the trainees: The "dead" soldiers can go home at night, have dinner with their families, and ponder ways to survive the next time. ■

John Rhea is a free-lance writer, living in Woodstock, Va., who specializes in military technology issues and is a frequent contributor to this magazine. His most recent article for AIR FORCE Magazine, "Beyond Electronics," appeared in the June '89 issue.

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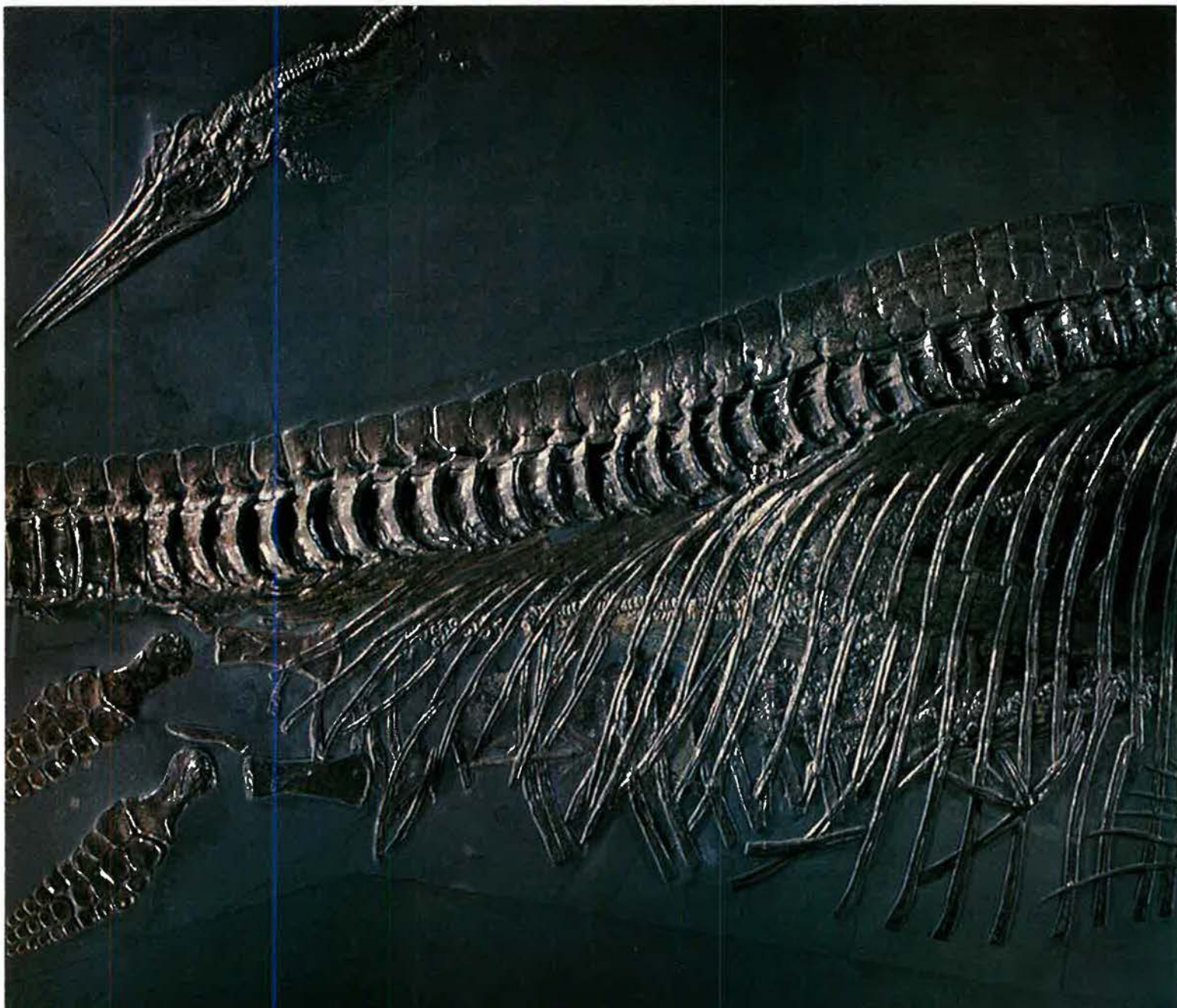
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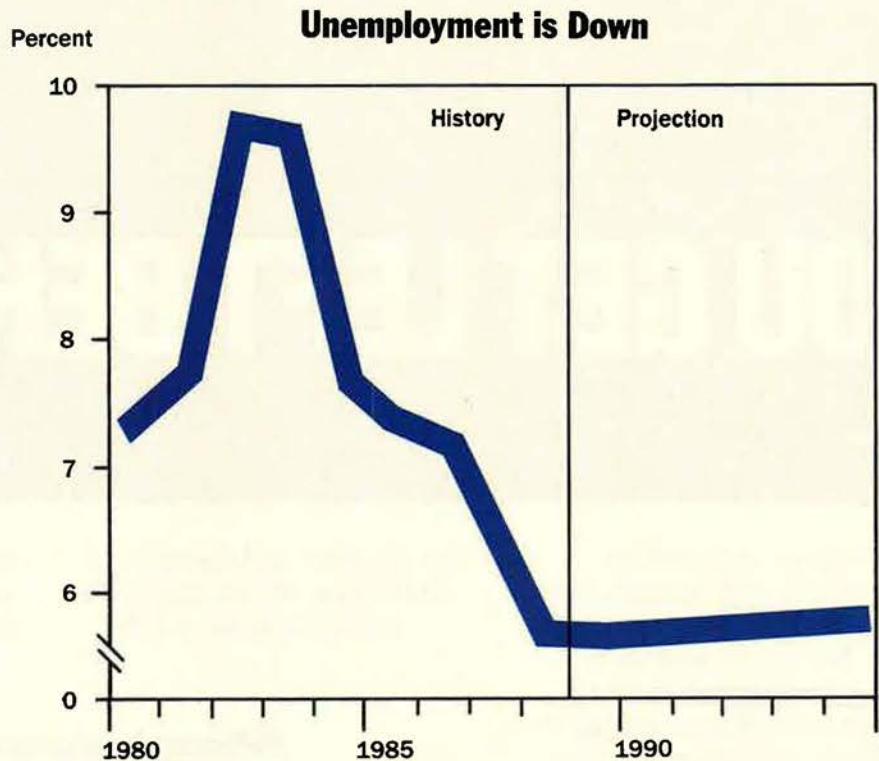
Veterans in Transition:

An Employment Supplement

Former military people are a perfect match with the needs of employers of the future.

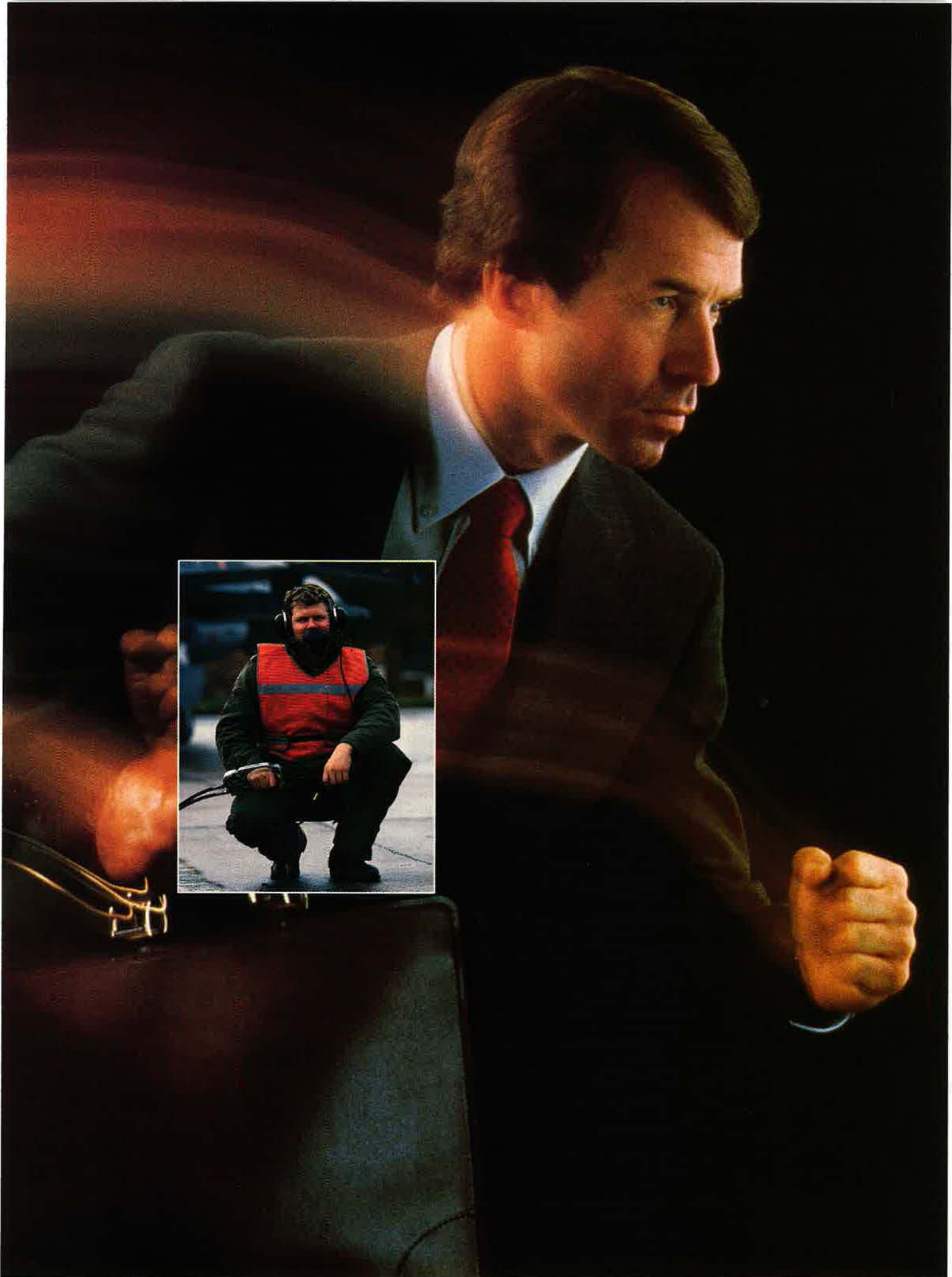
Last year, 81,843 people left the Air Force and returned to the civilian labor market. Of these, 16,464 retired after twenty or more years of service. Roughly half of the others were young people completing a single tour in the military, and half were experienced veterans who had decided, for one reason or another, to get out before reaching eligibility for retirement.

The conclusion will not be missed by alert employers that these Air Force veterans, along with their counterparts from the other services, form a resource of special value in today's tight labor market. They are trained, experienced, above average in intelligence, mature, and largely drug-free. (In 1988, the incidence of drug use by military personnel was 4.8 percent.) Moreover, as retired Lt. Gen. E. A. Chavarrie of Employment Transition Service (ETS) points out, "They have *documented* job skills that the ordinary worker may not have or cannot always demonstrate."



Last year, the unemployment rate fell to its lowest level since 1974. It is expected to remain low in the 1990s as the rate of US population growth slows.

Source: Congressional Budget Office.



Given its choice, the Air Force would not be losing some of these veterans. The departure of pilots for airline jobs, for example, is a serious problem. So is the loss of engineers and others in fields of technical specialty.

In most cases, however, the separations are in reasonable accord with Air Force plans. For reasons ranging from cost to grade structure, the intention is for some members to leave service after an initial tour while others remain in the career force and move up to senior supervisory positions. Even the full careerists will retire in the normal course of events.

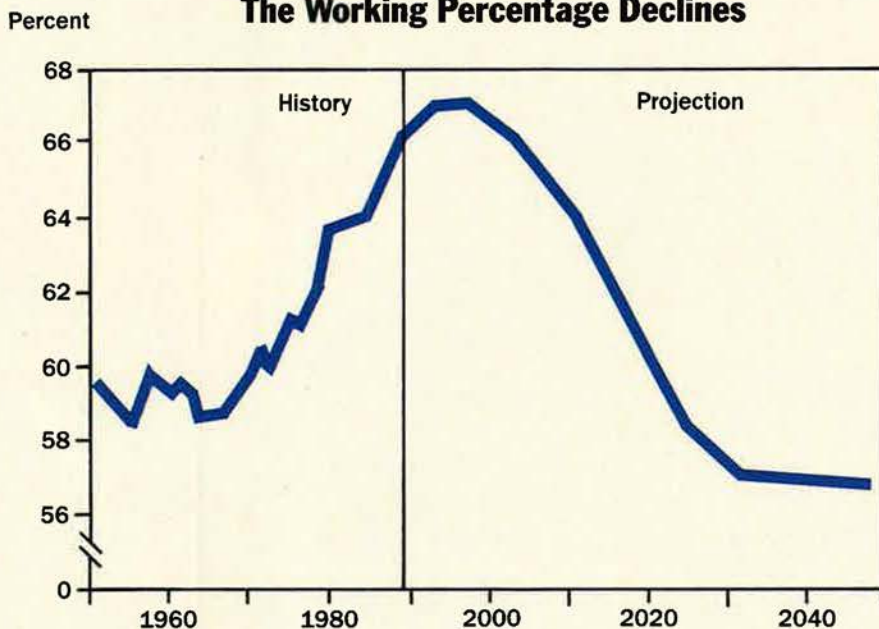
As the work force shrinks in relation to the requirement for workers between now and the year 2000, the training and experience of these veterans will be of particular importance to the nation's economy.

In 1988, the unemployment rate in the United States dropped to its lowest level in fourteen years. The number of people holding jobs increased by 2,400,000, while those entering the work force numbered only 1,800,000. As *Business Week* observed, "The American job machine is hitting on all cylinders."

The tightness of the labor market, however, is not a matter of numbers alone. The demand is greatest for workers with the ability to perform in complex, increasingly technical jobs. Such people are in short supply. Employers report difficulty in filling entry-level jobs because they cannot attract enough young applicants who have the basic qualifying skills.

"Over the next five years, the American Express Co. will be hiring a minimum of 75,000 people. That's the good news," says American Express President Louis V. Gerstner, Jr. "The bad news is that we may not be able to find them."

The Working Percentage Declines

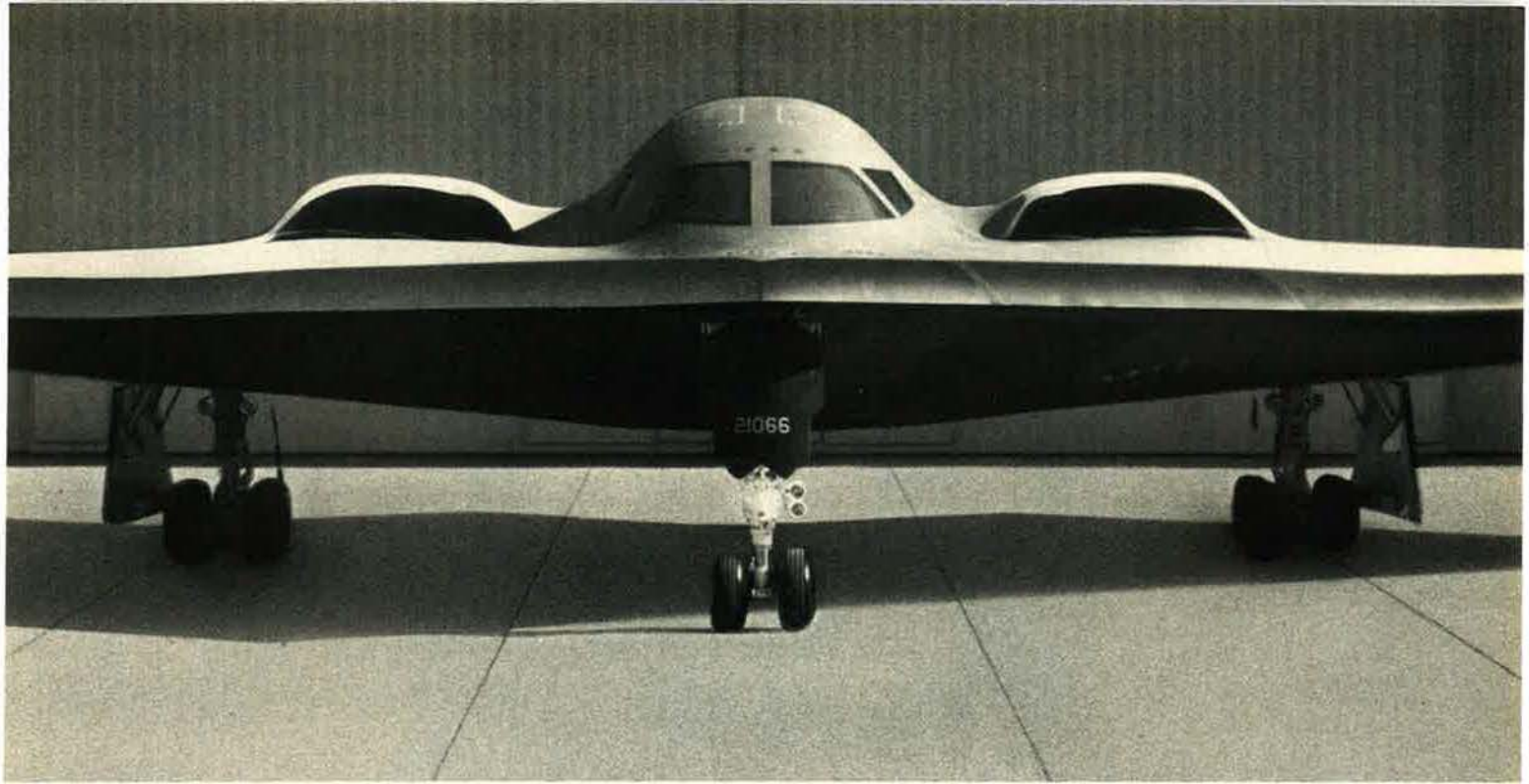


About two-thirds of the adult population today is in the labor force, but that percentage is on the brink of a long-term decline. This will put great pressure on the economy. Among other consequences, it will make critical the supply of skilled workers capable of high productivity.

Source: Congressional Budget Office.



The demand is greatest for workers with the ability to perform in complex, increasingly technical jobs.



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The trend is projected to intensify in the years ahead as the postwar baby-boom generation ages, growth in the labor force slows down, and the share of jobs that require education, training, or special ability increases.

As *US News & World Report* said in a 1988 analysis, "robots are now doing the painting in car factories. Companies need highly skilled workers to install and repair robots and fewer semiskilled people to paint cars."

In a Hudson Institute study on work and workers for the twenty-first century, William B. Johnston and Arnold H. Packer note that the nation is headed for "both higher and lower unemployment: more joblessness among the least skilled and less among the most educationally advantaged."

Air Force veterans are an excellent match with the needs of the future. They were initially chosen from among the best and brightest of their generation, and during their service, they built on their abilities.

The quality begins at the recruiting office door. Only thirty-two out of every 100 serious applicants can meet the mental and physical standards to enter the Air Force. A high percentage of them will subsequently receive technical training. After that, they perform their duties in an environment where technology and complexity are constants and in which getting the job done right can literally mean the difference between life and death.

Virtually all airmen are high school graduates, and Air Force officers are college graduates. More than half of the enlisted members have some college credit. Forty-four percent of the officers have master's or doctoral degrees. They will have learned management and leadership, both on the job and in the formal classrooms of Professional Military Education (PME).

"Military people bring a wealth of skills and experience to the workplace," General Chavarrie says. "They not only have a basic ability to perform a task or series of tasks, but they have developed a good range of peripheral skills as well. These include leadership of people, management of assets, problem-solving, communications and physical security, development and execution of budgets, and administrative and other experiences.

"The majority of employers we deal with seem to feel that military people are a good bet as employees. They have clean backgrounds, they will show up for work, and they are eager to learn and advance. A recent survey we conducted indicates that a large number of companies value military-trained workers because of character and integrity." One company responding to the survey said that military veterans have "desire, drive, determination, and dedication that can't be found in any other group."



After military people receive technical training, they perform in an environment where technology and complexity are everyday constants.

— Photo by Paul Kennedy



Workforce 2000

The turn of the century will see a labor force that is older and better educated, with higher percentages of women and minorities.

A Middle-Aged Work Force

Age of Worker	Percent of all workers in:		
	1972	1986	2000
16-24	23	20	16
25-54	60	67	73
55 and over	17	13	11

The young and the old will be smaller percentages of the labor force. Lower birth rates of the past twenty years limit the number of younger workers. Declining participation in the labor force by older persons offset the increase of their numbers in the population.

Source: Labor Department

In a broad effort called "Workforce 2000," the US Department of Labor has been sharpening its forecast of how the world of work will be transformed over the next ten years. The turn of the century will see a labor force that is older than today's and consists of a smaller percentage of the population.

Technical knowledge and training will become more important. Machines will take over some lower-level jobs now performed by humans. Employment will stagnate or dwindle for many occupations in which little formal education is required. Demand will be intense for workers with top qualifications.

Three broad occupational groups (executive, administrative, and managerial workers; professional workers; and technicians and related support workers) that accounted for twenty-

five percent of total employment in 1986 will account for almost forty percent of the job growth between now and 2000.

Labor Department analysts and independent researchers see five major trends developing.

■ **A Tight Labor Market.** Between 1986 and 2000, the work force will increase by eighteen percent, or about the rate of growth from 1972 to 1986. The number of new workers will roughly equal the number of new jobs. The outlook is for unemployment rates, currently the lowest in years, to remain low.

■ **Age of Workers.** The pool of younger workers will decline. By the turn of the century, the median age of the population will be thirty-six, older than at any earlier time in the nation's history. The average worker will be thirty-nine years old, compared to thirty-six today. Contrary to

Where the Jobs Will Be

Occupational Group	Number of Jobs in 2000 (millions)	Percent Gain: 1986-2000
Managerial, management-related	13.6	29
Engineers, architects, and surveyors	2.1	32
Natural, computer, and math scientists	1.1	46
Teachers, librarians, and counselors	5.7	16
Health professions	3.7	42
Other professional specialties	4.7	26
Technicians and technical assistants	5.1	38
Marketing and sales	16.3	30
Administrative support/clerical	22.1	11
Service occupations	22.9	31
Agriculture and forestry	3.4	-5
Mechanics and installers	5.4	15
Construction	4.7	18
Production occupations	12.3	0
Transportation and material moving	5.3	10
Helpers and laborers	4.5	6

Lower-than-average rate of growth does not automatically make an occupation a bad bet for a job-seeker. Administrative support, for example, will be a relatively slow-growing field, but it will employ 22,100,000 people in 2000.

Source: Labor Department

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The extraordinary Caracol at Chichen Itza was built around A.D. 800 by the Mayas. They built this astronomical observatory — a wonder of technology for its time — to observe, record and predict the movement and changes of the stars. Today, as we look back on this impressive structure, we marvel at their vision and ability.

What prompted them to look to the heavens for answers and insights? What advancements on earth developed from their fascination with the skies above?

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BOEING

Employment Transition Service

popular belief, however, the number of older persons working in 2000 will be only slightly higher than now. This is because fewer persons over sixty-five and fewer men between the ages of fifty-five and sixty-four will participate in the work force.

■ Growth of Service Industries.

Four out of five new jobs created in the next ten years will be in service industries rather than in manufacturing. This continues a trend already in evidence. Overall, employment in manufacturing will decline by four percent by 2000, but some manufacturing industries will grow. The decline will be sharpest in those already declining—basic steel, leather goods, tobacco, some textiles, basic metal processing, and many food-processing industries—with employment gains expected in printing and publishing, pharmaceuticals, computers, plastics, and instruments. Despite the decline, manufacturing will still provide more than 18,000,000 jobs in 2000.

■ Skills and Qualifications.

The fastest-growing occupations will be in executive, managerial, professional, and technical fields requiring higher levels of education and skill. The percentage of jobs requiring more than a high school education will increase. There will still be jobs for high school graduates, although the number of jobs for which completion of high school is the predominant educational level will decrease slightly. Dropouts will have difficulty finding jobs, particularly jobs with good pay and chance for advancement.

■ Women and Minorities.

Women, minorities, and immigrants will account for eighty percent of the net additions to the labor force between now and 2000. Women, thirty-nine percent of the labor force in 1972, will be forty-seven percent by the turn of the century.

ETS is designed specifically to put veterans' documented job skills into the hands of prospective employers.

Assume that Gofast Industries wants to hire three electronics technicians, a purchasing agent, and an assistant manager for its plant in Topeka. Gofast can try the traditional methods of recruiting—or its director of human resources can turn to Employment Transition Service (ETS).

The ETS database has information compiled from the résumés of thousands of military veterans, all translated by proprietary software into a form that civilian employers can use. It will be easy for Gofast to find several promising candidates for each of its openings.

ETS was scheduled to link up on July 26 with HRIN, an on-line human-resources information service that has about 800 corporate subscribers, including most of the Fortune 500 companies. As

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—Staff photo by Guy Aceto

Women, minorities, and immigrants will account for eighty percent of the net additions to the labor force between now and the year 2000.

Veterans in Transition:

An Employment Supplement



a result, Gofast Industries will hereafter be able to access the ETS database directly, or it can go through the HRIN service.

It's an excellent arrangement for both the employer and the job-seeking veteran. Although ETS is a relatively new company, it has been adding names and résumés to its database at the rate of 800 to 1,000 a month. After reviewing the ETS program last year, the Air Force Association decided to offer the service as a benefit to its members. ETS is available, at no charge, to veterans and their dependents.

The Chairman of the Board of ETS is Lt. Gen. Edgar A. Chavarrie, Deputy Assistant Secretary of Defense for Military Personnel and Force Management before he retired from the Air Force two years ago. He believed that most men and women retiring or separating from military service have training, skills, education, and attributes that are in demand by private industry. He wanted to put their credentials in front of as many prospective employers as possible, quickly and at no cost to the individual.

The problem facing ETS was how to serve up a résumé that matches the client's requirements. This is especially complicated for veterans, since private-sector skills are not always apparent from military occupational specialties and assignment histories.

Building on work by the Departments of Labor and Defense to link military specialties with civilian job classifications, ETS created special computer software to perform the matchup. As a result, users of the ETS database can begin with civilian job titles and search out corresponding military specialties of skill sets. The software also allows the user to start with a military specialty and work to the civilian job classification.



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Veterans in Transition:

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Some specialties, such as computer programming, translate directly to civilian jobs. Others, such as the administrative career field, fit a variety of occupations. Certain military specialties have no counterpart in the civilian world, but veterans who served in those fields may be well-suited to a number of other civilian pursuits.

It turns out, for example, that former E-8s from combat arms can make good employees in jobs that require initiative, leadership, teamwork, and integrity, General Chavarrie says. They can do well in sales positions, for example. Sometimes direct knowledge of a specific job is not at the top of an employer's list of criteria. The company may be looking for personal attributes and be willing to train the employee in the specifics of the job.

In a recent instance, a bank needed managers for branches it planned to open in retail stores. It might have chosen managers from a list of candidates with experience as bank tellers. Instead, the bank decided it wanted people with proven initiative, integrity, discipline, and interpersonal skills "who knew how to deal with diverse elements of the public," General Chavarrie said. To fill that bill, the bank asked ETS for the résumés of former military E-7s, E-8s, and E-9s.



—Staff photo by Guy Aceto



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For further information about ETS, write to Employment Transition Service, % the Air Force Association, 1501 Lee Highway, Arlington, Va. 22209-1198.

The company may be looking for personal attributes and may be willing to train the employee in the specifics of the job.

Perspectives on the Job Search

Your résumé is a marketing document. It is not an application for employment.

The newcomer to the job market will have dozens of questions—and nearly as many well-meaning coaches eager to volunteer their advice. Books on employment and résumé-writing guides are available at the local library. The approach suggested by each will be a little different from the last. In the end, the individual job-seeker will have to decide what seems to make the best sense in his or her own case.

Lt. Gen. E. A. Chavarrie of ETS

works the veterans' job market every day and talks regularly with counselors and corporate recruiters. Here are some of the views he has reached.

■ **Résumés.** "The main purpose of a résumé is to get an interview," General Chavarrie says. "It lets potential employers know that an individual is available for work. Once the interview is obtained, the résumé has less purpose, and the job-seeker begins to rely on personality to get the

position." As one corporate recruiter puts it, "the résumé is a marketing document. It's not an employment application."

A résumé, General Chavarrie says, "should focus on a specific field or position. It should be written in the language of that profession. People don't get hired for what they think they can do in the future. They get hired for what they have done—recently. If an individual wants to work as a brain surgeon, then he should focus on his brain surgery experience and not on some other background he may have."

If you want to pursue job opportunities in three career fields, then prepare three résumés. A generalist risks looking like a jack-of-all-trades and master of none.

■ "Civilianizing" Yourself.

"Remove the uniform mentally as well as physically when you go out the gate for the last time," General Chavarrie says. Such terms as "DCS/Ops." or "NCOIC" will not be understood by most prospective employers. It's possible, of course, to carry this to negative lengths. If you try to obscure the fact that your background is in military service, you will be forfeiting what may be one of your greatest strengths in the job market.

■ **Schedule.** "It is estimated that the average midlevel manager in America takes approximately 3.2 months to find a new position after leaving the old one," General Chavarrie says. The military veteran who expects to find a great job in a week is likely to be disappointed.

A realistic timetable might go something like this. Nine months from separation: Begin researching the marketplace, setting goals, and developing a résumé. Six months: Finish the résumé, intensify market research (including salary expectations), and study available publications

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for job vacancies. Four months: The job search begins in earnest, with responses to employment advertising, mailing of letters, if appropriate, and contact with persons, companies, or associations that will be able to help you.

"Many companies will not respond or be very interested until an individual is within thirty days of availability," General Chavarrie says, but he also adds that there are exceptions.

■ **Salary.** What kind of salary should you seek? Should you think of your retirement pay as a factor in the level of salary you will accept?

"An employee should be paid according to the median for his or her skill in a particular marketplace," General Chavarrie says. "Receipt of retired pay may help you select a job with a lot less pressure and responsibility, but it has no bearing on what an individual should be paid. A switchboard operator in Detroit makes \$292 per week, and the same person in Corpus Christi makes \$172.50 per week, regardless of any other income or assets."

■ **Plan, Research, and Market.** "Establish your goals early," General Chavarrie says. "What is most important to you? Money,

location, or job?" Answering that question is a big step toward finding the kind of job you really want.

Then, General Chavarrie says, "research, research, research." Study the industry of your interest and companies in that industry. Find out how much you are likely to be worth. Identify companies that need the skills you have to offer.

"Develop a marketing plan and think of yourself as a product," General Chavarrie says. "Above all, be positive and don't get discouraged. It takes time to find those really meaningful positions that offer career potential."

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How People Find Jobs

The approaches include direct application to employers, referrals, response to advertising, help from employment agencies, and job fairs.

About 30,000,000 people a year find new jobs in the United States, according to an analysis done recently for Employment Transition Service (ETS). Some of them will be hired two or three times during the year, raising the annual job placement total to about 45,000,000.

More than sixty percent of the successful job-seekers will find their positions either through direct application or contact with the employer or as the result of referrals from acquaintances,

friends, or relatives. Another twenty to twenty-five percent will find their jobs through advertising. Between fifteen and twenty percent will be placed by a public or private employment agency.

Former military people, the ETS analysis said, take the same approach to job-hunting that the general population does, but veterans are more likely than the average applicant to gain employment through direct contact, referral, or response to advertising.



—Staff photo by Guy Aceto

In job-hunting, former military people are more likely than the average applicant to gain employment through direct contact or referral.

Veterans in Transition:

An Employment Supplement



Public employment services, run by the states with support from the federal government, make around 5,000,000 placements a year. These, however, tend to be for low-paying, entry-level jobs. Only nine percent of them are in professional, managerial, or technical fields. In any given area, eighty percent of the jobs available may not be listed with the public employment service. About five percent of the people separating from military service find work through these offices.

Private employment agencies place another 5,000,000 applicants, about twenty-five percent of the job seekers who come to them, the ETS report says. Many of these agencies work the upper end of the job market. Most of them operate on fees—usually a percentage of the applicant's salary—paid by the employer.

Other avenues to employment include clearinghouses and job fairs. The Retired Officers Association (TROA), for example, places about 2,500 veterans a year by matching applicants and jobs in its computerized data bank. TROA's popular booklet, "Marketing Yourself for a Second Career," is free to members and for sale at \$2 to nonmembers.

The Non-Commissioned Officers Association (NCOA) conducts twenty job fairs a year as part of its veterans employment assistance program. Its services are available to all military veterans, regardless of the grade in which they served. Like the Air Force Association, NCOA participates in the Employment Transition Service (ETS), which is described in detail elsewhere in this supplement.

Best advice: Explore all of these approaches. Even if a technique works in only one percent of the successful placements, that means it will lead to landing a job in 450,000 instances a year. ■

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SPACEFLIGHT

BY JEFFREY P. RHODES, AERONAUTICS EDITOR

Date	Mission	Booster/Vehicle(s)	Crew
May 5, 1961	Mercury 3	Redstone/ <i>Freedom 7</i>	Cmdr. Alan B. Shepard, Jr., USN
July 21, 1961	Mercury 4	Redstone/ <i>Liberty Bell 7</i>	Capt. Virgil I. "Gus" Grissom, USAF
Feb. 20, 1962	Mercury 6	Atlas/ <i>Friendship 7</i>	Lt. Col. John H. Glenn, Jr., USMC
May 24, 1962	Mercury 7	Atlas/ <i>Aurora 7</i>	Lt. Cmdr. M. Scott Carpenter, USN
Oct. 3, 1962	Mercury 8	Atlas/ <i>Sigma 7</i>	Cmdr. Walter M. "Wally" Schirra, Jr., USN
May 15–16, 1963	Mercury 9	Atlas/ <i>Faith 7</i>	Maj. L. Gordon Cooper, Jr., USAF
March 23, 1965	Gemini 3	Titan II/ <i>Molly Brown</i> (unofficial)	Maj. Virgil I. "Gus" Grissom, USAF Lt. Cmdr. John W. Young, USN
June 3–7, 1965	Gemini 4	Titan II	Maj. James A. McDivitt, USAF Maj. Edward H. White II, USAF
Aug. 21–29, 1965	Gemini 5	Titan II	Lt. Col. L. Gordon Cooper, Jr., USAF Lt. Cmdr. Charles "Pete" Conrad, Jr., USN
Dec. 4–18, 1965	Gemini 7	Titan II	Lt. Col. Frank Borman, USAF Lt. Cmdr. James A. Lovell, Jr., USN
Dec. 15–16, 1965	Gemini 6A	Titan II	Capt. Walter M. "Wally" Schirra, Jr., USN Maj. Thomas P. Stafford, Jr., USAF
March 16, 1966	Gemini 8	Titan II	Neil A. Armstrong Maj. David R. Scott, USAF
June 3–6, 1966	Gemini 9A	Titan II	Lt. Col. Thomas P. Stafford, Jr., USAF Lt. Cmdr. Eugene A. Cernan, USN
July 18–21, 1966	Gemini 10	Titan II	Cmdr. John W. Young, USN Maj. Michael Collins, USAF
Sept. 12–15, 1966	Gemini 11	Titan II	Cmdr. Charles "Pete" Conrad, Jr., USN Lt. Cmdr. Richard F. Gordon, Jr., USN
Nov. 11–15, 1966	Gemini 12	Titan II	Cmdr. James A. Lovell, Jr., USN Maj. Edwin E. "Buzz" Aldrin, Jr., USAF
Oct. 11–22, 1968	Apollo 7	Saturn 1B	Capt. Walter M. "Wally" Schirra, Jr., USN Maj. Donn F. Eisele, USAF R. Walter Cunningham
Dec. 21–27, 1968	Apollo 8	Saturn V	Col. Frank Borman, USAF Capt. James A. Lovell, Jr., USN Maj. William A. Anders
March 3–13, 1969	Apollo 9	Saturn V/ <i>Gumdrop</i> (CM) <i>Spider</i> (LM)	Col. James A. McDivitt, USAF Col. David R. Scott, USAF (CMP) Russell L. "Rusty" Schweickart (LMP)
May 18–26, 1969	Apollo 10	Saturn V/ <i>Charlie Brown</i> (CM) <i>Snoopy</i> (LM)	Col. Thomas P. Stafford, Jr., USAF Cmdr. John W. Young, USN (CMP) Cmdr. Eugene A. Cernan, USN (LMP)
July 16–24, 1969	Apollo 11	Saturn V/ <i>Columbia</i> (CM); <i>Eagle</i> (LM)	Neil A. Armstrong Lt. Col. Michael Collins, USAF (CMP) Col. Edwin E. "Buzz" Aldrin, Jr., USAF (LMP)
Nov. 14–24, 1969	Apollo 12	Saturn V/ <i>Yankee Clipper</i> (CM) <i>Intrepid</i> (LM)	Cmdr. Charles "Pete" Conrad, Jr., USN Cmdr. Richard F. Gordon, Jr., USN (CMP) Cmdr. Alan L. Bean, USN (LMP)

Note: CM = Command Module
LM = Lunar Module
CMP = Command Module Pilot
LMP = Lunar Module Pilot

Highlight of all the US space activities was the landing on the moon in July 1969. Shown here in a picture taken by the camera mounted in the Lunar Module are Astronauts Neil A. Armstrong (left) and Edwin E. "Buzz" Aldrin planting the US flag on the moon's surface during the Apollo 11 mission.



Date	Mission	Booster/Vehicle(s)	Crew
April 11-17, 1970	Apollo 13	Saturn V/Odyssey (CM) Aquarius (LM)	Capt. James A. Lovell, Jr., USN John L. "Jack" Swigert, Jr. (CMP) Fred W. Haise, Jr. (LMP)
Jan. 31-Feb. 9, 1971	Apollo 14	Saturn V/Kitty Hawk (CM) Antares (LM)	Capt. Alan B. Shepard, Jr., USN Maj. Stuart A. Roosa, USAF (CMP) Cmdr. Edgar D. Mitchell, USN (LMP)
July 26-Aug. 7, 1971	Apollo 15	Saturn V/Endeavor (CM) Falcon (LM)	Col. David R. Scott, USAF Maj. Alfred M. Worden, USAF (CMP) Lt. Col. James B. Irwin, USAF (LMP)
April 16-27, 1972	Apollo 16	Saturn V/Caspar (CM) Orion (LM)	Capt. John W. Young, USN Lt. Cmdr. Thomas K. Mattingly, USN (CMP) Lt. Col. Charles M. Duke, Jr., USAF (LMP)
Dec. 7-19, 1972	Apollo 17	Saturn V/America (CM) Challenger (LM)	Capt. Eugene A. Cernan, USN Cmdr. Ronald E. Evans, USN (CMP) Dr. Harrison H. "Jack" Schmitt (LMP)
May 25-June 22, 1973	Skylab 2	Saturn 1B	Capt. Charles "Pete" Conrad, Jr., USN Cmdr. Joseph P. Kerwin, USN Cmdr. Paul J. Weitz, USN
July 28-Sept. 25, 1973	Skylab 3	Saturn 1B	Capt. Alan L. Bean, USN Owen K. Garriott Maj. Jack R. Lousma, USMC
Nov. 16, 1973-Feb. 8, 1974	Skylab 4	Saturn 1B	Lt. Col. Gerald P. Carr, USMC Edward G. Gibson Lt. Col. William R. Pogue, USAF
July 15-24, 1975	Apollo-Soyuz Test Project	Saturn 1B	Brig. Gen. Thomas P. Stafford, Jr., USAF Vance D. Brand Donald K. "Deke" Slayton
April 12-14, 1981	STS-1	Columbia (OV-102)	John W. Young Capt. Robert L. Crippen, USN
Nov. 12-14, 1981	STS-2	Columbia	Col. Joseph H. Engle, USAF Capt. Richard H. Truly, USN
March 22-30, 1982	STS-3	Columbia	Col. Jack R. Lousma, USMC Col. C. Gordon Fullerton, USAF
June 27-July 4, 1982	STS-4	Columbia	Capt. Thomas K. Mattingly, USN Henry W. "Hank" Hartsfield, Jr.
Nov. 11-16, 1982	STS-5	Columbia	Vance D. Brand Col. Robert F. Overmyer, USMC Dr. William B. Lenoir Dr. Joseph P. Allen
April 4-9, 1983	STS-6	Challenger (OV-99)	Paul J. Weitz Col. Karol J. Bobko, USAF Dr. F. Story Musgrave Donald H. Peterson
June 18-24, 1983	STS-7	Challenger	Capt. Robert L. Crippen, USN Capt. Frederick "Rick" Hauck, USN Col. John M. Fabian, USAF Dr. Sally K. Ride Dr. Norman E. Thagard

<i>Date</i>	<i>Mission</i>	<i>Booster/Vehicle(s)</i>	<i>Crew</i>
Aug. 30–Sept. 5, 1983	STS-8	<i>Challenger</i>	Capt. Richard H. Truly, USN Cmdr. Daniel C. Brandenstein, USN Lt. Cmdr. Dale A. Gardner, USN Lt. Col. Guion S. Bluford, USAF Dr. William E. Thornton
Nov. 28–Dec. 8, 1983	STS-9 (41-A)	<i>Columbia</i>	John W. Young Maj. Brewster H. Shaw, Jr., USAF Owen K. Garriott Dr. Robert A. R. Parker Dr. Byron K. Lichtenberg Dr. Ulf Merbold
Feb. 3–11, 1984	41-B	<i>Challenger</i>	Vance D. Brand Lt. Cmdr. Robert L. "Hooch" Gibson, USN Capt. Bruce McCandless II, USN Dr. Ronald E. McNair Lt. Col. Robert L. Stewart, USA
April 6–13, 1984	41-C	<i>Challenger</i>	Capt. Robert L. Crippen, USN F. Richard "Dick" Scobee Terry J. "T. J." Hart Dr. George D. "Pinkie" Nelson Dr. James D. A. "Ox" van Hoften
Aug. 30–Sept. 5, 1984	41-D	<i>Discovery (OV-103)</i>	Henry W. "Hank" Hartsfield, Jr. Cmdr. Michael L. Coats, USN Dr. Steven A. Hawley Dr. Judith A. Resnik Lt. Col. R. Michael Mullane, USAF Charles D. Walker
Oct. 5–13, 1984	41-G	<i>Challenger</i>	Capt. Robert L. Crippen, USN Cmdr. Jon A. McBride, USN Dr. Sally K. Ride Dr. Kathryn D. Sullivan Lt. Cmdr. David C. Leestma, USN Paul Scully-Power Cmdr. Marc Garneau, CF
Nov. 8–16, 1984	51-A	<i>Discovery</i>	Cmdr. Frederick "Rick" Hauck, USN Cmdr. David M. Walker, USN Cmdr. Dale A. Gardner, USN Dr. Joseph P. Allen Dr. Anna L. Fisher
Jan. 24–27, 1985	51-C	<i>Discovery</i>	Capt. Thomas K. Mattingly, USN Lt. Col. Loren J. Shriver, USAF Lt. Col. Ellison S. Onizuka, USAF Lt. Col. James F. Buchli, JSMC Maj. Gary E. Payton, USAF
April 12–19, 1985	51-D	<i>Discovery</i>	Col. Karol J. Bobko, USAF Cmdr. Donald E. Williams, USN S. David Griggs Dr. Jeffrey A. Hoffman Dr. M. Rhea Seddon Charles D. Walker Sen. Edwin J. "Jake" Garn
April 29–May 6, 1985	51-B	<i>Challenger</i>	Col. Robert F. Overmyer, USMC Col. Frederick D. Gregory, USAF Dr. Norman E. Thagard Dr. William E. Thornton Dr. Don L. Lind Dr. Lodewijk van den Berg Dr. Taylor G. Wang
June 17–24, 1985	51-G	<i>Discovery</i>	Capt. Daniel C. Brandenstein, USN Cmdr. John O. Creighton, USN Col. John M. Fabian, USAF Dr. Shannon W. Lucid Lt. Col. Steven R. Nagel, USAF Maj. Patrick Baudry (Armée de l'Air) Prince Sultan Salman al-Saud (RSAF)
July 29–Aug. 6, 1985	51-F	<i>Challenger</i>	Col. C. Gordon Fullerton, USAF Lt. Col. Roy D. Bridges, Jr., USAF Anthony W. England Karl G. Henize Dr. F. Story Musgrave Loren W. Acton John-David Bartoe
Aug. 27–Sept. 3, 1985	51-I	<i>Discovery</i>	Col. Joseph H. Engle, USAF Lt. Col. Richard O. Covey, USAF William F. Fisher J. Michael Lounge Dr. James D. A. "Ox" van Hoften
Oct. 3–7, 1985	51-J	<i>Atlantis (OV-104)</i>	Col. Karol J. Bobko, USAF Lt. Col. Ronald J. Grabe, USMC Maj. David C. Hilmers, USMC Lt. Col. Robert L. Stewart, USA Maj. William Pailes, USAF

Date	Mission	Booster Vehicle(s)	Crew
Oct. 30–Nov. 6, 1985	61-A	<i>Challenger</i>	Henry W. "Hank" Hartsfield, Jr. Lt. Col. Steven R. Nagel, USAF Col. Guion S. Bluford, USAF Col. James F. Buchli, USMC Bonnie J. Dunbar Reinhard Furrer Ernst W. Messerschmid Wubbo Ockels
Nov. 26–Dec. 3, 1985	61-B	<i>Atlantis</i>	Lt. Col. Brewster H. Shaw, Jr., USAF Lt. Col. Bryan D. O'Connor, USMC Dr. Mary L. Cleave Lt. Col. Sherwood C. Spring, USA Maj. Jerry L. Ross, USAF Rudolfo Neri Vela Charles D. Walker
Jan. 12–18, 1986	61-C	<i>Columbia</i>	Lt. Cmdr. Robert L. "Hoot" Gibson, USN Lt. Col. Charles F. Bolden, Jr., USMC Dr. Steven A. Hawley Dr. George D. "Pinkie" Nelson Franklin R. Chang-Diaz Robert J. Cenker Rep. C. William "Bill" Nelson
Jan. 28, 1985	51-L	<i>Challenger</i> ¹	F. Richard "Dick" Scobee Cmdr. Michael J. Smith, USN Dr. Judith A. Resnik Dr. Ronald E. McNair Col. Ellison S. Onizuka, USAF Gregory B. Jarvis S. Christa McAuliffe
Sept. 29–Oct. 3, 1988	STS-26	<i>Discovery</i>	Capt. Frederick "Rick" Hauck Col. Richard O. Covey, USAF Dr. George D. "Pinkie" Nelson Lt. Col. David C. Hilmers, USMC J. Michael Lounge
Dec. 26, 1988	STS-27	<i>Atlantis</i>	Lt. Cmdr. Robert L. "Hoot" Gibson, USN Lt. Col. Guy S. Gardner, USAF Col. R. Michael Mullane, USAF Lt. Col. Jerry R. Ross, USAF Cmdr. William B. Shepherd, USN
March 13–18, 1989	STS-29	<i>Discovery</i>	Capt. Michael L. Coats, USN Col. John E. Blaha, USAF Col. James F. Buchli, USMC Col. Robert C. Springer, USMC Dr. James P. Bagian
May 4–8, 1989	STS-30	<i>Atlantis</i>	Capt. David M. Walker, USN Col. Ronald J. Grabe, USAF Dr. Norman E. Thagard Dr. Mary L. Cleave Maj. Mark C. Lee, USAF

¹Explicded 1:13 into the flight, resulting in loss of crew and vehicle.

X-15 FLIGHTS INTO SPACE¹

Date	Pilot/Agency	Speed (Mach)	Altitude (feet)
July 17, 1962	Maj. Robert M. White, USAF	5.45	314,750
Jan. 17, 1963	Joseph A. Walker, NASA	5.47	271,700
June 27, 1963	Maj. Robert A. Rushworth, USAF	4.89	265,000
July 19, 1963	Joseph A. Walker, NASA	5.50	347,900
Aug. 22, 1963	Joseph A. Walker, NASA	5.58	354,200
June 29, 1965	Capt. Joseph H. Engle, USAF	4.94	280,800
Aug. 10, 1965	Capt. Joseph H. Engle, USAF	5.20	271,300
Sept. 28, 1965	John B. McKay, NASA	5.33	295,300
Oct. 14, 1965	Capt. Joseph H. Engle, USAF	5.08	266,500
Nov. 1, 1966	William H. Dana, NASA	5.46	306,900
Oct. 17, 1967	Maj. William "Pete" Knight, USAF	5.53	280,500
Nov. 15, 1967	Maj. Michael J. Adams, USAF ²	5.20	266,000
Aug. 21, 1968	William H. Dana, NASA	4.71	264,000

¹The Air Force and NASA recognize "space" as beginning at an altitude of fifty miles. The Fédération Aéronautique Internationale's definition of space is sixty-two miles (100 km).

²Major Adams was killed when X-15 #3 (serial number 56-6672) entered a spin after reaching maximum altitude and broke apart when it reached 60,000 feet.

North American X-15 #1 (serial number 56-6670) was later redesignated X-15A and is now on display at the National Air and Space Museum in Washington, D. C. X-15 #2 (serial number 56-6671) was modified and redesignated X-15A-2. It is now on display at the US Air Force Museum in Dayton, Ohio.

He came out of the clouds, flying down a narrow valley—on course for an airfield, with just enough altitude to land on the short runway.

A Miracle at Cortez

BY HSICHUN M. HUA

"Cortez, Colo., Aug. 4, 1959—An Air Force major escaped injury shortly before midnight when his weather reconnaissance jet flamed out and he was forced to make a crash landing here. The Air Force said the pilot, Maj. H. C. Hua, glided the Lockheed U-2 to the Cortez Airport. . . . Major Hua was on a weather reconnaissance mission out of Laughlin AFB, Tex. . . ."—News item

"Major Hsi-Chon Hua, Chinese Air Force, distinguished himself by extraordinary achievement participating in aerial flight on 3 August 1959, while serving as Aircraft Commander, 4080th Strategic Reconnaissance Wing, Light."—Citation accompanying Distinguished Flying Cross

IT WAS my seventh training flight in the new, super-secret U-2 reconnaissance aircraft, and it was a night mission. Months before, I had been selected by the Nationalist Chinese Air Force (NCAF) to go to the US for training in the exotic U-2. Everything about U-2 operations was clandestine, even the pilot selection process.

We NCAF U-2 trainees had been told only that top fighter pilots were being evaluated for a new mission and that selectees would have to pass rigorous physical and English-proficiency exams. That was about all. Not until we arrived at Laughlin AFB, Tex., in April 1959 did we find out what kind of aircraft we would fly.

Training was a challenge, even for someone like myself who had flown many F-86 sorties over the Taiwan Strait during the 1958 Quemoy crisis. The small U-2 cockpit was uncomfortable, the special pressure suit was cumbersome, and preflight oxygen-breathing was taxing.

My initial flight, and that of each pilot, was conducted over the wide-open spaces of southwest Texas. Subsequent flight courses would range across the US. With a pilot required constantly to identify current position, update the flight direction, and make corrections toward the next waypoint, the typical ten-hour flight was never boring.

For my seventh mission, I was to fly to Ogden, Utah, and back, using celestial navigation. The flight began around 8:30 p.m. on a hot August night. Flying weather was good, and everything was going reasonably well.

It was my first night flight in a foreign country. I recall that, with thousands of glittering stars crowding the clear dark sky, it was difficult to find the precise celestial body needed for a navigation fix. The heating wire inside the glass faceplate of the pressure suit obscured my vision, and the cockpit light was not bright enough to allow me easily to draw the most probable position line on my map.

"Altitude Above 450"

When at last I reached Ogden, I was happy and gratified that I had been able to reach the farthest route point without getting lost. I made a 300-degree left turn, heading toward Delta, Utah. Once over Delta, I called out my position report: "Altitude above 450." Actually, I was flying above 70,000 feet, but the fictitious altitude was reported as a security precaution. That done, I concentrated once more on celestial navigation.

Suddenly, only a few minutes after I rounded Delta, the U-2's engine flamed out and died. A quick glance at my clock showed it was 0528 Zulu, or 10:28 p.m. local time.

Things got bad very quickly. When the pressure suit started to inflate, I had to pull the helmet cable down hard to keep the rubber bladder inside from choking me. Then the autopilot went out. Soon, I learned firsthand just how great was the U-2's lack of stability and control at high altitudes.

No try for an engine airstart could be attempted until the aircraft had descended below 35,000 feet. But the speed range between the stall buffet boundary and the Mach buffet boundary of the U-2 is less than twenty KIAS (knots indicated airspeed) at that altitude. I thus could not go into a rapid descent in order to ease the uncomfortable situation.

The only way that I could right the situation was to keep the aircraft gliding on course. Indeed, we had been told in ground school that many U-2s that had flamed out at high altitude had been successfully relighted at lower altitudes. I resolved not to panic.

The U-2 glided into the clouds below 40,000 feet. The air was bumpy. I struggled to keep the aircraft under control. Upon reaching 35,000 feet, I tried to relight the engine, but failed.

I thought that I must have followed an incorrect procedure, so I took the checklist out of my pocket, reviewed the airstart procedure once more, and tried again. This attempt also failed.

I tried again, using the alternate airstart procedure. It also failed.

By this time, the altimeter indicated 17,000 feet. I was really in trouble. Lurking unseen in the clouds just below, I knew, were high peaks of the Rocky Mountains, some of which rose to altitudes of more than 13,000 feet.

A Desperate Mayday

What should I do? Bail out? Under normal circumstances, that would be the proper decision. But I was still in the clouds, and was unable to see what kind of terrain stretched below. My prospects for surviving a bail-out over rough, remote mountain areas were low at best. I called out a desperate "Mayday!" to a nearby Air Force base but got no response.

God Almighty, I reckoned, would be the only one to save me now. So I prayed. I prayed aloud.

Suddenly, I was astonished at what I saw: lights on the ground at the eleven o'clock position. I had come out of the clouds to find that I was clipping along through a narrow valley, flying between tall mountains. Their sheer black walls rose and disappeared into the clouds above me. Even so, I felt a surge of relief. If there are ground lights, I calculated, there are probably people nearby, and that means that the terrain might be reasonably flat and I might be able to survive a forced landing.

I headed toward the lights. Gradually, I discerned alternating white and blue flashes, which I took to be a rotating beacon that normally identified an airfield. The altimeter showed the U-2 to be at about 7,000 feet. Bereft of information about the true elevation of the surrounding terrain, however, I had no way of knowing the actual altitude of the plane above ground. Under these circumstances, I had no alternative but to maintain an optimum glide speed and try to stay airborne until I reached the beacon.

As I drew nearer to the beacon, I saw that there were also some runway lights, meaning that I had stumbled on an airfield. How wonderful was that vision! I had enough altitude to glide across the runway and go into a 270-degree emergency landing pattern.

On final approach, I put down the U-2's landing gear and used the speed brake. The aircraft touched down fairly smoothly, but did not stay on the landing gear. The aircraft, with its belly scratching the pavement and its left wing tip striking the shoulder of the runway, went into a ground loop and came to rest in one piece.

Imagine Their Surprise

Quickly, I scrambled from the cockpit and made for the only lighted building around. Inside, I found the airport manager and a radio operator. It took me a little while to fully apprise them of the situation, using my Chinese-accented English. One can imagine their surprise at coming face to face with a Chinese pilot, wearing a pressure suit, having just flown in unannounced in the



Here's Major Hua's U-2, No. 56-6721, as it looked the morning after his emergency landing and resulting ground loop at the tiny municipal airstrip at Cortez, Colo., back in August 1959.

dead of night in an aircraft of the strangest appearance. They had never heard of a U-2. It would be nine months before the Soviet downing of Francis Gary Powers in Russian airspace was to make the name of the aircraft a household word.

As for me, I had never heard of Cortez, Colo. Not even the town, much less its airport, appeared on my map. The airport manager informed me that, due to the cost of supplying electricity, the local city council was debating whether to keep the tiny community's airport lights on at night. What's more, he told me, he and the radio operator had been preparing to close the office, douse the lights, and head home for the night.

That night, I was able to contact Laughlin AFB to report the accident. Next morning, the 4080th Strategic Reconnaissance Wing sent in a team, which dismantled the U-2 and loaded it in a C-124 transport. Inspection showed the problem had been caused by a broken fuel line, but the U-2 was otherwise in good shape. We all boarded the C-124 and flew back to Texas.

Months later, I was awarded a Distinguished Flying Cross by the US Air Force. The U-2—No. 56-6721—was modified and continued in active research and development use at Edwards AFB for many years.

Though this incident had a fortuitous ending, it was for me a solemn lesson about life. I do not believe that it was mere luck that brought me through the difficult moments. Think of the coincidences: The U-2 breaks out of the clouds in a valley, flying in the proper direction; within this valley lies the Cortez airfield, with no others around for 100 miles; the Cortez city council, against its better judgment, decides to leave the airfield lights on at night; and I had just the right altitude—no more, no less—required to land on such a short runway. For me, the conclusion to be drawn from all these "coincidences" is inescapable. My prayer was answered. ■

Hsichun M. Hua, now a lieutenant general in the Chinese Air Force, lives in Taiwan, the Republic of China. He has served in his nation's air force for more than thirty years. He was prompted to send this account of his experience to AIR FORCE Magazine after seeing, in the February '89 issue, a Bob Stevens "There I Was" cartoon depicting his narrow escape.

What Follows the Reductions?

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

Mutual Force Reductions in Europe are almost an imperative if NATO is to remain credible—but clear thinking about the future is essential, too.



Manlio Brosio, long since deceased, was NATO's Secretary General during the 1960s. An Italian diplomat by trade, Brosio was a wise and patient chairman at meetings of

the Atlantic Council and other NATO assemblies. He seemed never to tire, or even fidget, while the various representatives of that alliance of equals stated their national positions in as many words as possible.

What brought Manlio Brosio to mind were the propositions on force reductions currently occupying NATO's attention. Twenty years ago, Mr. Brosio decided, over the furious protests of certain allies, that I should head a NATO working group on Mutual and Balanced Force Reductions. It became obvious almost immediately that the working group, made up of aspiring diplomats from the NATO nations, was useful only for speechifying.

If we were to produce anything in time for the Rome meeting of foreign and defense ministers, the need for a little subterfuge was indicated. Accordingly, I borrowed a few knowledgeable military officers from the US, the UK, and West Germany, appointed as taskmaster a choleric one-armed German colonel, veteran of Stalingrad, and hid the lot at SHAPE, with the connivance of the Supreme Allied Commander.

Our working group, in the NATO tradition, debated and wrangled while the Colonel and his minions produced the first basic documents on NATO/Warsaw Pact arms reduction, a massive database. After this labor had

been presented in Rome to mixed reviews—the UK praised us, while the US implied that our work was not up to snuff—I reported to Mr. Brosio and asked to be relieved of my charge on the ground that the task was at an end. Mr. Brosio smiled and replied in his gentle way that I still had much to learn. The subject of force reductions, he said, would keep people occupied long after both of us were gone. Well, Manlio Brosio has departed this earth, and there are days when I seem to be fading fast. The force reduction business, on the other hand, is thriving, as he predicted it would be.

This time, there is a good chance that reductions actually will be negotiated. Mikhail Gorbachev's astonishing popularity in West Germany has given our forces a resemblance to the title character in *The Man Who Came to Dinner*, the central figure in a popular farce of the early 1940s. Invited for the evening, he slips on the ice outside the front door of the house he's visiting, falls and breaks his leg, and becomes a houseguest. At first, he is welcome, the object of solicitous attention, but as time goes on, the guest, an imperious fellow, becomes increasingly unwelcome.

There is no reason to believe that Germans are that anxious to rid their country of US forces. However, the German adulation of Gorbachev, coupled with growing opposition to NATO ground maneuvers and low-level flying, has created a receptive climate for reductions. Our own budget troubles are an added incentive. Unless the current Soviet image of nonaggressive reasonableness is soon replaced by the one that has sustained NATO all these years, there doubtless will be force reductions. In all honesty, it is about time, provided these reductions are accompanied by a realistic appraisal of NATO's structure, its strategy, and what must be done to make it a credible alliance for the future.

NATO is essentially a facade, de-

pendent more than ever on US strategic weapons now that the INF Treaty has removed the threat to Soviet territory of intermediate nuclear missiles. Even before the treaty, the forces and munitions needed for the conventional part of the flexible response strategy were sadly lacking. According to General Galvin, the present SACEUR, matters have not taken a turn for the better. In 1988, ten NATO nations failed to meet even three-quarters of their stated conventional defense improvements. At least one air force is down to a one-to-one ratio of pilots to aircraft.

As we look ahead, declining birth rates and austere budgets will make conventional force improvements increasingly difficult. Mutual and equitable reductions with the Warsaw Pact, then, are almost an imperative if NATO is to remain a believable guarantor against Soviet power moves.

With those reductions should come new thinking. The NATO structure, a fine facade of headquarters and flags, has little behind it. The forces are national, and decisions that affect Alliance capability are made at the national level. Mobilization of the forces allocated to NATO in time of crisis is a complicated walk through a political minefield, one that has never been attempted.

Admittedly, East-West relations are at present in a congenial state. The Chairman of the Joint Chiefs of Staff, Admiral Crowe, accompanied by the service Vice Chiefs, made a visit to Russia in June that could not have been more cordial if the Russians and we were allies. The fact remains that we are not. The USSR is our potential enemy, and we, the USSR's.

The proposed force reductions can be a good thing—and never mind that reductions may come whether they are good or not—if they are accompanied by clear thinking about the future of NATO.

It just will not do to allow the present agglomeration to wander on, unchanged, toward the year 2000. ■



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Mama Joe's Tablecloth

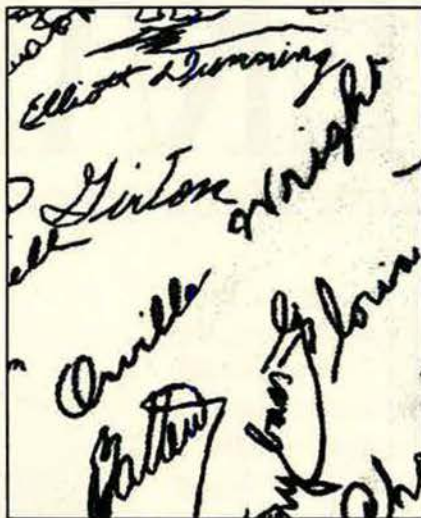
BY C. V. GLINES

AMONG the aviation memorabilia on display at the National Air and Space Museum in Washington, D. C., is a large, white tablecloth. Although it might seem out of place among the multitude of aerospace artifacts, it is in fact a priceless acquisition.

What makes this tablecloth unique and well worth preserving in the world's top aerospace museum is that it bears the signatures of more than 500 key aviation personalities. All these signatures were embroidered for posterity by Mrs. James H. Doolittle, the recently deceased wife of the legendary aviator.

The tablecloth preserves the original handwriting of Orville Wright, Eddie Rickenbacker, and many of the other "name" pioneers of aviation. At least as important, however, is the way that it helps preserve something of the spirit of the remarkable woman who created it.

Called "Joe" by all who knew her, Mrs. Doolittle was born Josephine Daniels. She was given her lifelong nickname of "Joe" by her father, who spelled it with an "e" because he had wanted a boy. In future years, she came to be known as



Like other aviators and well-known figures who dined with the Doolittles, Orville Wright signed Mrs. Doolittle's tablecloth in pencil so she could preserve his signature in embroidery.

"Mama Joe" to her adopted family, Doolittle's Tokyo Raiders.

The Doolittles were always noted for their gracious hospitality. Wherever they lived, their home was a favorite place for pilots to remain overnight, relax, and sample Joe's excellent cooking. As her husband's fame grew with his ever-growing list of accomplishments, so did the number of visitors who would drop in to take potluck. Never surprised at whom Jimmy would bring home, Joe would put an additional leaf in the dining room table, set another place, and stretch whatever she had on her menu.

Joe became an expert in the use of leftovers, coming up with enough recipes to fill a cookbook. "Leftovers got to be such a problem," she once explained. "I thought something intelligent ought to be done about them." While she never had time to put the recipes into book form, she felt that all of hers should be shared as widely as possible.

Cooking might have been her specialty, but one of her hobbies during the 1930s was embroidering her tablecloth. After a meal at the Doolittle home, each guest who had not

previously done so would be asked to sign his or her name on the tablecloth in pencil. Then, whether on one of her many trips with Jimmy or while waiting for his return, Joe would carefully stitch the signatures in black thread.

A Who's Who of Aviation

Over the years, the tablecloth came to represent a Who's Who of aviation. In addition to Wright and Rickenbacker, those who signed their names included Alexander P. deSeversky, Elmer Sperry, E. M. "Matty" Laird, Henry H. "Hap" Arnold, Ruth Nichols, Laura Ingalls, Albert F. Hegenberger, John A. Macready, Walter H. Beech, St. Clair Streett, Benjamin S. Kelsey, and Frank Hawks.

Other guests were the famous German pilots Ernst Udet and Ellie Beinhorn. Three of the 1924 round-the-world flyers—Leigh Wade, Lowell Smith, and Leslie Arnold—also signed. Several Chinese names are embroidered on the tablecloth, as are those of long-time family friends such as "Hungry" Gates, "Thirsty" Gaines, "Gabby" Henshaw, and "Bromo" Selser.

The world of the Doolittles was not limited to aviation. Other signatures stitched in silk for posterity include those of writer-adventurer Lowell Thomas, comedians Olsen and Johnson, and singer Lawrence Tibbett, a man both Doolittles had known since high school days.

For all its historical interest, the tablecloth is even more reflective of the nature of the Doolittles themselves. The number of embroidered signatures provides a dramatic reminder of the open and gracious way of life that the couple pursued through seven decades of happy marriage. Warm, friendly, and hospitable, the man with the famous grin and his gracious white-haired lady touched the lives of thousands.

As Jimmy continued to reach out and widen the couple's circle of friends and acquaintances, Joe kept up correspondence at a prodigious pace. She never failed to send notes to "my shut-ins" whenever she learned of friends who were ill, had suffered bad luck, or had experienced personal tragedy. Even more remarkable, she wrote to the unfortunates every day until they were functioning again. During one

lengthy trip around the world with Jimmy, she mailed 500 cards to friends and relatives in a single day. Her messages of friendship, sympathy, and courage brightened the lives of all on whom she focused her special brand of love and encouragement. Her letters continue to be prized by all who received them.

A Revered Figure

Joe died last December 24, the Doolittles' seventy-first anniversary, and was buried in Arlington National Cemetery. Having met in high school, she and Jimmy remained sweethearts ever after.

"Mama Joe" examines the record of her dinner guests. The more than 500 signatures and sketches attest to the Doolittles' wide circle of friends and seven decades of hospitality. Not only aviators, but entertainers, writers, and just plain friends shared Mama Joe's table.



Mama Joe bore two sons and was a revered figure to her six grandchildren and fourteen great-grandchildren.

In a graveside eulogy, granddaughter Jonna Doolittle Hoppes paid Joe a tribute that reflected the sentiments of all those whose lives she inspired.

"Granny was the embodiment of goodness," she began. "She was everything that is good, everything

that is kind. She always had a smile for everyone, a kind word. She was never in so much of a hurry that she couldn't stop and say 'Hello' or 'Thank you.' She always made you feel she was glad to see you.

"She [was] . . . that special person who cooked unforgettable meals . . . and who always took the time to have those treats she knew you loved.

"She [was] . . . someone I could talk to and who could talk to me. Someone I had fun with. Someone I just enjoyed being with. We played cards, went to the theater, went to lunch, talked until dawn. . . .

"She lived a glamorous life filled with adventure and surrounded by all kinds of people. But it wasn't without its sorrows, and through those sorrows she showed her strength, her wisdom. . . . I came to depend upon her wisdom, to value her honesty, and to respect the remarkable woman she was."

Mama Joe's tablecloth is not only a lasting tribute to her friends, but her final gift to everyone. ■

C. V. Glines is a regular contributor to this magazine. A retired Air Force colonel, he is a free-lance writer, a magazine editor, and the author of numerous books. His most recent article for AIR FORCE Magazine was "The First Intercom" in the March '89 issue.

Airman's Bookshelf

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Apollo: The Race to the Moon, by Charles Murray and Catherine Bly Cox. Landing a man on the moon is quite possibly the outstanding achievement of the century. Much is known about the astronauts, but they were just the tip of the iceberg. Very little is known about the other people—the ones who manned consoles in Mission Control, assembled Saturn Vs at the Cape, or ran the space agency in Washington. This book remedies that situation in spades. The whole story of the moon landing is told—the backroom politics, the engineering feats, the arguments among the principals (there was a protracted and bitter argument about exactly how to land on the moon), and even the personal struggles faced and overcome. Simon and Schuster, New York, N. Y., 1989. 472 pages with photos, notes, and index. \$24.95.

Bent & Battered Wings Volume 2: USAAF/USAF Damaged Aircraft 1935-1957, by Larry Davis. Car wrecks fascinate most onlookers, though people don't like to admit it. In much the same way, this book about airplane wrecks is hard to put down. The photos (a number in color) show accidents, results of pilot error and mechanical failures, aircraft extensively damaged by the enemy, and even planes that were blown up to prevent them from being captured. The book shows crashes of almost every major aircraft type in all locales during World War II and in Korea. The most amazing thing is that most of the pilots and crews walked away from these mishaps. The only text is a brief introduction, but the lengthy captions for each picture give a wealth of information. The first volume covered Navy and Marine Corps crashes. Squadron/Signal Publications, Carrollton, Tex., 1989. Sixty-four pages with photos and illustrations. \$8.95.

Men From Earth, by Buzz Aldrin and Malcolm McConnell. Whereas *Apollo: The Race to the Moon* gives the view from behind the consoles, this book gives the view from in front of the camera. Buzz Aldrin is a member of the extremely select group of men who have both walked in space and on the moon, and he uses his unique perspective to great advantage. As can be expected, Aldrin describes both the Gemini 12 and Apollo 11 missions in great detail, and he also talks about his lesser-known contributions, such as orbital docking maneuvers, that were just as important. But rather than presenting just a straight autobiography, author Aldrin also talks a great deal about the space race with the Soviets, not only from a political but also from a technical standpoint. Now a consultant,

Dr. Aldrin ends the book with his opinions on where space technology is headed, and should be headed, in the next twenty years. Bantam Book, New York, N. Y., 1989. 312 pages with photos, references, notes, and index. \$19.95.

OV-1 Mohawk in Action, by Terry Love and *CH-47 Chinook in Action*, by Wayne Mutza. These latest volumes in the "In Action" series are detailed studies of two of the Army's workhorses that first gained fame in Vietnam and are still on duty today. As is typical of the series, the books are extensively illustrated, but these later volumes seem to include more unusual photos and describe each type's various versions a little better. The typographical errors that plagued some of the earlier editions are largely gone, too. The operational history of the aircraft as well as descriptions of modifications and line drawings of some of the special equipment used are included, as is the now-standard color centerspread with profile drawings of the more colorful or significant examples of the type. Squadron/Signal Publications, Carrollton, Tex., 1989. Fifty pages each with photos and illustrations. \$7.95 each.

The Stars and Stripes: World War II and the Early Years, by Ken Zumwalt. World War II has been covered in depth (and occasionally to the extreme), but only now, forty years after the momentous events happened, are some of the interesting sidelights from the period starting to emerge. This book is one of those interesting sidelights. The author started on the staff of *The Stars and Stripes* in Paris in 1944 and stayed on for six editions (as the war moved into Germany) and eleven years. Nine of those years were spent as the paper's managing editor, both as a soldier and a civilian. Though not under enemy fire, Mr. Zumwalt was often in combat—whether fighting with the censor (who had a desk in the newsroom and a seat at the staff poker table after the paper was put to bed) or fighting with the top brass over the coverage of the war. Eakin Press, Austin, Tex., 1989. 295 pages with a roster of the staffers, bibliography, photos, and index. \$16.95.

Thunder Gods: The Kamikaze Pilots Tell Their Story, by Hatsuho Naito, translated by Mayumi Ichikawa. One of the least-understood military operations ever (at least by the West) was the Japanese kamikaze missions late in World War II. The author, who helped engineer the Ohka manned bomb, combines interviews with

many of the survivors of the program (they either didn't go or were brought back) and the documented history of the period to bring this highly unusual story to print. Interestingly, the survivors of the program faced some of the same hardships and scorn on their return that the US veterans of Vietnam faced when they came home. Far from being fanatics, a majority of the pilots from the four units were resigned to their fate but did not go quietly. This is an important look at a subject that has been cloaked for a long time. Kodansha International Press, New York, N. Y., 1989. 215 pages with a list of principals, chronology, photos, and index. Foreword by James Michener. \$18.95.

The War in South Vietnam: The Years of the Offensive 1965-1968, by John Schlicht. This latest volume in the *United States Air Force in Southeast Asia* series looks at the Air Force's support of the ground war in South Vietnam when the US was moving from an advisory role to one of active involvement in the war. The book's last episode is the air campaign to relieve the US Marines under siege at Khe Sanh in early 1968. In addition to describing the close air support and airlift roles, this volume also looks at the Air Force's reconnaissance, psychological warfare (the appendix even has pictures and translations of the various psyop leaflets), defoliation, and medical evacuation. Office of Air Force History, Washington, D. C., 1988. 410 pages with photos, charts, maps, appendix, notes, glossary, bibliography, and index. \$24.00.

World and United States Aviation and Space Records, edited by Wanda Odom. This annual listing of every speed, altitude, or distance record that can be accurately measured includes every craft that can fly, and the book seems to get bigger every year. Categories such as human-powered flight, microlights, and hang gliders are now regular inclusions along with the "standards" such as landplanes, amphibians, and jet aircraft. Interestingly, most of the absolute aviation world records (maximum performance in any class) are more than ten years old, and many of the absolute space records are more than five years old. In addition to the absolute records, all of the class and subclass records are listed. Speed over a recognized route, parachuting, air racing, and aerobatic records are listed, as well as a "how-to" guide on setting a record. National Aeronautic Association, Washington, D. C., 1989. 308 pages with photos and index of pilot names. \$13.95. ■

The Saga of Barrel House Bessie

There were many crises that day on the way back from Bremen, and each time TSgt. Maurice Henry came through.

BY JOHN L. FRISBEE

BREMEN, in northwest Germany, stood high on the Eighth Air Force's target list. It was Germany's second largest port, the site of submarine pens, and the center of an industrial complex that produced aircraft, ships, trucks, ordnance, and petroleum products. With so many prime targets, it was well defended by guns and fighters. Bremen was no milk run, especially in late 1943 when there was only a handful of P-38 and P-51 long-range escort fighters.

On November 26, 1943, the Eighth launched 633 aircraft in its largest strike up to that time. The 384th Bombardment Group, commanded by Col. Dale O. Smith, was assigned targets in the Bremen area. The group had been there before. Colonel Smith (now a retired major general) led the mission on a bitterly cold day with layer after layer of heavy stratus clouds.

Among the 384th B-17s was *Barrel House Bessie*, piloted by Maj. William Gilmore. His flight engineer and top turret gunner, twenty-nine-year-old TSgt. Maurice Henry, emerged as one of the heroes of the mission. Because of conflicting reports, the exact sequence of events that befell *Bessie* and in which Maurice Henry played a key role is impossible to recount with certain accuracy, though there is agreement on Sergeant Henry's acts of heroism.

In the target area, the group encountered intense flak and from 150 to 200 enemy fighters. Short of the target, *Bessie* sustained extensive structural damage and the loss of No. 3 engine. *Bessie* was unable to keep up with the formation. Major Gilmore ordered the bombs to be jettisoned, but one, fully armed, hung up in the bomb rack. Sergeant Henry left the top turret, went into the open bomb bay at forty degrees below zero, and freed the bomb.

The fighter attacks continued, and an incendiary shell started a fire in the cockpit. Again Sergeant Henry left his turret to put out the fire, though he was almost overcome by the acrid smoke. In the interval between these events, Sergeant Henry is credited with shooting down one enemy fighter and damaging another.

Diving into the clouds for protection, *Bessie* broke out at 6,000 feet directly over the city of Emden, where she came under heavy attack by anti-aircraft guns. By this time the oxygen and electrical systems and all instruments were knocked out, a quarter of the nose shot away, the flight controls and all four engines damaged. Once over the icy waters of the North Sea with more than 200 miles between *Bessie* and her home base at Grafton Underwood, Sergeant Henry helped the pilots restart the No. 3 engine, which ran only spasmodically. Then No. 4 quit, and its propeller couldn't be feathered. Ditching was imminent. Henry made repeated trips through the open bomb bay passage to supervise the jettisoning of equipment. Finally Nos. 1 and 2 engines, which had been running erratically, failed.

The wake of a ship was sighted in the distance. Major Gilmore headed

for it with little hope of success. *Bessie*, now an oversized glider, was losing altitude too rapidly. Since the radio was out, Sergeant Henry found a Very pistol and fired flares in hopes that the ship's crew would see them.

Henry next assembled the crew in the radio compartment and prepared them for ditching about forty miles from the coast of England in rough seas. When the B-17 hit the surface, water poured in through the damaged nose and the open bomb bay, breaking *Bessie* in two just aft of the radio compartment. Henry directed the other crew members in inflating and launching an undamaged liferaft and helped those who couldn't get aboard the raft into the water. He was last to leave the sinking B-17, but only after he had searched for and found the emergency radio.

Maurice Henry was last seen plunging into the icy water, still clutching the radio. Before he could fight his way to the liferaft, he was swept away by the waves and lost. Ten minutes later an RAF rescue boat pulled one man from the water and took aboard six from the raft. Lost with Sergeant Henry were tail gunner SSgt. Albert Schamber and one of the waist gunners, SSgt. James Bucher.

TSgt. Maurice Henry was posthumously awarded the Distinguished Service Medal, second only to the Medal of Honor, for his heroism and "selfless devotion to other members of the crew." *Barrel House Bessie* didn't make it home, but that she got as far as she did with no greater loss of life was due in large part to Maurice Henry's leadership, professional competence, and heroism. "He was," said Major Gilmore, "an example to the entire crew." ■



BEECHJET FOR TTTS—THE FOR TOMORROW'S

The Air Force Tanker Transport Training System (TTTS) using the Beechjet will be able to accomplish its mission of training undergraduate pilots well into the 21st century.

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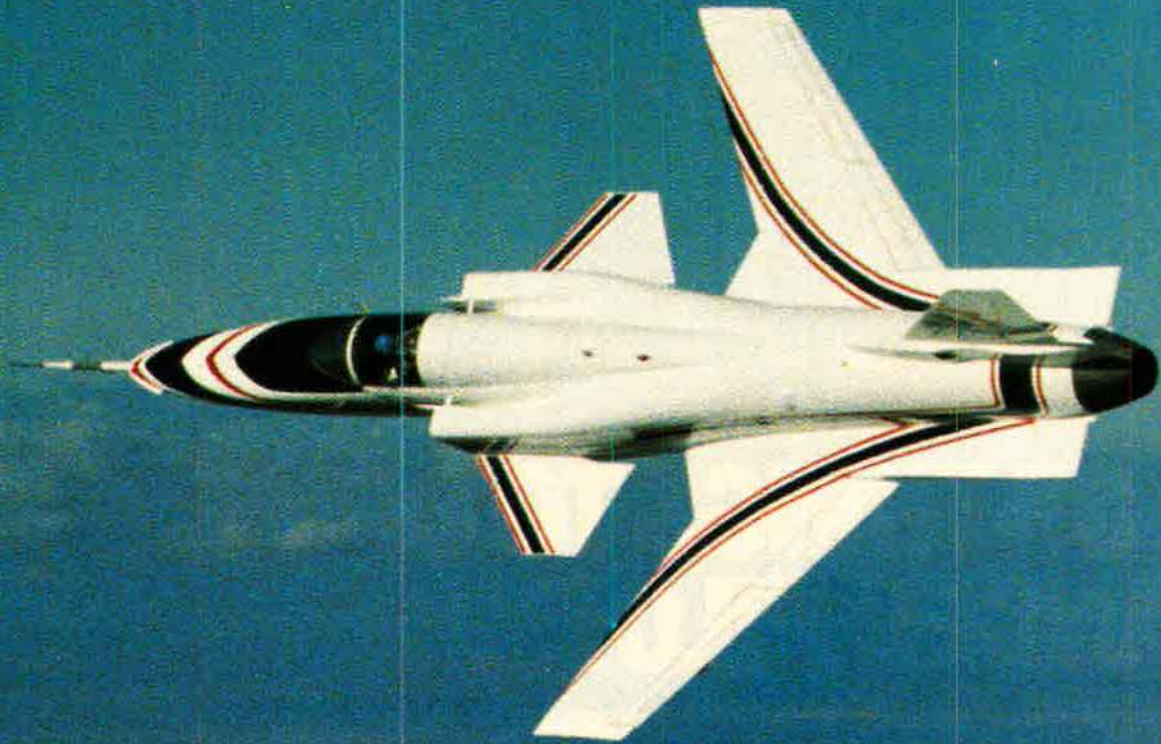
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By J. R. "Doc" McCauslin, CHIEF, FIELD ORGANIZATION DIVISION

Foothills Chapter Chartered

The Foothills Chapter, AFA's newest, was recently chartered in Hickory, N. C., with Ted H. Rhyne as president. Foothills was chartered with thirty-one members and through support of North Carolina State President Bob Newman and James E. "Red" Smith, National Vice President (Southeast Region). AFA is pleased to welcome its thirteenth chapter in the Tar Heel State, where AFA epitomizes the state motto *Esse Quam Videri* ("To be rather than to seem").

Utah's Community Partners Night

Utah State AFA held its first annual Community Partners Night at the Ogden Hotel with Maj. Gen. James W. Hopp, USAF, Commander of Ogden Air Logistics Center, Hill AFB, as guest speaker. General Hopp spoke on "Air Force Issues: Hill AFB, the Community, and AFA." Twenty-three Community Partners joined Steve



AFA National President Jack C. Price recently took part in the New York State AFA Convention in Buffalo. During the awards program, he presented the N. Y. Exceptional Service Award to National Vice President Ken Thayer (Northeast Region). Shown, left to right, are Mr. Price; National Director Bill Rapp; Mr. Thayer; and Gerald Hasler, National Director, former National President, and current New York State AFA President.



New Jersey AFA President Col. Bob Gregory, USAF (Ret.), recently presented AEF-NJ awards to outstanding AFROTC Junior and Senior Cadets during the New Jersey Institute of Technology AFROTC awards program. Shown, left to right, are Joe Capriglione, President of the Sal Capriglione Chapter; Outstanding Senior Cadet, Cadet Col. Augustin Amundarian (N.J.I.T.); Outstanding Junior Cadet, Cadet Maj. Debra Schnitzius (Seton Hall); and Colonel Gregory. Cadet Amundarian received the Col. Thomas J. Lynch Memorial Award and a \$500 grant; Cadet Schnitzius received the AFA AFROTC Medal and a \$250 grant.

Lawson, President of the Ogden Chamber of Commerce, all six Utah chapter presidents, and nearly 150 others, including Utah State AFA President Glenn Lusk, AFA National Director William "Hoot" Gibson, and AFA National President Jack C. Price. During the evening, eleven new Community Partners were signed up, bringing the Utah total to thirty-seven.

AFA and the Thunderbirds

The Air Force Thunderbirds F-16 aerial demonstration squadron draws huge crowds whenever and wherever it performs, and AFA continues to support the Thunderbirds' outstanding performances. AFA chapters will be supporting the following scheduled Thunderbird events:

August 11-13—Abbotsford, Canada; 16—Stillwater, Minn.; 19—Offutt AFB, Neb.; 20—Fargo N. D.; 26—Schenectady, N. Y.; 27—Langley AFB, Va.; and 30—Wurtsmith AFB, Mich.

September 2—Avoca, Pa.; 3-4—Cleveland, Ohio; 9—Pease AFB, N. H.; 10—Burlington, Vt.; 13—Loring AFB, Me.; 16—Griffiss AFB, N. Y.; 17—Har-



On November 19, 1988, KC-135R crews from Altus, Grand Forks, McConnell and Robins AFBs together set 16 time-to-climb records for transport-type aircraft. Beyond professional pride, the feat stands as tribute to the enhanced performance of F108 (CFM56) powered aircraft, and the expanded mission capabilities of the tanker fleet and the entire United States Air Force.

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Petrina Merritt, President of the Richard D. Kisling (Iowa) Chapter, recently presented the Cadet of the Year award to Cadet Sgt. Tom Fechter. The presentation took place at the 1989 Civil Air Patrol Southland Composite Squadron awards banquet in Sioux City, Iowa.

risburg, Pa.; 23—McConnell AFB, Kan.; 24—Sioux City, Iowa; and 30—Goodfellow AFB, Tex.

October 1—Vance AFB, Okla.; 7—Fort Huachuca, Ariz.; 8—Cannon AFB, N. M.; 14—Hammond, La.; 15—Bergstrom AFB, Tex.; 18—Laughlin AFB, Tex.; 21—Charleston AFB, S. C.; 22—Robins AFB, Ga.; 28—NAS Point Mugu, Calif.; and 29—Edwards AFB, Calif.

November 4—Patrick AFB, Fla.; 5—Tyndall AFB, Fla.; 11—March AFB, Calif.; and 12—MCAS Yuma, Ariz.

Salute to the Armed Forces

In Maryland, the Thomas W. Anthony Chapter held its 1989 "Salute to the Armed Forces" at Andrews AFB. A capacity crowd of 400 was on hand to "salute each of the armed forces and all their dedicated members. Your skill is a requisite to national survival. Your professionalism is a source of our pride. Your patriotism is a matter of honor for all." Chapter President Samuel O'Dennis and 1776th Air Base Wing Commander Col. William R. Phillips did an excellent job at the podium. The USAF Airmen of Note performed flawlessly, and chapter founder and namesake Thomas W. Anthony presented honors.

Connecticut Hears About B-2

Connecticut State AFA held its fourteenth annual State Convention in Meriden in May with a large gathering there to hear Brig. Gen. (Maj. Gen. selectee) Richard M. Scofield, USAF, speak about the B-2 bomber. General

Scofield (an AFA member for twenty-seven years) is Program Director for the B-2 Advanced Technology Bomber, ASD, Wright-Patterson AFB, Ohio. Connecticut State AFA President Brad Day and all nine of the Connecticut chapters joined incoming State President Al Hudson for the event.

Florida Gathering of Eagles

The Morgan S. Tyler (Fla.) Chapter recently sponsored its first "Gathering of Eagles" banquet to bring together and honor everyone in the Gulf Ridge Boy Scout Council who has at-

tained the rank of Eagle Scout. Noted public speaker Harris Remley provided good humor, inspiration, and praise. Some 175 Eagle Scouts and guests attended the event in Winter Haven, Fla. Only two percent of all Boy Scouts reach the rank of Eagle. Thus, the Morgan S. Tyler Chapter event exhibits outstanding support of the 1989 AFA convention theme "Youth of Today—Leaders of Tomorrow."

Salute to Chanute

The Illini (Ill.) Chapter sponsored a "Chanute Anniversary Celebration—Seventy-two Years," complete with Color Guard from nearby American Legion Post 24; World War I, World War II, and Korean-era uniforms; music by the 505th Air Force Band of the Midwest; and a narration of the history of Chanute AFB and the Air Force. Chapter President Donald O. Weckhorst, Illinois State AFA President Dr. Glen Wensch, and a number of Rantoul, Ill., AFA members continue enthusiastically to support activities for the Chanute Technical Training Center.

Team of the Year

In May, the Air Force Chief of Security Police, Brig. Gen. Frank Martin, and CMSAF James Binnicker saluted the USAF/AFA Team of the Year in Arlington, Va.

An evening dinner was cosponsored by AFA and Anheuser-Busch Corp. "to honor Air Force enlisted people who displayed outstanding performance during 1988 in the Secu-



Guest speaker at the recent "Salute to the Air National Guard" meeting of the Major John S. Southrey Chapter of Massachusetts was ANG Director Maj. Gen. (then Brig. Gen.) Philip Killey. The event, held at the New England Air Museum, Bradley IAP, Hartford, Conn., attracted more than 200 people to hear General Killey describe the ANG's role. Shown, left to right, are General Killey; Chapter President David R. Cummock, and George A. Varelas, Mayor of Westfield, Mass.



AFA Board Chairman Sam E. Keith, Jr. (left), presents long-time Alamo (Tex.) Chapter member and Vice President Jim Lloyd the AFA Exceptional Service Award. The event was attended by several hundred from San Antonio area bases and was held at Lackland AFB as part of the Alamo Chapter's annual Blue Suit awards banquet.



In California, Plastics Research Corp., an AFA Community Partner of the General Curtis E. LeMay Chapter, was recently honored for its Advanced Cruise Missile work. Shown are Col. Clint Asbury, USAF; James I. Marvin, PRC President and Chairman; Don Brechtel of General Dynamics; and California State AFA President John W. Lynch.

city Police field, thereby contributing significantly to the enhancement of the national defense posture and earning designation as members of the Air Force Association's Team of the Year."

Awardees are TSgt. James R. Bingham, AFSPACECOM, Peterson AFB, Colo.; TSgt. Ronald G. Kessinger, 142d SPF (ANG), Portland IAP, Ore.; TSgt. Russell S. Rickert, 4th SPS, Seymour Johnson AFB, N. C.; SSgt. Randall E. McCormick, 842d SPG, Grand Forks AFB, N. D.; and A1C Linda K. Dean, 142d SPF (ANG), Portland IAP, Ore.

All of this year's team winners are AFA members.

Antelope Valley Honors Night

The Antelope Valley (Calif.) Chapter and the Lancaster Chamber of Commerce cosponsored the nineteenth annual Honors and Awards Banquet at Edwards AFB, with more than 200 guests. Special guests were AFFTC Commander Maj. Gen. John P. Schoeppner, Jr., USAF; Els Grove, Mayor of Lancaster; and William "Pete" Knight, Mayor of Palmdale. Chapter President Sam Kilanowski and Robert L. Slase, Executive Advisor to the Lancaster Chamber of Commerce, presented awards to the following Edwards AFB winners: Col. Frank M. Fleming Outstanding Reserve Person award to TSgt. John A. Franz, 6515th FMS; Outstanding Officer award jointly to Capt. Kenneth Komyathy, 6500th MSS, and 1st Lt. Gregory A. Norris, Air Force Astro-

navics Laboratory; Outstanding Senior NCO award jointly to MSgt. William E. Seiler, 6510th TS, and MSgt. Clyde A. Pierce, 31st Test Evaluation Sqdn.; Outstanding Career NCO award jointly to SSgt. Stella Bloom, 6521st RS, and TSgt. Samuel D. Howard, 3306th Test Evaluation Sqdn.; Outstanding FTA award jointly to Sgt. Robert W. Dazey, 6500th SPS, and SrA. David Ramirez, 1925th Communications Sqdn.; and Outstanding Civilian award jointly to Johnny C. Armstrong, 6510th Test Wing, and Robert D. Robbins, US Army Aviation Engineering Flight Activity.

Washington State Convention

Washington State AFA held its convention in Tacoma. One highlight was a reunion of the Doolittle Tokyo Raiders at nearby McChord AFB. The State AFA joined McChord Air Museum to host the Raiders in a significant gathering, inasmuch as the original 17th Bomb Group, then based at McChord Field, was the source of the aircraft and crews that made up the sixteen-plane, eighty-man raider force led into history by then Lt. Col. Jimmy Doolittle.

Honored guests included Tacoma Mayor Doug Sutherland, National AFA President Jack C. Price, and Medal of Honor recipients Col. Joe Jackson, USAF (Ret.), Bob Bush (Navy), and Del Jennings (Army).

During the program, Mr. Price presented the Loveless Award to AF-ROTC Cadet David A. Wyatt of Central Washington University. Tacoma

Chapter President Bob Baltzell hosted the evening.

CAP Cadets Honored in Miami

The Miami (Fla.) Chapter honored outstanding cadets from nine Dade County Civil Air Patrol squadrons during a banquet sponsored by the chapter. A Humanitarian Award was also presented to a tenth cadet for providing life-sustaining first aid and assistance to an accident victim. The

Coming Events

August 4-6, **North Dakota State Convention**, Grand Forks; August 11-12, **Utah State Convention**, Wendover; August 11-13, **Arizona State Convention**, Sedona; August 12, **Indiana State Convention**, West Lafayette; August 12-13, **Delaware State Convention**, Dover AFB; August 18-19, **Wisconsin State Convention**, Milwaukee; August 24-26, **California State Convention**, San Francisco; August 26, **Illinois State Convention**, Chanute AFB; September 18-21, **AFA National Convention and Aerospace Development Briefings and Displays**, Washington, D. C.; October 6-7, **Arizona State Workshop**, Tucson; October 20-21, **25th Annual Orientation of AFA State Presidents and New Directors**, Washington, D. C.; October 27-29, **North Central Regional Workshop**, Sioux Falls, S. D.; November 17-18, **Southeast Regional Workshop**, Savannah, Ga.



Maj. Gen. Billy J. Boles, Commander, Air Force Military Personnel Center, was guest speaker at a recent Phoenix Sky Harbor (Ariz.) Chapter function held at Williams AFB. Here, General Boles is holding the World War I print he was given. Shown, from left, are James W. Boyce, American Fighter Aces Association Executive Director; Col. Jerry Stecklein, Commander, 82d TFW, Williams AFB; General Boles; and Phoenix Sky Harbor Chapter President Mac Bolton.

awards, which are named after the Miami Chapter's past president, Col. Stanley J. Bodner, USAF (Ret.), were presented in ceremonies before nearly 100 cadets, parents, and chapter members.

The nine outstanding cadets are: Lt. Col. Aaron Wessner, Miami Enterprise Sqdn.; 2d Lt. Jazmin Flores, University Cadet Sqdn.; Flt. Officer Elizabeth D. Kendrick, N. Miami Cadet Sqdn.; Eric A. Espino, Miami Springs Optical Cadet Sqdn.; MSgt. Mark Winter, Homestead AFB Cadet Sqdn.; A1C Jean Velasquez, Palm Springs Cadet Sqdn.; Sgt. Drevino Woods, Miami Blue Eagles Cadet Sqdn.; Sgt. Ryan Reis, Tamiami Composite Sqdn.; and MSgt. Raymond Ledue, Miami Challenger Cadet Sqdn. The Humanitarian Service award went to 2d Lt. Richard Clarke, Miami Challenger Cadet Sqdn.

Contributions

Contributions to "Intercom" should be sent to J. R. "Doc" McCauslin, AFA Headquarters, 1501 Lee Highway, Arlington, Va. 22209-1198. ■

Bulletin Board

Information on the B-17 "Sack Hound" of the 613th Sqdn., 401st Bomb Group, based at Deenethrope, England, and shot down over Belgium on March 2, 1944, while returning from a raid on Frankfurt. In particular, any information on Lt. Robert Davis (navigator), Lt. Elliot Egden (copilot), SSgt. Richard Rickey (engineer/top-turret), and SSgt. Don Silverstein (radio operator). **Contact:** Bill Harness, P. O. Box 1485, APO New York 09283.

For a book on **Gunsmoke**, USAF's worldwide fighter gunnery meet, information from participants, particularly those who took part in the 1949, 1950, and the 1954-62 events. All materials loaned will be returned. **Contact:** John Sheehan, 643 Hidden Valley Ct., Fairborn, Ohio 45324.

Information from USAF veterans who have first-hand knowledge of the use of **shotguns for air**

base defense during World War II, Korea, or Vietnam. **Contact:** Eric H. Archer, 6940 Bristol Dr., Berkeley, Calif. 94705.

Information, pictures, rebuilding experiences, and suggestions for a book about **PT-13, PT-17, and PT-27 aircraft**. **Contact:** Richard M. Allen, 472 Spurlock St., Layton, Utah 84041.

Information on the current whereabouts of aviation students belonging to the **38th College Training Detachment** at Erskine College, Due West, S. C., during the years 1942-44. **Contact:** Robert J. Shirkey, P. O. Box 57, Roswell, N. M. 88202.

Information on or photographs of **airfields in Essex, England**, during World War II, especially from veterans of the Eighth and Ninth Air Forces. **Contact:** E. H. Clark, 11 West Ave., Chelmsford, Essex CM1-2DB, England.

Information on a USAF training film for the **F-84G**. The aircraft in the film was from the 31st Fighter Escort Wing, Turner AFB, Ga. **Contact:** Robert Williams, 7744 W. Lilac Rd., Bonsall, Calif. 92003.

Information on a **song sung by B-26 crews** during the Korean War. The song contained the lyric, "early abort, avoid the rush." **Contact:** Maj. C. J. DuPont, USAF (Ret.), P. O. Box 64, Camp Nelson, Calif. 93208-0064.

Information on the use of **war dogs** in combat, especially from former dog-handlers and others who worked with dog teams in Vietnam, Korea, or World War II. **Contact:** Michael J. Quinlivan, 1209 Bradley Ave., Oklahoma City, Okla. 73127.

Seeking unpublished personal **anecdotes, jokes, legends, stories of the supernatural, chants, and songs** from veterans. **Contact:** Dr. C. Burke, Dept. of English, US Naval Academy, Annapolis, Md. 21402.

For a video documentary about the **8th TFW** during its tenure at Ubon, Thailand, the Wolfpack Project is seeking information, stories, documents, and photos. We are particularly interested in hearing from any FACs (Forward Air Controllers). **Contact:** R. Michael Thompson, 125 Oscar Dr., Grass Valley, Calif. 95949.

Information from anyone who knew or served with **Lt. John H. S. Long** from Media, Pa., who served with the 37th Air Rescue Squadron in Da Nang, Vietnam. He was shot down October 15, 1966, over the Gulf of Tonkin. I am also interested in any stories about the 37th ARS. **Contact:** Karen Andes, 444B Scenic Rd., Fairfax, Calif. 94930.

Trying to locate **Leo Severs**, who was stationed at RAF Burtonwood, England, Site 5, in the 1950s. I believe he was from California. **Contact:** J. P. Brown, Penrivendell, Rte. 1, Box 119-H, Cabot, Ark. 72023.

Information on the **75th FIS** or any of its sister squadrons operating the F-101B/F and any information about Virgil I. "Gus" Grissom during his tenure with the 75th FIS. Contributed photos, orders, newspaper accounts, and other written accounts will be copied, credited, and returned. **Contact:** Rick Riggio, P. O. Box 3986, Fort Pierce, Fla. 34948-3986.

Information on **Capt. Frederick Harper**, USAAF,

If you need information on an individual, unit, or aircraft, or if you want to collect, donate, or trade USAF-related items, write to "Bulletin Board," AIR FORCE Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Letters should be brief and typewritten. We cannot acknowledge receipt of letters to "Bulletin Board." We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Photographs cannot be used or returned.—THE EDITORS

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): **H. R. Case**, P. O. Box 16625, Mobile, Ala. 36616 (phone 205-639-0168).

ALASKA (Anchorage, Fairbanks): **William L. Pair**, 2517 Riverview Dr., Fairbanks, Alaska 99709 (phone 907-452-3370).

ARIZONA (Green Valley, Phoenix, Sierra Vista, Sun City, Tucson, Verde Valley): **Robert A. Munn**, 7042 E. Calle Bellatrix, Tucson, Ariz. 85710 (phone 602-747-9649).

ARKANSAS (Blytheville, Fayetteville, Fort Smith, Hot Springs, Little Rock): **Bud A. Walters**, 903 Dixie Dr., Blytheville, Ark. 72315 (phone 501-763-1825).

CALIFORNIA (Apple Valley, Bakersfield, Camarillo, Edwards, Fairfield, Fresno, Los Angeles, Merced, Monterey, Novato, Crange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, Sunnyvale, Vandenberg AFB, Yuba City): **John W. Lynch**, 1940 W. Orangewood, Suite 110, Orange, Calif. 92668 (phone 714-639-8188).

COLORADO (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Pueblo): **William D. Croom**, 31 N. Tejon, Colorado Springs, Colo. 80903 (phone 719-550-5059).

CONNECTICUT (Brookfield, East Hartford, Middletown, Storrs, Stratford, Torrington, Waterbury, Westport, Windsor Locks): **Brad Day**, 16 Hemlock Trail, Trumbull, Conn. 06611 (phone 203-386-7221).

DELAWARE (Dover, Milford, Newark, Rehoboth Beach, Wilmington): **Horace W. Cook**, P. O. Box 1555, Dover, Del. 19903 (phone 302-674-1051).

DISTRICT OF COLUMBIA (Washington, D. C.): **Dave Osterhout**, 1501 Lee Highway, Arlington, Va. 22209-1198 (phone 703-955-3309).

FLORIDA (Avon Park, Broward County, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Homestead, Jacksonville, Leesburg, Miami, New Port Richey, Ocala, Orlando, Palm Harbor, Panama City, Patrick AFB, Port Charlotte, Redington Beach, Sarasota, Spring Hill, Tallahassee, Tampa, Vero Beach, 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): **Homer N. Childs**, P. O. Box 2189, Warner Robins, Ga. 31099 (phone 912-923-2623).

GUAM (Agana): **Thomas P. Foster**, Box 822, Agana, Guam 96910-0822 (phone 671-477-9088).

HAWAII (Honolulu, Maui): **John F. O'Donnell**, McDonnell Douglas Corp., P. O. Box 6283, Honolulu, Hawaii 96818 (phone 808-422-1905).

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, Rockford, 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. Zimmer-**

man, 608 Waterloo Bldg., Waterloo, Iowa 50701 (phone 319-232-2650).

KANSAS (Garden City, Topeka, Wichita): **Cletus J. Pottebaum**, 6503 E. Murdock, Wichita, Kan. 67206 (phone 316-683-3963).

KENTUCKY (Lexington, Louisville): **Jo Brendel**, 726 Fairhill Dr., Louisville, Ky. 40207 (phone 502-897-7647).

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): **Richard F. Strelka**, 54 Country Rd., Caribou, Me. 04736 (phone 207-492-4381).

MARYLAND (Andrews AFB area, Baltimore, Rockville): **Vince duCellier**, P. O. Box 279, North Beach, Md. 20714 (phone 301-855-7661).

MASSACHUSETTS (Bedford, Boston, East Longmeadow, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): **William J. Lewis**, 33 Bedford St., No. 11, Lexington, Mass. 02173 (phone 617-863-8254).

MICHIGAN (Alpena, Battle Creek, Calumet, Detroit, East Lansing, Kalamazoo, Marquette, Mount Clemens, Oscoda, Petoskey, Southfield): **William L. Stone**, 7357 Lakewood Dr., Oscoda, Mich. 48750 (phone 517-724-6266).

MINNESOTA (Duluth, Minneapolis-St. Paul): **Doyle E. Larson**, 13509 York Ave., South, Burnsville, Minn. 55337 (phone 612-890-9140).

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): **Garrett R. Crouch**, P. O. Box 495, Warrensburg, Mo. 64093 (phone 816-747-6141).

MONTANA (Bozeman, Great Falls): **Ronald Glock**, 321 N. 17th, Bozeman, Mont. 59715 (phone 406-586-5455).

NEBRASKA (Lincoln, Omaha): **Ralph Bradley**, 1221 N. 101st St., Omaha, Neb. 68114 (phone 402-392-1904).

NEVADA (Las Vegas, Reno): **Emery S. Wetzel, Jr.**, 2938 S. Duneville St., Las Vegas, Nev. 89102 (phone 702-384-7483).

NEW HAMPSHIRE (Manchester, Pease AFB): **Robert N. McChesney**, Scruton Pond Rd., Barrington, N. H. 03825 (phone 603-433-1550).

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 W. 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, Greenville,

Havelock, Hickory, Kitty Hawk, Littleton, Raleigh, Wilmington): **Robert C. Newman, Jr.**, 3037 Truitt Dr., Burlington, N. C. 27215 (phone 919-584-7069).

NORTH DAKOTA (Concrete, Fargo, Grand Forks, Minot): **George Christensen**, #5 Fairway, Minot, N. D. 58701 (phone 701-857-4750).

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): **Aaron C. Burleson**, P. O. Box 757, Altus, Okla. 73522-0757 (phone 405-482-0005).

OREGON (Eugene, Klamath Falls, Portland): **Barbara M. Brooks**, 7315 N. Curtis, Portland, Ore. 97217 (phone 503-283-4541).

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): **S. Ron Chromulak**, 126 Phillips St., Charleroi, Pa. 15022 (phone 412-864-7220).

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): **George J. Thom**, 25 Calhoun Dr., Sumter, S. C. 29150-4738 (phone 803-775-6256).

SOUTH DAKOTA (Belle Fourche, Rapid City, Sioux Falls): **Jan M. Laitos**, 2919 Country Club Dr., Rapid City, S. D. 57702 (phone 605-394-6203).

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tri-Cities Area, Tullahoma): **Ben Cole**, 5361 Egypt Central Rd., Memphis Tenn. 38134 (phone 901-372-7237).

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): **M. N. Dan Heth**, P. O. Box 748, MZ 5804, Fort Worth, Tex. 76101 (phone 817-777-4458).

UTAH (Bountiful, Clearfield, Ogden, Salt Lake City): **Glenn M. Lusk**, 2144 West 4000 South, Roy, Utah 84067 (phone 801-731-3366).

VERMONT (Burlington): **Ralph R. Goss**, 8 Summit Circle, Shelburn, Vt. 05482 (phone 802-985-2257).

VIRGINIA (Alexandria, Charlottesville, Danville, Dulles Airport Corridor, Harrisonburg, Langley AFB, Lynchburg, McLean, Norfolk, Petersburg, Richmond, Roanoke): **Don Anderson**, Box 54, 2101 Executive Dr., Hampton, Va. 23666 (phone 804-838-7980).

WASHINGTON (Seattle, Spokane, Tacoma): **A. R. "Dick" Lewis**, 7435 Cooper Point Rd., Olympia, Wash. 98502 (phone 206-866-7135).

WISCONSIN (Madison, Milwaukee, Mitchell Field): **Gilbert M. 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).

Bulletin Board

who was based at Norwich, England, in 1943, and information on **Ethel Laye**, a WAF member. **Contact:** Eileen Childers, 4039½ Park Blvd., San Diego, Calif. 92103.

Seeking photos, color slides, or information on the **Northrop F-89 Scorpion** series of aircraft in USAF or ANG service. **Contact:** Larry Davis, Squadron/Signal Publications, 4713 Cleveland Ave. N. W., Canton, Ohio 44709.

Information about the squadron insignia or nose art on the **P-51D** that appeared on p. 172 of the May issue of *Air Force Magazine*. **Contact:** SSgt. Blaine H. Nolan, Delaware ANG, 12 Penns Way, Corporate Commons, New Castle, Del. 19720-2495.

Looking to buy issues or collections of the following magazines: *Wings* or *Air Power*. **Contact:** Checuz Francesco, P. O. Box 6, I-31015 Conigliano (TV), Italy.

Interested in collecting patches, insignia, decals, and memorabilia connected with the **EF-111 Ravens**. **Contact:** Robert L. Hodge, Jr., EF-111 Technical Order Librarian, 85 N. Long Beach Ave., P. O. Box 528, Freeport, N. Y. 11520.

Seeking donation of **aviation patches** from all eras and all services. **Contact:** Chris Simmons, 2609 Glacier Ct. S. E., Puyallup, Wash. 98374.

Seeking copies of two books: *FW-190 in Action*, published by Squadron/Signal Publications, and *Ploesti: The Great Ground/Air Battle of 1 August, 1943*, by James Dugan and Carroll Stewart. Hardcover preferred, but paperback acceptable. **Contact:** L. B. Groover III, 103 Appleseed Ct., Peachtree City, Ga. 30269.

Looking for all types of **military artifacts**—uniforms, photos, insignia, etc. **Contact:** Steven P. Schultz, Museum of War and Military History, P. O. Box 5602, Spokane, Wash. 99205.

Anyone with information on **SSgt. John B. Mackinaw** of the 768th Bomb Sqdn., 462d Bomb Group, 58th Bomb Wing. He was reported MIA on January 6, 1945, south of Omura, Japan. **Contact:** William J. Mackinaw, 50 Kangas Rd., Esko, Minn. 55733.

Would like to locate the following members of the **14th and 4th TC Sqdns.** who served during the period 1948–53: David Cosby, Frank Gatti, William B. Manly, Clement K. Kuanoni, Richard Callender, and Glen N. Daniels. **Contact:** Charles S. Blakely, 8090 Morrow Circle, Detroit, Mich. 48204.

Looking for the following two men who were on

the crew of the B-25Hs *Barbie II* and *Barbie III* based at Hailikandi, Assam, with the 1st Air Commando Group in 1944: **SSgt. Richard M. Dixon** (radio operator) of Grass Valley, Calif.; and **Sgt. Gerald D. Fitzgerald** (crew chief) of Chicago, Ill. **Contact:** Charles Baisden, 109 Wales Ct., Savannah, Ga. 31410.

Trying to locate **Dale Fischer**, whose last known post was Kadena AB, Japan. He also served at Travis, Beale, and Sheppard AFBs. **Contact:** SSgt. David T. Chamberlin, USAF, 317 Augusta Dr., Newport News, Va. 23601.

Seeking information on the whereabouts of **Lynnda Moss**, niece of Margaret Moss of Ealing, England. We understand she married a native of Little Rock, Ark., USAF officer **Jim Mahoney**, in 1953. **Contact:** Bird & Lovibond, Solicitors, 3 Vine St., Uxbridge, Middlesex UB8 1RP, England.

Information on the following members of the 3575th Maintenance Sqdn., Headquarters Group, Flight Test Section, who served at Vance AFB, Okla., during the early 1950s: **Maj. Arnold H. Clark**, **Capt. L. French**, **Capt. Everett Luckey**, **Colonel Lockwood**, **Capt. Stanley Hyman**, and **Lt. A. Schumann**. **Contact:** Pat Corrado, 48 Center Ave., Cedar Grove, N. J. 07009.

Trying to locate **Reserve Lt. Col. Raymond George Kroker**, who served as a navigator during World War II in the CBI theater. Last known address was Albuquerque, N. M. He once worked for the Nader Engineering Co. in Chicago, Ill., and has a son, George, and a daughter, Linda. **Contact:** George Kostakis, 3831 Paducah Dr., San Diego, Calif. 92117.

Anyone who has knowledge about the formation of **Grand Forks and Minot AFBs**, N. D., during the period 1953–58 and who has knowledge of the SAGE system or the following personnel: **Maj. Gen. Lee Washbourne**, **Brig. Gen. Joe Kelly**, **Col. J. F. Rodenhauer**, and **Lt. Col. Fred Mauck**. **Contact:** Rich Nolan, 1121 Hawthorne Lane, Lawrenceburg, Ky. 40342.

Information about **Lt. S. G. Johnston**, who served with the 88th Fighter Sqdn. in Burma during World War II. **Contact:** Edward L. Garrison, 117 Garden Springs Rd., Columbia S. C. 29209.

Trying to contact **SSgt. George Wilson** and **SSgt. Cecil Goodroe**, who were with the 47th Pursuit Sqdn., 15th Pursuit Group, in Hawaii during the attack on Pearl Harbor. Also seek address of the **Pearl Harbor Survivors Assn.** **Contact:** Don Dawson, P. O. Box 6955, Ketchikan, Alaska 99901. ■



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Unit Reunions

Air Commando Ass'n

The Air Commandos of World War II (2d and 3d Air Commando Groups) will hold a reunion October 5–7, 1989, in Indianapolis, Ind. **Contacts:** W. R. Eason, Rte. 1, Box 28, Orange, Va. 22960. Phone: (703) 672-4074. Norman Trzynka, 729 Moeller Rd., New Haven, Ind. 46774. Phone: (219) 749-5248.

Air War College

Air War College class of 1958 (students and instructors) will hold a reunion October 26–28, 1989, at the Gunter Hotel in San Antonio, Tex.

Contact: Col. Thomas J. Hanley, USAF (Ret.), 5838 N. Gap, San Antonio, Tex. 78239.

AACS Alumni Ass'n

Airways and Air Communications Service alumni will hold a reunion October 19–22, 1989, in Montgomery, Ala. **Contact:** Alton E. Erdman, 3025 Pelzer Ave., Montgomery, Ala. 36109.

Forts Sherman and Randolph

Personnel (and their wives, widows, and children) who served at Fort Sherman and Fort Randolph between 1934 and 1944 will hold a

reunion September 14-17, 1989, in Nashville, Tenn. **Contact:** MSgt. Darius M. Cooper, USAF (Ret.), P. O. Box 142, Glen Dale, W. Va. 26038. Phone: (304) 845-0880.

Ranch Hands

Vietnam Ranch Hand personnel will hold a reunion October 6-9, 1989, at the Ramada Inn in Fort Walton Beach, Fla. **Contact:** Jack Spey, 850 Tarpon, Fort Walton Beach, Fla. 32548. Phone: (904) 243-5696.

Strategic Support Squadrons

Members of the Strategic Support Squadrons (1st, 2d, 3d, and 4th) will hold a reunion October 20-22, 1989, at the El Tropicano Hotel in San Antonio, Tex. **Contact:** William H. Gosdin, HCO 3, Box 230, Marble Falls, Tex. 78654. Phone: (512) 598-5589.

4th Emergency Rescue Squadron

Members of the 4th Emergency Rescue Squadron will hold a reunion October 18-21, 1989, in New Orleans, La. **Contact:** William "Mac" McGregor, Box 98, St. Germain, Wis. 54558. Phone: (715) 479-8801.

4th Fighter Squadron

The 4th Fighter Squadron will hold a reunion September 14-16, 1989, in Grand Rapids, Mich. **Contact:** Clair Alcumbrack, 1419 Pickett St. S. E., Kentwood, Mich. 49508. Phone: (616) 455-3738.

6th ARU

Members of the 6th ARU (Floating) will hold a reunion August 23-27, 1989, in Nashville, Tenn. **Contact:** William Blockley, 301 Yuma Ct., Boulder City, Nev. 89005. Phone: (702) 293-5676.

9th Photo Recon Squadron

Members of the 9th Photo Reconnaissance Squadron (World War II in the CBI theater) will hold a reunion October 26-28, 1989, in Titusville, Fla. **Contact:** Lt. Col. William H. Greenhalgh, USAF (Ret.), 654 Haggerty Rd., Wetumpka, Ala. 36092.

9th Bomb Group

Members of the 9th Bomb Group who served on Tinian in 1945 will hold a reunion October 12-15, 1989, in Orlando, Fla. **Contact:** Earl L. Johnson, 244 Whittier Circle, Orlando, Fla. 32806. Phone: (407) 422-4500.

13th Bomb Squadron

Members of the 13th Bomb Squadron, 3d Bomb Group "Grim Reapers," who served in Korea will hold a reunion October 4-8, 1989, in Charleston, S. C. **Contact:** Ed Lewis, 802 Lewis Rd., Sumter, S. C. 29154. Phone: (803) 775-6574.

33d Fighter Group

Members of the 33d Fighter Group, including 58th, 59th, and 60th Fighter Squadrons (World War II), will hold a reunion September 27-30, 1989, at the Embassy Suites Hotel in Colorado Springs, Colo. **Contacts:** Mrs. Marylyn Zywan, 44 Lodge Ave., Huntington Station, N. Y. 11746. Phone: (516) 423-4593. George Coates, 6 Myrtle Ave., Secaucus, N. J. 07094. Phone: (201) 348-8065.

39th Bomb Group

The 39th Bomb Group who served on Guam during World War II will hold a reunion in the summer of 1990. **Contacts:** James W. Wyckoff, 2714 E. Hayts Corners Rd., Ovid, N. Y. 14521.

Phone: (607) 869-2574. Robert E. Weiler, 3360 S. Osprey Ave., #101B, Sarasota, Fla. 34239. Phone: (813) 954-2118.

Class 41-F

Members of Class 41-F Southeast Training Command of Maxwell, Craig, and Barksdale Fields are organizing a fiftieth-year reunion, scheduled for May 1990. **Contact:** Bill Ceely, 1103 N. Garfield Ave., Deland, Fla. 32724. Phone: (904) 734-2460.

Class 42-A

Pilot Class 42-A (Brooks Field, Tex.) will hold a reunion November 1-5, 1989, at the Grosvenor Resort in Orlando, Fla. **Contact:** Jack Sperling, 4090. Bugle View Dr., Tallahassee, Fla. 32301. Phone: (904) 878-5011.

43d Bomb Group

The 43d Bomb Group will hold its reunion October 10-15, 1989, at the Marriott Hotel in Colorado Springs, Colo. **Contact:** Lloyd Boren, 102 Beechwood, Universal City, Tex. 78148. Phone: (512) 658-5978.

Class 43-D

Members who attended Primary at Lafayette, La., will hold a reunion in 1990, in New Orleans, La. **Contact:** Maj. Philip G. Mack, USAFR (Ret.), 5436 116th Pl. S. E., Bellevue, Wash. 98006. Phone: (206) 644-0233.

Class 52-B

Pilot Class 52-B will hold a reunion October 11-14, 1991, at the Sheraton Ferncroft in Danvers, Mass. **Contact:** Jack Lee, 14 Morrison Rd., Windham, N. H. 03087. Phone: (603) 432-9632.

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Classes 52-H/58-J

Veterans of the 3308th Pilot Training Squadron (all classes), Pilot Classes 52-H through 58-J (Stallings Field), and Service Air Instructors will hold a reunion October 6-7, 1989, at the Sheraton Kinston in Kinston, N. C. **Contact:** 3308th Pilot Training Reunion, 1607 Cambridge Dr., Kinston, N. C. 28501. Phone: (919) 527-0425 (Bill Dyer).

53d Fighter Group

Veterans of the 53d Fighter Group who were stationed in the Fort Myers, Fla., area during World War II and gunners who received their training at Buckingham Field will hold a reunion October 21-22, 1989, in Fort Myers, Fla. **Contact:** Richard T. Beattie, Fort Myers Historical Museum, 2300 Peck St., Fort Myers, Fla. 33902. Phone: (813) 332-5955.

62d Troop Carrier Group

Members of the 62d Troop Carrier Group Association will hold a reunion October 22-25, 1989. **Contact:** James N. Boles, 3112 Windsor Blvd., Oklahoma City, Okla. 73122. Phone: (405) 943-0405.

64th Troop Carrier Group

The 64th Troop Carrier Group will hold a reunion October 11-14, 1989, at the Red Lion Inn in Colorado Springs, Colo. **Contact:** Carl A. Looney, Rte. 1, Box 119, Chickasha, Okla. 73018.

80th Troop Carrier Squadron

The 80th Troop Carrier Squadron will hold a reunion October 6-8, 1989, in Omaha, Neb. **Contact:** Gilbert G. Vogt, 6044 Oakcrest Plaza, Omaha, Neb. 68137. Phone: (402) 895-0440.

86th Fighter-Bomber Group

Members of the 86th Fighter-Bomber Group will hold a reunion September 14-17, 1989, at the Embassy Suites Hotel in Colorado Springs, Colo. **Contact:** A. B. Nickels, P. O. Box 791431, San Antonio, Tex. 78279-1431.

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, a time and location, and a contact for additional information.

100th Air Service Squadron

The 100th Air Service Squadron, 5th Air Force (World War II), will hold a reunion August 18-20, 1989, in Sherman, Tex. **Contact:** Charles L. Blumenthal, 8046 Via Del Desierto, Scottsdale, Ariz. 85258.

107th Tactical Recon Squadron

Members of the 107th Tactical Reconnaissance Squadron (World War II) will hold a reunion October 1-4, 1989, at the Shem Creek Inn in Charleston, S. C. **Contact:** Col. Ernest C. Holland, Jr., USAF (Ret.), Rte. 4, Box 1240, Manning, S. C. 29102. Phone: (803) 478-4613.

111th Tactical Recon Squadron

The 111th Tactical Reconnaissance Squadron (World War II) will hold a reunion October 11-15, 1989, at the Hampton Inn in Tampa, Fla. **Contact:** Tony P. Suarez, 810 W. Peninsula Ave., Tampa, Fla. 33603. Phone: (813) 229-2429.

303d Bomb Wing

Members of the 303d Bomb Wing and associated units will hold a reunion October 19-22, 1989, at the Rio Rico Resort and Country Club in Rio Rico, Ariz. **Contact:** O. R. Smith, 1321 N. Via Ronda Oeste, Tucson, Ariz. 85715. Phone: (602) 722-9437.

319th Bomb Group/Wing

Veterans of the 319th Bomb Group will hold a reunion October 3-6, 1989, at the Holiday Inn in Branson, Mo. **Contact:** Joseph P. Madrano, 8308 Springtown, Converse, Tex. 78109. Phone: (512) 659-4237.

355th Fighter Group

Veterans of the 355th Fighter Group, 8th Air Force, who served in World War II at Steeple Morden, England, will hold a reunion October 12-15, 1989, in Long Beach, Calif. **Contact:** Robert E. Kuhnert, 4230 Shroyer Rd., Dayton, Ohio 45429. Phone: (513) 294-2986.

368th Fighter Group

The 368th Fighter Group will hold a reunion October 26-29, 1989, at the Westshore Marriott Hotel in Tampa, Fla. **Contact:** Roy Carlson, 5401-J Bayshore Blvd., Tampa, Fla. 33611. Phone: (813) 831-6856.

450th Bomb Squadron

Members of the 450th Bomb Squadron will hold a reunion October 17-20, 1989, in Savannah, Ga. **Contact:** Eugene Allen, 412 Homer Rd., Minden, La. 71055.

455th Bomb Squadron

Members of the 455th Bomb Squadron, 323d Bomb Group "Whitetail Marauders," 9th Air Force, who served in World War II will hold a reunion October 5-8, 1989, in Myrtle Beach, S. C. **Contact:** Frank Brewer, P. O. Box 59273, Birmingham, Ala. 35259. Phone: (205) 823-2694.

461st Bomb Wing

The 461st Bomb Wing will hold a reunion October 5-8, 1989, at the Holiday Inn in Sacramento, Calif. **Contact:** Paul J. Petrul, 2460 Five Oak Dr., Meadow Vista, Calif. 95722. Phone: (916) 878-1193.

463d Bomb Group

Members of the 463d Bomb Group and attached personnel and squadrons will hold a reunion November 16-19, 1989, in San Diego, Calif. **Contact:** Rev. Eugene E. Parker, P. O. Box 127, Edwardsport, Ind. 47528.

492d Bomb Group

Members of the 492d Bomb Group, 8th Air Force, will hold a reunion in conjunction with the 8th Air Force Historical Society October 4-8, 1989, in Denver, Colo. **Contact:** Elmer W. "Bill" Clarey, 2015 Victoria Ct., Los Altos, Calif. 94022. Phone: (415) 961-0231.

US Strategic Bombing

I am attempting to locate personnel of the US Strategic Bombing Survey who were on detached service from the USAAF during World War II and on duty in England and Japan from 1943 through 1946. I am trying to organize a reunion.

Please contact the address below.

Maj. Gerry Curtis, USAF (Ret.)
216 Ridge Terrace
Montebello, Calif. 90640

47th Bomb Squadron

I would like to hear from members of the 47th Bomb Squadron, 41st Bomb Group, 7th Air Force, for the purpose of organizing a reunion.

Please contact the address below.

John Mahan
P. O. Box 232
Hinsdale, N. H. 03451



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3. Up to 30 days per year for each insured person confined in a Skilled Nursing Facility.
4. Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Residential Treatment Center.
5. Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Special Treatment Facility.
6. Up to five visits per year for each insured person to Marriage and Family Counselors under conditions defined by CHAMPUS.

And the New 'Expense Protector' Benefit

While CHAMPUS Supplement coverage was originally intended to cover the cost of medical services not provided by CHAMPUS, practitioners and service institutions may charge fees that are considerably greater than those approved for payment by CHAMPUS. And, because Supplement policies traditionally base their payments on the amount paid by CHAMPUS, the insured can be left with sizable out-of-pocket expenses. AFA's ChamPLUS® coverage includes a special feature which places a limit on these out-of-pocket expenses.

Called the 'Expense Protector' Benefit, this program limits out-of-pocket expenses for CHAMPUS covered charges in any single calendar year to \$1,000 for any one insured person

(or \$2,000 for all insured family members combined). Once those out-of-pocket expense maximums are reached, ChamPLUS® will pay 100% of CHAMPUS covered charges for the remainder of that year.

An example of the way the 'Expense Protector' works follows. Assume you are hospitalized for 35 days, that the hospital charges you \$330 per day and that this is \$75 per day *more* than allowed by CHAMPUS. This would mean that you have an out-of-pocket expense of \$2,625. With AFA's 'Expense Protector' benefit, your cost would be limited to \$1,000. All covered costs over this amount—for the whole

calendar year—would be paid by ChamPLUS®!

It's an important benefit that can mean significant savings to you and your family.

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Who Is Eligible?

1. All AFA members under 65 years of age who are currently receiving retired pay based upon their military service and who are eligible for benefits under Public Law 89-614 (CHAMPUS) their spouses under age 65 and their unmarried

AFA ChamPLUS® Benefit Schedule

Care	CHAMPUS Pays	AFA CHAMPLUS® PAYS
For Military Retirees Under Age 65 and Their Dependents		
Inpatient civilian hospital care	CHAMPUS pays the balance of the Diagnostic Related Group (DRG) allowance after the beneficiary's cost share* is deducted.	CHAMPLUS® pays the 25% of allowable charges not paid by CHAMPUS . . . plus 100% of covered charges after out-of-pocket expenses exceed \$1,000 per person (or \$2,000 per family) during any single calendar year.
Inpatient military hospital care	The only charge normally made is a daily subsistence fee, not paid by CHAMPUS.	CHAMPLUS® pays the daily subsistence fee.
Outpatient care	CHAMPUS covers 75% of outpatient care fees after an annual deductible of \$50 per person (\$100 maximum per family) is satisfied.	CHAMPLUS® pays the 25% of allowable charges not paid by CHAMPUS after the deductible has been satisfied . . . plus 100% of covered charges after out-of-pocket expenses exceed \$1,000 per person (or \$2,000 per family) during any single calendar year.
For dependents of Active Duty Military Personnel		
Inpatient civilian hospital care	CHAMPUS pays all covered services and supplies furnished by a hospital less \$25 or the total of daily subsistence fees, whichever is greater.	CHAMPLUS® pays the greater of the total subsistence fees, or the \$25 hospital charge not paid by CHAMPUS
Inpatient military hospital care	The only charge normally made is a daily subsistence fee, not paid by CHAMPUS.	CHAMPLUS® pays the daily subsistence fee.
Outpatient care	CHAMPUS covers 80% of outpatient care fees after an annual deductible of \$50 per person (\$100 maximum per family) is satisfied.	CHAMPLUS® pays the 20% of allowable charges not paid by CHAMPUS after the deductible has been satisfied . . . plus 100% of covered charges after out-of-pocket expenses exceed \$1,000 per person (or \$2,000 per family) during any single calendar year.

NOTE: Outpatient benefits cover emergency room treatment, doctor bills, pharmaceuticals, and other professional services. There are some reasonable limitation and exclusions for both inpatient and outpatient coverage. Please note these elsewhere in the plan description.

*The beneficiary cost share is the lesser of 25% of CHAMPUS-allowable billed charges or a daily fixed amount. For fiscal year 1989, the daily limit is \$210.

New 'Expense Protector' Benefit!

dependent children under age 21, or age 23 if in college.

2. All eligible dependents of AFA members on active duty. Eligible dependents are spouses under age 65 and unmarried dependent children under age 21 (or age 23 if in college). (There are some exceptions for older age children. See "Exceptions and Limitations.")

Renewal Provision

As long as you remain eligible for CHAMPUS benefits and the Master Policy with AFA remains in force, termination of your coverage can occur only if premiums for coverage are due and unpaid, or if you are no longer an AFA member. Your certificate cannot be terminated because of the number of times you receive benefits.

Exceptions and Limitations

Coverage will not be provided for conditions for which treatment has been received during the 12-month period prior to the effective date of insurance until the expiration of 12 consecutive months of insurance coverage without further treatment. After coverage has been in force for 24 consecutive months, pre-existing conditions will be covered regardless of prior treatment. Children of active duty members over age 21 (age 23 if in college) will continue to be eligible if they have been declared incapacitated and if they are insured under CHAMPUS* on the date so declared. Coverage for these older age children will only be provided upon a) notification to AFA and b) payment of a special premium amount.

Plan 1 For Military Retirees and Dependents QUARTERLY PREMIUM SCHEDULE

In-Patient Benefits Only

Member's Attained Age*	Member	Spouse	Each Child
Under 50	\$22.97	\$ 45.12	\$16.34
50-54	\$34.33	\$ 56.21	\$16.34
55-59	\$50.32	\$ 60.17	\$16.34
60-64	\$62.98	\$ 69.27	\$16.34

In-Patient and Out-Patient Benefits

Member's Attained Age*	Member	Spouse	Each Child
Under 50	\$33.90	\$ 61.02	\$40.84
50-54	\$46.59	\$ 69.87	\$40.84
55-59	\$64.41	\$ 96.11	\$40.84
60-64	\$77.38	\$102.15	\$40.84

*Note: Premium amounts increase with the member's attained age

Plan 2 For Dependents of Active Duty Personnel ANNUAL PREMIUM SCHEDULE

In-Patient Benefits Only

All Ages	Member	Spouse	Each Child
	None	\$ 9.68	\$ 5.94

In-Patient and Out-Patient Benefits

All Ages	Member	Spouse	Each Child
	None	\$38.72	\$29.70

Coverage After Age 65

Upon attainment of age 65, the coverage of members insured under CHAMPUS* will automatically be converted to AFA's Medicare Supplement program so that there will be no lapse in coverage. Members not wishing this automatic coverage should notify AFA prior to their attainment of age 65.

Exclusions

This plan does not cover and no payment shall be made for:

- routine physical examinations or immunizations
- domiciliary or custodial care
- dental care (except as required as a necessary adjunct to medical or surgical treatment)

- routine care of the newborn or well-baby care
- injuries or sickness resulting from declared or undeclared war or any act thereof
- injuries or sickness due to acts of intentional self-destruction or attempted suicide, while sane or insane
- treatment for prevention or cure of alcoholism or drug addiction
- eye refraction examinations
- prosthetic devices (other than artificial limbs and artificial eyes), hearing aids, orthopedic footwear, eyeglasses and contact lenses
- expenses for which benefits are or may be payable under Public Law 89-614 (CHAMPUS)

APPLICATION FOR AFA CHAMPUS*

Group Policy GMG-FC70
Mutual of Omaha Insurance Company
Home Office: Omaha, Nebraska

Full name of Member _____
Rank _____ Last _____ First _____ Middle _____

Address _____
Number and Street _____ City _____ State _____ ZIP Code _____

Date of Birth _____ Current Age _____ Height _____ Weight _____ Soc. Sec. No. _____
Month/Day/Year

This insurance coverage may only be issued to AFA members. Please check the appropriate box below:

- I am currently an AFA Member. I enclose \$21 for annual AFA membership dues (includes subscription (\$18) to AIR FORCE Magazine).

PLAN & TYPE OF COVERAGE REQUESTED

- Plan Requested (Check One) AFA CHAMPUS* PLAN I (for military retirees & dependents) AFA CHAMPUS* PLAN II (for dependents of active-duty personnel)
- Coverage Requested (Check One) Inpatient Benefits Only Inpatient and Outpatient Benefits
- Person(s) to be insured (Check One) Member Only Member & Children Spouse Only Spouse & Children Member & Spouse Member, Spouse & Children

PREMIUM CALCULATION

All premiums are based on the attained age of the AFA member applying for this coverage. Plan I premium payments are normally paid on a quarterly basis but, if desired, they may be made on either a semi-annual (multiply by 2), or annual (multiply by 4) basis.

Quarterly (annual) premium for member (age _____) \$ _____

Quarterly (annual) premium for spouse (based on member's age) \$ _____

Quarterly (annual) premium for _____ children @ \$ _____ \$ _____

Total premium enclosed \$ _____

If this application requests coverage for your spouse and/or eligible children, please complete the following information for each person for whom you are requesting coverage.

Names of Dependents to be Insured _____ Relationship to Member _____ Date of Birth (Month/Day/Year) _____

(To list additional dependents, please use a separate sheet.)

In applying for this coverage, I understand and agree that (a) coverage shall become effective on the last day of the calendar month during which my application together with the proper amount is mailed to AFA, (b) only hospital confinements (both inpatient and outpatient) or other CHAMPUS-approved services commencing after the effective date of insurance are covered and (c) any conditions for which I or my eligible dependents received medical treatment or advice or have taken prescribed drugs or medicine within 12 months prior to the effective date of this insurance coverage will not be covered until the expiration of 12 consecutive months of insurance coverage without medical treatment or advice or having taken prescribed drugs or medicine for such conditions. I also understand and agree that all such pre-existing conditions will be covered after this insurance has been in effect for 24 consecutive months.

Date _____, 19____ Member's Signature _____ Form 6173GH App

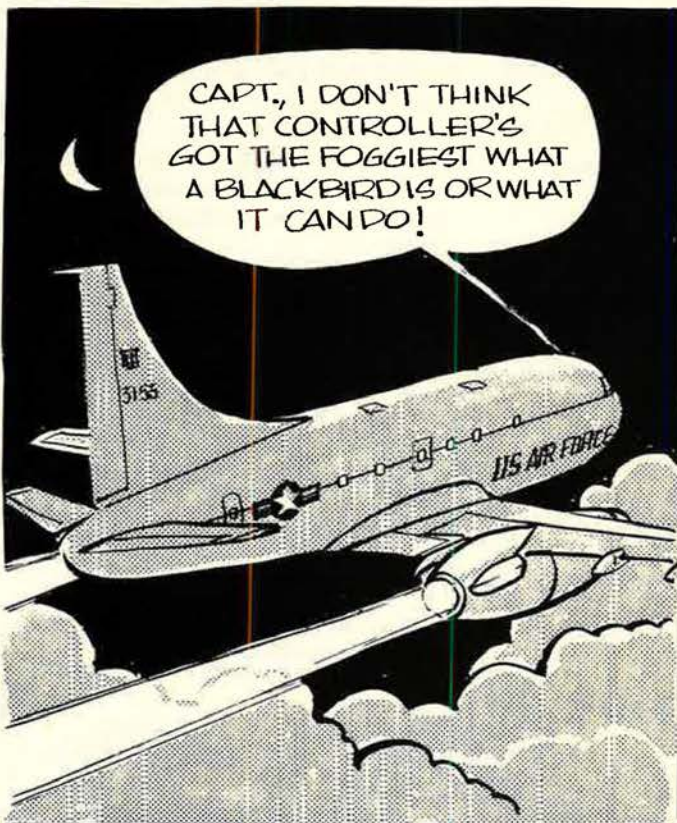
8-89

Application must be accompanied by a check or money order. Send remittance to:
Air Force Association, Insurance Division, 1501 Lee Highway, Arlington, VA
22209-1198

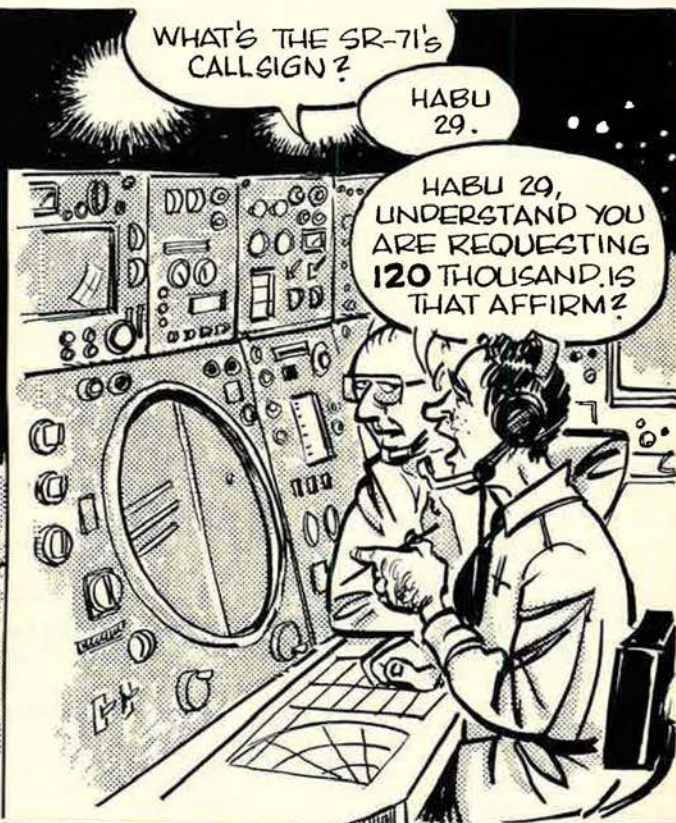
Bob Stevens'

"There I Was..."

LIKE MOST STORIES, THE TRUE ONES ARE THE REAL BELL-RINGERS. THIS ONE INVOLVES A T-43, AKA "FLUF" (FAT LI'L UGLY FELLER) LISTENING TO A TRAINEE CONTROLLER WORKIN' A SR-71 BLACKBIRD ONE NIGHT-



CAPT, I DON'T THINK THAT CONTROLLER'S GOT THE FOGGIEST WHAT A BLACKBIRD IS OR WHAT IT CAN DO!



WHAT'S THE SR-71'S CALLSIGN?
HABU 29.

HABU 29, UNDERSTAND YOU ARE REQUESTING 120 THOUSAND. IS THAT AFFIRM?



THAT'S AFFIRM, CENTER...

WELL, IF YOU THINK YOU CAN MAKE IT, GO AHEAD AN' TRY.
HEH HEH

ROG. THIS IS HABU 29 OUTTA 140 THOUSAND FOR 120.



THANKS TO CAPT. NEWT HUNEYCLITT, 145 TAG NCANG
Bob Stevens

MILSTAR



IF THEY'RE OUT OF TOUCH, THEY'RE OUT OF ACTION.

Satellite communications are essential for keeping some U.S. military forces connected to their chain of command. If those communications were ever cut off, some of our forces would be impaired.

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It's as simple as this. Our forces can't be effective if they can't communicate. By providing secure and survivable communications, Milstar will help ensure that a breakdown like this never takes place. That's why America needs Milstar. Few other programs are so vital to our national defense.

For more information contact: Collins Defense Communications, 3200 East Renner Road, Richardson, Texas 75081, (214) 705-3950.



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