JUNE 1990/$2

AIR FORCE MAGAZINE

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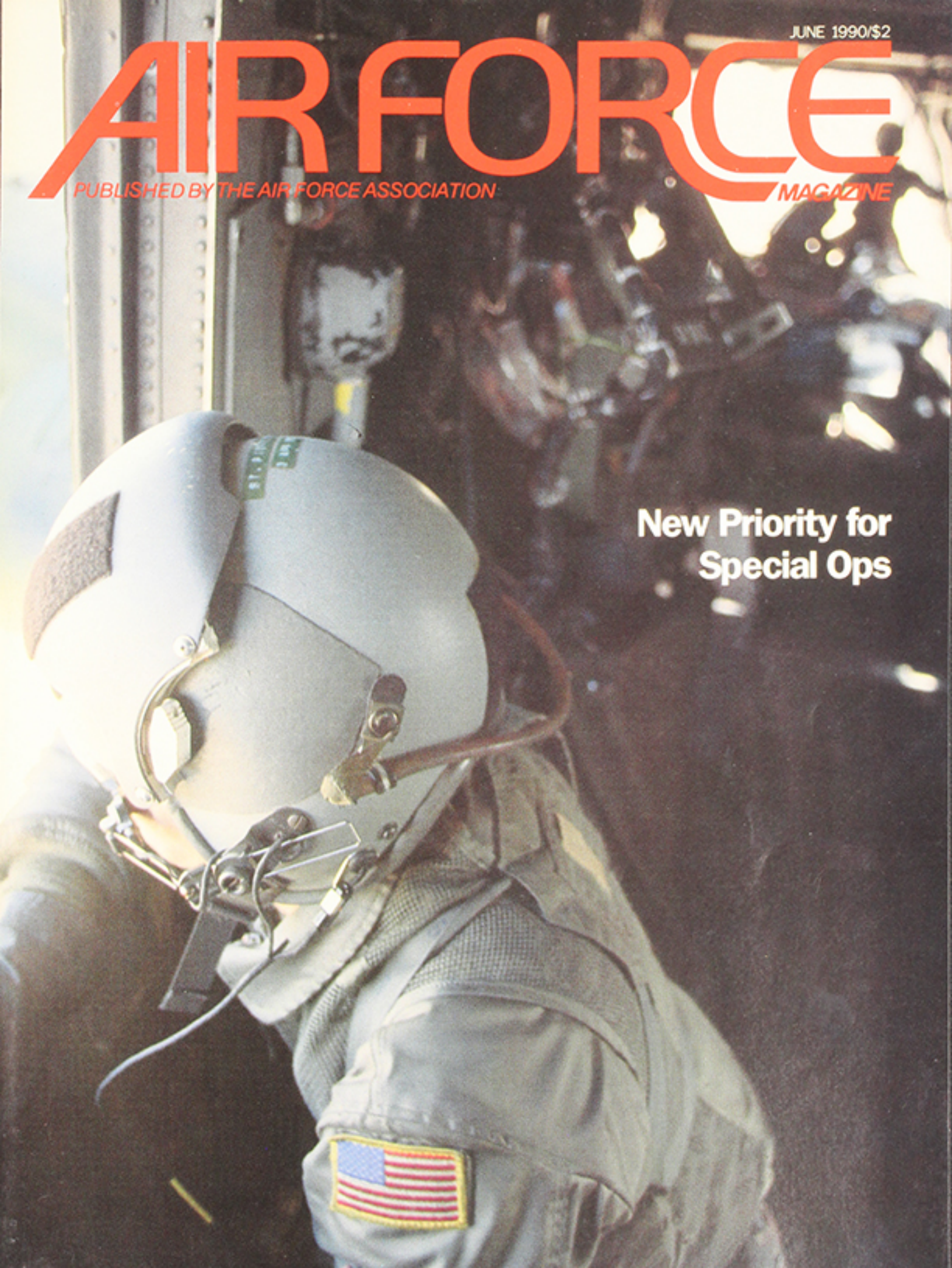

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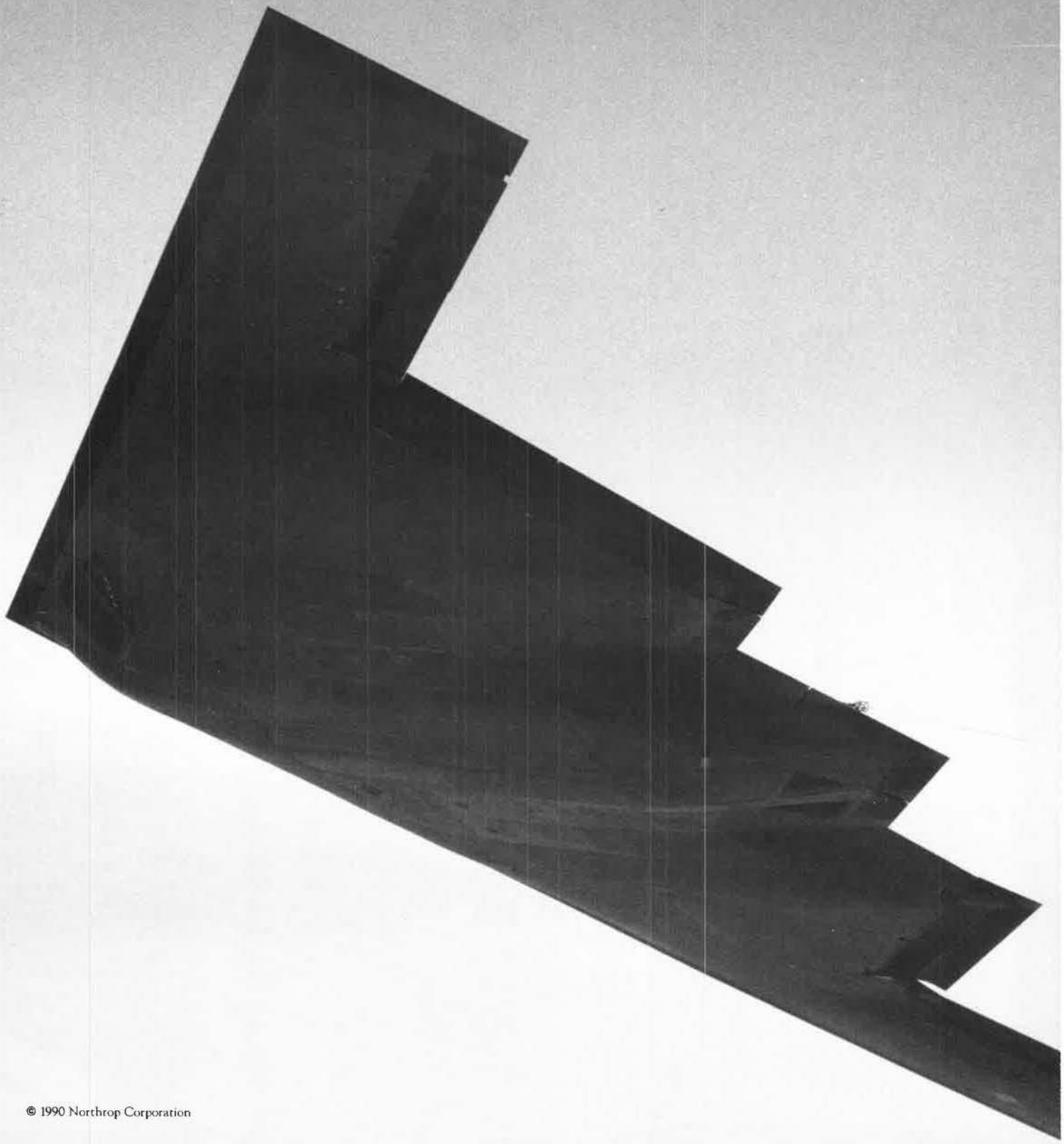

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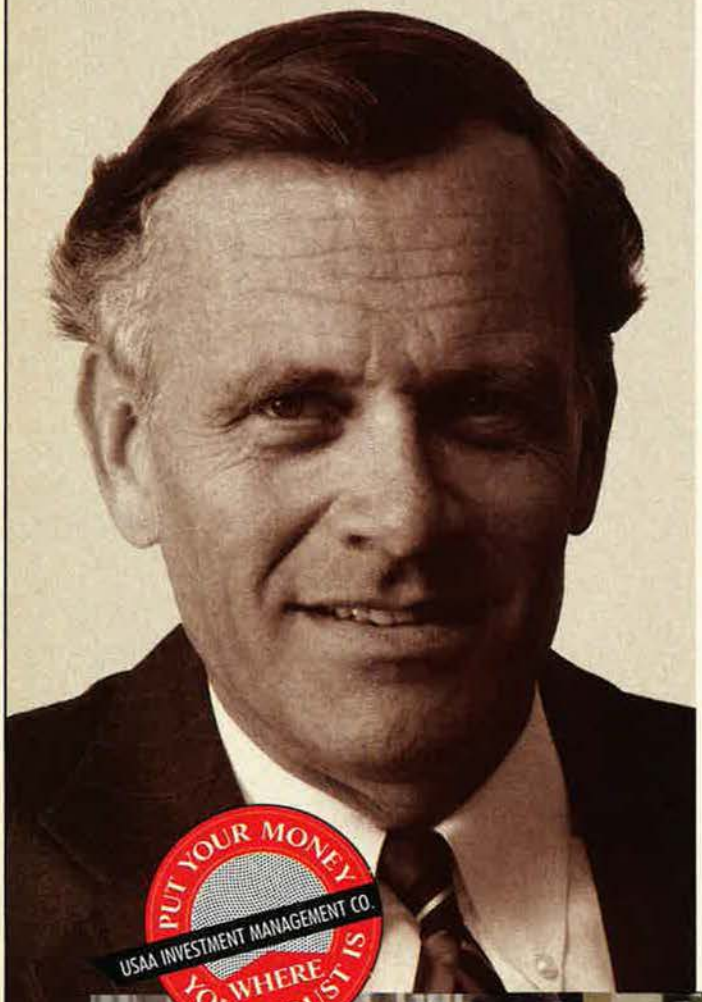

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JUNE 1990
VOLUME 73, NUMBER 6

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About the cover: SSgt. Laurent St. Pierre, a scanner, peers out the window of an MH-53J helicopter. His job is to watch and warn the pilot of hazards not visible from the cockpit. Behind him, Navy SEALs catch a nap. Cover photo by Guy Aceto.

New Emphasis on Special Operations

Departments

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Editorial

By John T. Correll, Editor in Chief

Sam Nunn's Defense Strategy

DISSATISFIED with the caliber of what he was hearing from the Pentagon, Sen. Sam Nunn (D-Ga.) decided to try his own hand at drafting a defense strategy attuned to the times. He disclosed the conclusions in four major speeches to the Senate in March and April.

It is an impressive body of work: comprehensive, tightly reasoned, and coherent. Coming as it does from the most respected voice in Congress on defense matters, it may be the most accurate preview yet of what lies ahead for the armed forces.

Senator Nunn prescribes a smaller and leaner military. Unlike those who slash at defense blindly, though, he surveys the threats, requirements, and programs fully, rather than poking at isolated parts. He also recognizes the scope of Soviet military power that will remain when drawdowns and arms-control reductions are done.

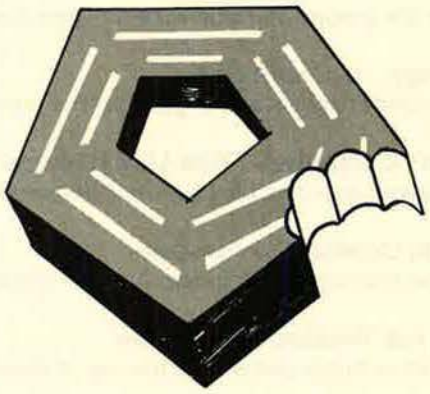
Pitting the potential threats against requirements that range from defense of the American homeland to "forcible entry in small or medium-scale contingencies," Senator Nunn arrives at his alternative strategy. It groups into five "essential elements":

Deterring with less. Nuclear deterrence must continue as "the critical underpinning" of US strategy, but Senator Nunn argues that it can be achieved with fewer weapons and greater stability. He would "slow down" the Peacekeeper rail-garrison ICBM and seek an arms-control ban on land-based ICBMs with multiple warheads. The single-warhead Midgetman might be deployed initially in existing Minuteman silos.

Fewer forces abroad. Gradually reduce US troop strength in Europe to 75,000–100,000. Those remaining overseas would be mainly lead elements of combat and support forces, structured to receive reinforcements. Some bases might be manned by austere rotational units. Allies would assume larger defense roles in their regions.

Reliance on Guard and Reserve. Unless there is a clear reason to keep a mission in the active forces, consider its transfer to the Guard or Reserve. Senator Nunn says that the Air Force uses air reserve force components effectively, but that the Navy "must get more serious."

"Flexible readiness." Keep high-priority forces at full readiness, holding others at an adjusted level of readiness with a mission to "be ready to get ready." Applied wisely, Senator Nunn says, this approach need not lead to "hollow forces." The other choice, he says, will be deep cuts in force structure.



Managing and modernizing. Retire such older, high-maintenance systems as the B-52 bomber and the RF-4 reconnaissance aircraft. Emphasize upgrades to existing systems. It might be possible, Senator Nunn suggests, to improve the F-15 and F-16 sufficiently to defer the Advanced Tactical Fighter (ATF). Seventeen modernization programs are on his list for more deliberate scrutiny, now that a reduced threat "means we do not have to rush to buy a weapon system." Substantial investments are indicated in sensors, "smart" weapons, simulators, and "leapfrog" capabilities that promote technological advantage.

This strategy Senator Nunn believes, would provide an adequate defense and might also save up to $255 billion in budget authority ($190 billion in outlays) over the next five years. At the same time, he warns against frantic efforts to cut the defense budget and offers a tutorial for those who believe a quick peace dividend in the $20 billion range can be had from 1991 defense outlays.

(The federal deficit crisis revolves around outlays—funds actually disbursed during a year—rather than budget authority, which is authorization to spend, with outlays perhaps spanning several years.)

Careful to note that he does *not* endorse them, Senator Nunn cited examples of actions that would achieve only modest savings in 1991 outlays. Putting 100,000 active-duty troops out of service involuntarily would yield $1.4 billion—and less if enlisted members thus dumped get severance pay. Laying off 100,000 civilian employees would save $1.8 billion.

Pickings are likewise slim in the procurement account, which spends out slowly. To save $3 billion in 1991 outlays, it would be necessary to cancel the B-2 bomber, rail-garrison Peacekeeper, Trident submarine, D5 missile, *Seawolf*-class attack submarine, C-17 airlifter, LH helicopter, National Aerospace Plane, ATF, F-15, F-16, F/A-18, and AV-8B aircraft, M1 tank, Bradley Fighting Vehicle, and assorted surface ships.

There are shaky spots in Senator Nunn's strategy. If things turn sour, rebuilding US forces may be more difficult than he makes it sound. The industrial base will be scattered and the trained manpower demobilized.

What if our allies refuse the roles assigned them in the strategy? We defend allied interests because doing so is in our own interest. Our global presence may shrink, but our global interests will not.

If the Soviets keep developing new weapons while we hold back, they could be the technological leapfroggers and we the leapfrogged.

There is no chance that Senator Nunn's strategy will be adopted without much amending, patching, and debate—but it may well be the departure point from which the defense program of the future arises. If Secretary of Defense Dick Cheney has a more credible plan, he had better trot it out. ■

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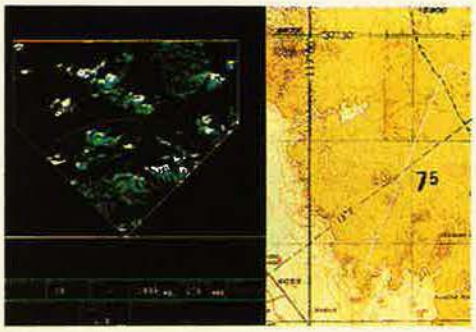

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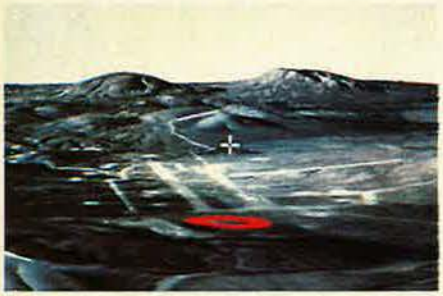

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Letters

Love-Hate Relationship

The American body politic has a love-hate relationship with national security. They love a strong, capable national defense establishment, and they love it when American GIs are successful. Yet at the same time they only reluctantly accept the burden of maintaining that capability. There are two realities concerning resources that derive from this love-hate relationship. First, significant national resources will continue to be dedicated to the nation's security. Second, a significant reduction will be made in those resources. Economics—particularly the deficit—would dictate reduced security spending even if the threat were not perceived to have changed.

The senior civilian and military establishments in this Administration accept, understand, and can manage the transition to a smaller defense establishment—if they are permitted to. The Administration carefully and deliberately develops programs to meet the threat and to support the strategy. It does this in a fiercely competitive process that determines which programs are to be cut and which are to be supported. Not everyone is pleased with all of the specifics, but the programs are balanced to best fit national security interests.

Then a whole new resource allocation process begins—in Congress. In compliance with its Constitutional mandate to raise armies and maintain the Navy, Congress has micromanaged the defense budget down to the eaches: one each rifle, one each aircraft, one each destroyer. I do not challenge the congressional prerogative and obligation to determine the national budget. However, I am frustrated when the same Congress that dictates jointness among the military services permits and encourages narrow, local political concerns to have more influence on the defense budget than do national security considerations. In Congress, national security strategy is second only to the strategy of constituent satisfaction.

The public's perception of a greatly reduced threat and Congress's desire to carve a peace dividend and [payment of] the national deficit from the Defense Department budget *[see "Editorial: The $64 Billion Question," March 1990 issue, p. 2]* dictate that a new national security strategy must emerge. We cannot have a strategy of nuclear deterrence and forward defense if as a nation we choose not to fund the necessary forces. We cannot ask our military to support with their lives a strategy that we as citizens refuse to support with our tax dollars.

Our current strategy has been effective for more than forty years because it has had public support. I believe that support is eroding. Developing a new strategy is a slow, iterative process. In our society, that process should be open—it should be publicly deliberated. Without public debate in Congress, in newspapers, in groups like the Air Force Association, . . . the new strategy will evolve without public understanding or support. A strategy not supported by the public is a sham—it cannot be effective.

We as individuals, and the Air Force Association with the aggregate strength of our voices, must demand public debate. The most important mission of the Air Force Association will be to insist upon, to participate in, and to mold that debate. Each of us must get involved.

Maj. Gen. Richard B. Goetze, Jr., USAF (Ret.)
Fairfax Station, Va.

Standoff or Not Standoff

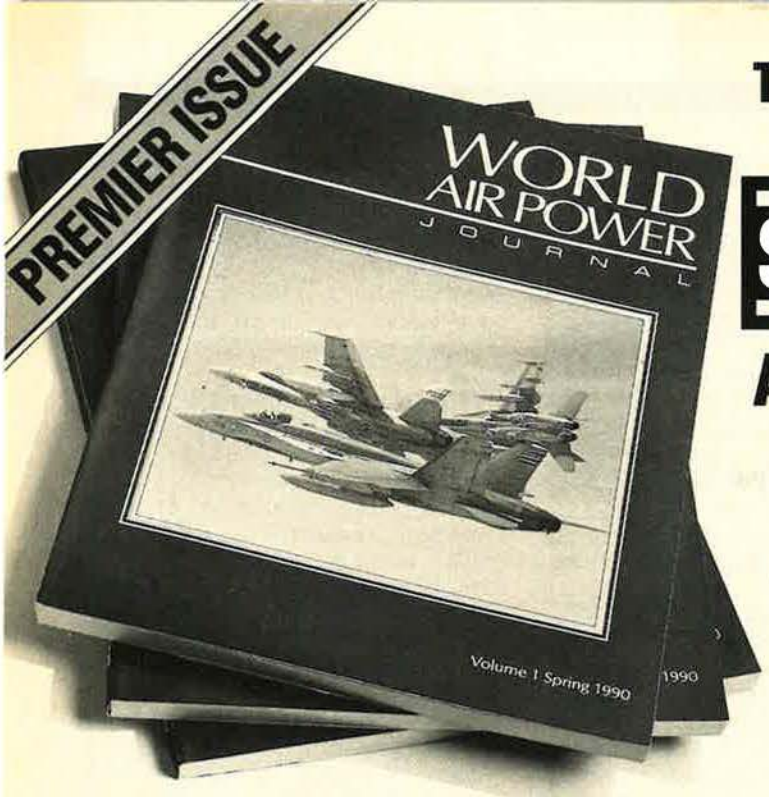
I feel compelled to address several apparent inaccuracies in Mr. Canan's "Comeback of the AGM-130" in the April 1990 issue *[see p. 50]*.

Do you have a comment about a current issue? Write to "Letters," 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. We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Photographs cannot be used or returned.—THE EDITORS

His comments specifically addressing the AGM-130 program seem to be accurate on most counts. Additionally, his praise for Col. Glenn Vogel, Lt. Col. Joe Banks, Wanda Kaus-Hagen, and the rest of the MSD team is understated and long overdue. However, the comments regarding the Air Force and its standoff weapon (SOW) inventory are grossly misleading, in my opinion. I was disappointed by the tone of the article, which suggested that, as a result of the AGM-130, "the Air Force finally became a believer in standoff weapons."

The story of the AGM-130, risen from the ashes, and the fact that it delivers a 2,000-pound warhead over twenty miles are impressive, but I would hardly call the AGM-130 program "pivotal," as Mr. Canan does. The history of standoff weapons in the Air Force is a long and successful one. Let us not forget glide bombs, Harpoon, Maverick, Shrike, Standard Arm, High-Speed Antiradiation Missile (HARM), and Short-Range Attack Missile A (SRAM-A) in the air-to-surface role or the Sidewinder and Sparrow in the air-to-air game. Whether conventional or nuclear, all are SOWs currently in the Air Force inventory, as is the nuclear capable Air-Launched Cruise Missile (ALCM). Those, like Mr. Canan, who discount Air Force support of SOWs and claim that the Air Force "is reluctant to tap the potential of standoff weapons" have forgotten early SOWs, like Falcon and Bullpup, and that SAC has continuously employed standoff weapons, in one form or another, since the Hound Dog entered the inventory in 1961.

Mr. Canan continued to err with the comment that SAC has "but one nonnuclear standoff weapon, the Israel-made, medium-range Have Nap missile." B-52s have been equipped with the conventionally armed Harpoon since 1986. If anything, the AGM-130 is only a by-product of a well-founded belief in SOWs. . . . Saying that failure of the AGM-130 program would have affected the Air Force's confidence in SOWs overlooks the fact that the AGM-130 is only one of many SOWs in development. . . . I don't think the



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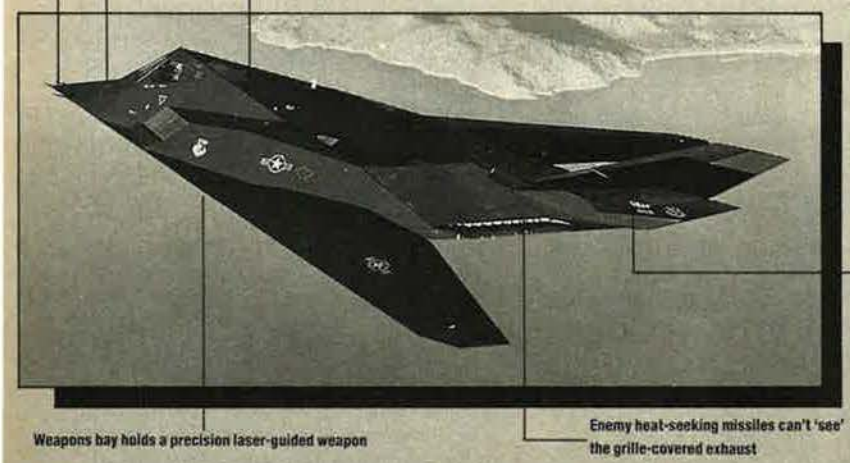

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failure of the AGM-130 would have been the death knell that Mr. Canan would have the reader believe.

In addition to overstating the significance of the AGM-130, Mr. Canan is inaccurate in other claims he makes about this SOW and others. It does not "fly farther than any tactical standoff weapon that the Air Force has ever had." In fact, the range of the AGM-130 is exceeded by tactical missiles such as Harpoon and HARM. He then states that the Navy's Standoff Land-Attack Missile (SLAM) "is roughly comparable in range" to the AGM-130. This is false; as a modification of Harpoon with a Maverick seeker and a Walleye data link instead of the autonomous radar seeker, SLAM has demonstrated a range over twice that of the AGM-130. Mr. Canan also leads the reader to believe that AGM-130's twenty-mile range allows the launch aircraft to "be kept well out of the range of antiaircraft guns or SAMs in the target area." AGM-130s can only achieve that twenty miles from a launch altitude of almost 21,000 feet; all but the stealthiest of aircraft will have their hands full at that range and altitude from the most-current long-range SAMs.

When Mr. Canan discussed "fire and forget" or "launch and leave" capability that "is nowhere to be had . . . in air-to-surface weaponry," he was wrong again. Harpoon, HARM, SRAM-A, and ALCM are all autonomous in this context. . . .

Mr. Canan indicates that SLAM "is expected to cost about $800,000 if put into production." This is only partially true and is misleading at best. The Navy is currently committed to procure only several hundred SLAMs. . . . I wager that if McDonnell Douglas were given a contract for 4,000 SLAMs, the number one defense contractor could produce SLAM for significantly less, and I guarantee the unit cost of the AGM-130 would be significantly higher if Rockwell only produced several hundred AGM-130s. In essence, Mr. Canan was comparing apples to oranges. Finally, I inferred from his comments that SLAM is not in production; there's no "if" to it. According to my sources at McDonnell Douglas, all of the SLAM test flights have been flown with production missiles. . . .

Lt. Col. Chip Frazier,
USAF
Bellevue, Neb.

Mr. Canan replies:

The basis of the story was USAF's admission that it lacks SOWs, as acknowledged by USAF Chief of Staff Gen. Larry Welch and TAC Commander Gen. Robert Russ. The article quoted them, early on and quite specifically, to the effect that USAF had finally figured out how to build SOWs and would now do so and that the success of the AGM-130 exemplified this.

This story was about the need for weapons, such as the AGM-130, that permit their launch platforms to stay well clear of increasingly long-range air defenses. "Close-in" standoff weapons, even if they go several miles, won't cut it and, thus, are no longer considered standoff weapons in the purest sense. USAF sources who were quoted in the story and who read it affirmed that USAF needs weapons—such as the twenty-plus-mile AGM-130—of much greater range than the likes of the GBU-15, Maverick, HARM, and others mentioned by the Colonel. Harpoon, though it has enough range to qualify as "standoff," is not a USAF missile but a Navy antiship missile that USAF has adapted for B-52 maritime missions. SRAM is a standoff weapon, but it is nuclear, and the article addressed the need for nonnuclear *standoff weapons. Have Nap is SAC's only one. As for Bullpup and others of that vintage, I have been around long enough to remember them, and also to wonder whatever became of them.*

Keeping the Faith

John Correll's excellent editorial in the April 1990 issue *[see "Requirements and Wolf Stories," p. 4]* brought back a rush of memories and increased my concern over the inevitable cancellation of needed weapon systems and the criteria for such cancellations.

The E-3 (AWACS), as pointed out in the quote from *The New Republic*, is an outstanding example of a requirement that was only fulfilled through the dogged persistence of a few in the military and industry who believed in the technical feasibility and operational efficiency of such a system. I have a file full of articles and reports such as "The Plane That Would Not Die" gathered in some thirteen years of association with the AWACS program beginning in 1962. They range from the Washington *Post*'s calling the program a "boondoggle" to the negative (and technically inaccurate) GAO reports and include the Scientific Advisory Board's 1963 report, which concluded that the radar performance was not achievable. . . .

A prime example [of distortions by

the system's opponents] is *The New Republic*'s statement concerning AWACS's beginning as a strategic program and changing to a tactical program as the strategic threat diminished, implying that this was done to keep it alive.

This misconception was the bedrock of congressional and GAO arguments against the program for years. The fact is, the first Specific Operational Requirement issued in May 1964 clearly stated a tactical requirement. (I was one of the authors.) Although this was pointed out in testimony after testimony, it was ignored. This is probably not as serious as the performance numbers that the GAO distorted to support its opposition to approving production in 1974. Knowing personally how close we came so many times to the E-3's cancellation, my concern is that these things can happen to current systems under scrutiny.

So how do proponents of current systems "on the bubble" combat such unfair and unscrupulous tactics? I'm too far removed from the battle to offer any advice other than to say to those in the military and industry who truly believe in the operational need for their system, "Keep the faith and hang in there." A bunch of lower-ranking officers and Air Force Department civilians and working engineers from industry kept the AWACS alive, and maybe another miracle can happen for your program!

Maj. James F. Patton,
USAF (Ret.)
Annapolis, Md.

A Fair Shake

Your April 1990 article "Revolution in the Hangar" *[by Douglas Baldwin, p. 78]* was truly an excellent argument for AFLC.

As an employee of the Sacramento Air Logistics Center (ALC), I feel that I should add a few points to the article.

QP4 [quality = people + process + performance + product] works—and works well. The brainchild of General Hansen was a godsend to those of us on the floor doing the work. Pride in workmanship is what it boils down to.

In the Industrial Products Division of the Directorate of Maintenance at Sacramento ALC we have a branch called the "Electric Company." We at the Electric Company are unique in that what we do is done nowhere else in DoD—not Army, not Navy, not Marines, not the Coast Guard.

We rewind and rebuild many electrical accessories used on aircraft, from actuator motor assemblies to fuel-transfer pumps to electrical generators used on many aircraft (from the F-106 to the F-15 and many other types in the inventory today). We also rewind and rebuild the massive ground power units that provide that special power needed by aircraft while on the ground. We also do transformers and radar units. You name it, and we probably do it and do it well.

This is done at a great savings to the taxpayer. Why buy a new generator for the F-15 at $75,000 when we can rewind and rebuild it for about ten percent of the cost?

My advice to Secretary Cheney and those fat-cat congressmen in Washington, D. C., is that before you cut any deeper into the AFLC budget, come to the bases, see what we do firsthand, then make your decisions.

A fair shake is all we ask.

Leland A. Norville
Roseville, Calif.

Not a Machine Gun

In an "Aerospace World" news item on p. 26 of the February 1990 issue, you reported that "American forces patrolling the West German border in the Fulda Gap area have been ordered to leave their *M16 machine guns* in the barracks." (Emphasis mine.)

Well, for one, the M16 is not a machine gun, though it can fire automatically. It is a military rifle or carbine. You could call it an assault rifle if you live inside the Beltway.

Maybe the item should have read, "American forces have been ordered to use sidearms only, leaving their M16s and squad automatic weapons M249 in the barracks."

Good magazine. Keep up the good reporting, keeping the field informed.

Bill Larson
Brindisi, Italy

NATO's New Role

As the metamorphosis in eastern Europe and the Soviet Union continues and even seems to accelerate, it is increasingly popular to regard NATO as an irrelevancy. *[See "War and Peace," March 1990 issue, "Letters," p. 7.]* Such a perception is clearly premature, since the much-publicized drawdown of Soviet forces east of the Iron Curtain has a long way to go. But NATO is important to the United States for political and economic, as well as military, reasons. Its demise would certainly be to our disadvantage on all three counts.

The increasing aid from nations around the world to eastern Europe is in danger of becoming a hodgepodge, because it is not centrally managed. Further, the United States may well fall into the category of "contributing observer," while the European Community attains sharply increased trade with eastern Europe because of its primacy in the aid program.

These problems may have a single solution: The assignment of NATO as the international agency to coordinate and manage all the aid given to the nations of eastern Europe. At first glance, this may sound incongruous, since it is plowshares rather than swords we are talking about. But NATO, with its established organization and lines of authority, could take on the additional economic function with a minimum of disruption.

Col. George Mort Lunsford,
USAF (Ret.)
Redington Shores, Fla.

Rocking Onizuka

I was interested in Col. Jim Grogan's description of the impact and aftermath of the San Francisco earthquake on the Inertial Upper Stage (IUS) Mission and Control Center (MCC) at Onizuka AFB, Calif. *[see "Letters," April 1990]*. It is ironic, but I believe had conventional wisdom been followed several years ago, the IUS MCC would have been located at the Consolidated Space Operations Center (CSOC) near Colorado Springs, Colo. CSOC was built, not only to provide additional MCCs for operational satellites, but to mitigate the potential for MCC damage due to earthquake (and other dangers) inherent at Onizuka. IUS was a prime candidate for assignment to CSOC, but was allocated to Onizuka instead.

Maj. Keith R. Smith, Jr.,
USAF (Ret.)
Agoura Hills, Calif.

Soviet Safety

The article "A Gap in Glasnost" by Vladimir P. Gorshenin in the April 1990 issue, p. 98, was well presented. My main interest was the discussion of the A-20. While stationed at Love Field, Tex., in 1944, with the 5th Ferrying Group, we were assigned to A-20s bound for Abadan, Iran, under Lend-Lease for the Soviets.

The climate in Abadan on the Persian Gulf was ghastly hot. The Soviet pilots flew the accepted A-20s out almost immediately and, as your article relates, with "never the slightest pause for 'revving up' nor in a final check between taxiing and departure." As a navigator, I saw this as lax and dangerous, at the least. The excellent record of "deliveries" over thousands of miles from the US strongly discredits any criticism of the quality of these aircraft.

Kenneth S. McAlpine
Arlington, Va.

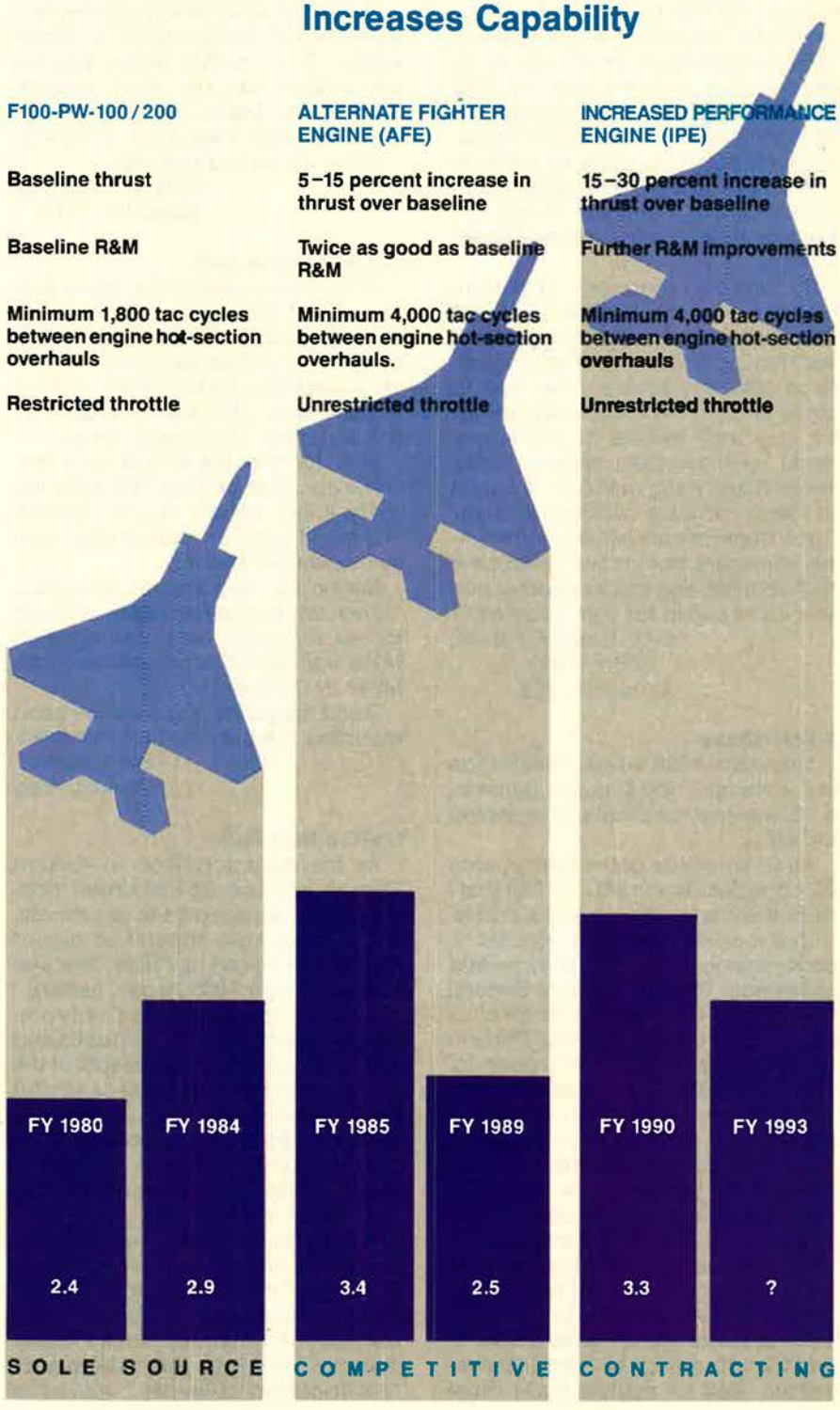
The Chart Page

Edited by Colleen A. Nash, Associate Editor

Competition Saves Money and Increases Capability

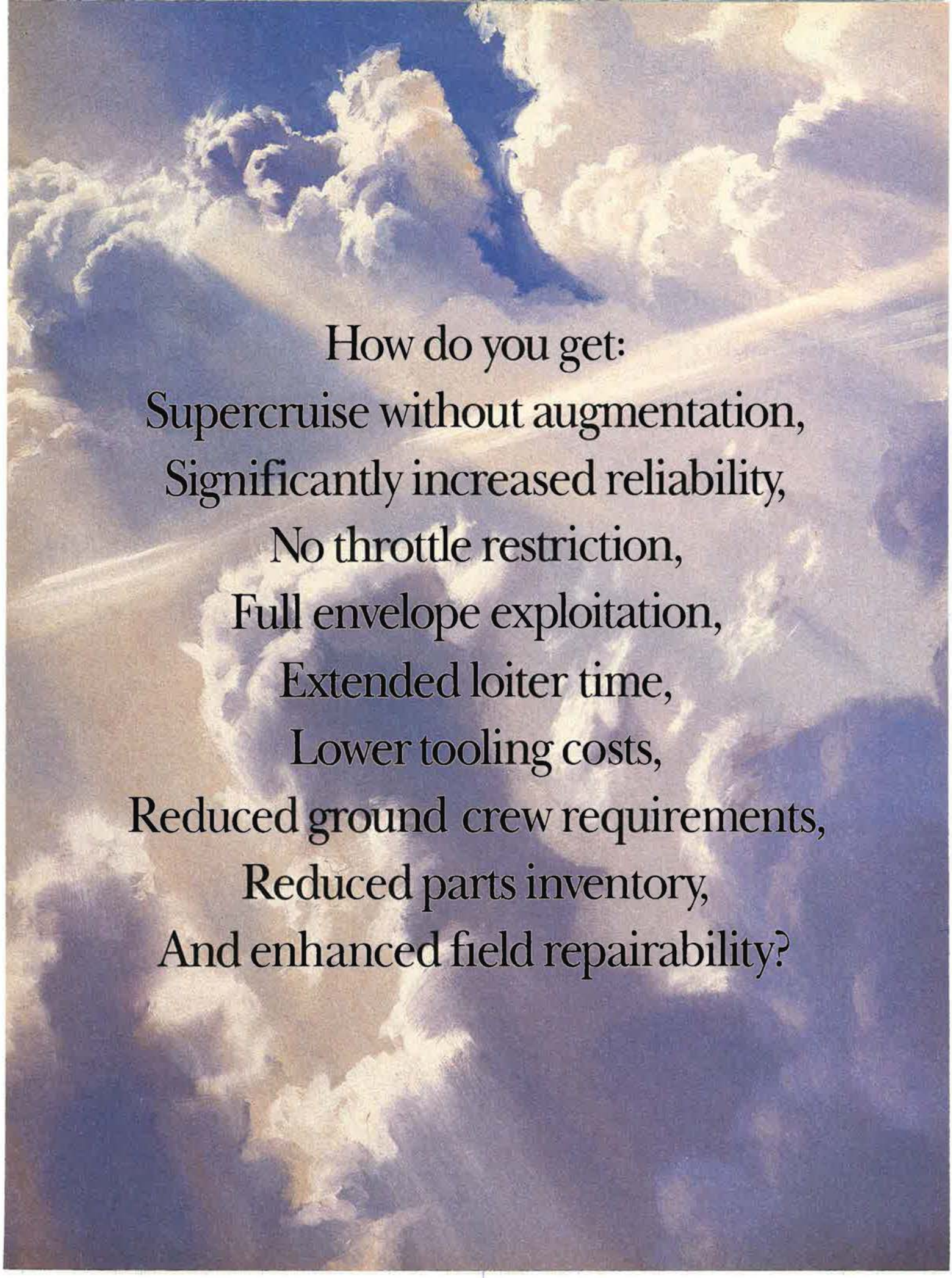
During the sole-source period, the Air Force was buying F-15 and F-16 fighter engines from one supplier, Pratt & Whitney. In 1983, USAF began an annual fighter engine competition in an effort to improve quality and cut costs. In this Alternate Fighter Engine (AFE) program, General Electric entered its F110-GE-100 engines against Pratt & Whitney's F100-PW-220 engines. The Increased Performance Engine (IPE) program will pit GE's upgraded F110-GE-129 engines against Pratt & Whitney's upgraded F100-PW-229 powerplants.

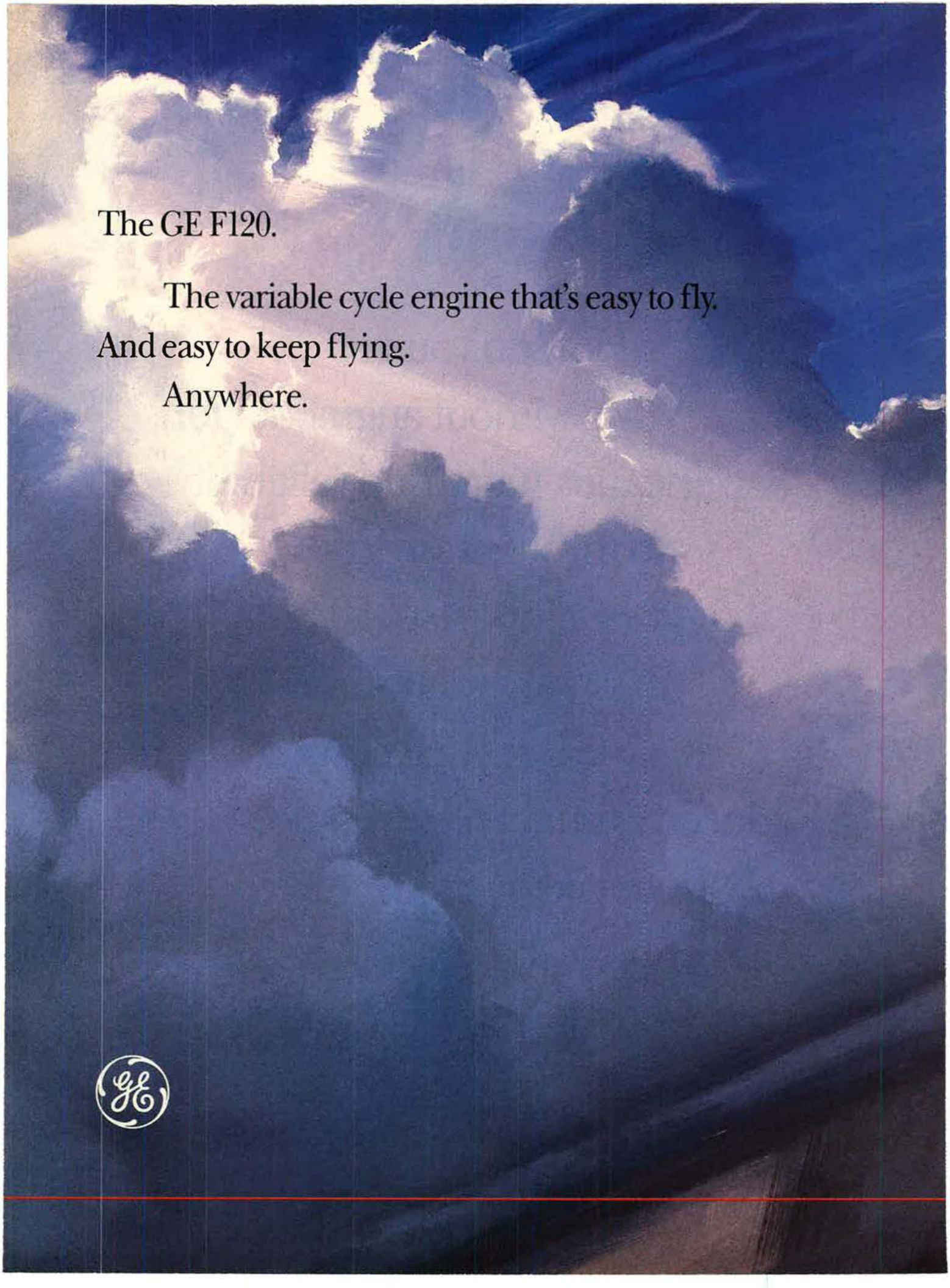
Not only did the Air Force end up paying much *less* for engines once competition began, but engine quality improved as well. USAF expects that, by 1993, it will be acquiring engines significantly more powerful, reliable, and durable than those of 1980.



Average Unit Flyaway Cost (in millions of 1988 dollars)

Source of Data: USAF Aeronautical Systems Division.


How do you get:
Supercruise without augmentation,
Significantly increased reliability,
No throttle restriction,
Full envelope exploitation,
Extended loiter time,
Lower tooling costs,
Reduced ground crew requirements,
Reduced parts inventory,
And enhanced field repairability?


The GE F120.
The variable cycle engine that's easy to fly.
And easy to keep flying.
Anywhere.


GE Aircraft Engines
Keeping the Promise

Capitol Hill

By Brian Green, Congressional Editor

Four Survivors—So Far

The big aircraft programs were cut in the Pentagon review, but all of them emerged alive. Worse could happen in the congressional review, now under way.

Defense Secretary Dick Cheney announced cuts and stretch-outs in four major aircraft programs but refused to cancel any. The move, which followed an internal Pentagon review of the four systems, guarantees a continuation of congressional infighting and political controversy.

At packed hearings before the Senate and House Armed Services Committees in April, the Secretary revealed plans to make deep cuts in the Air Force's B-2 bomber and C-17 airlifter programs, delay production of USAF's Advanced Tactical Fighter (ATF), and trim the Navy A-12/Advanced Tactical Aircraft.

The Secretary projects the moves will save $2.4 billion in budget authority—the amount DoD can obligate today and in future years—in Fiscal Year 1991, $17 billion in FY 1991–94, and $35 billion in FY 1991–97. Outlays (money actually spent in a given year) decline by $109 million for FY 1991.

Rep. Les Aspin, the Wisconsin Democrat who chairs the House committee, asserts that the Cheney plan is still out of step with reality and "based heavily on an unrealistically pessimistic view of the Soviet threat." SASC Chairman Sen. Sam Nunn was more upbeat. The Georgia Democrat praised the plan as a "substantial down payment" on reductions needed to meet lower defense spending targets. Few members of Congress shifted positions on the basis of the proposed program revisions. The revisions included the four programs discussed below.

B-2 Bomber

The stealth bomber program declines sharply, from 132 to seventy-five aircraft. FY 1991 procurement drops from five aircraft to two, and maximum annual production falls from twenty-four to twelve. Total program cost, once $75.4 billion, is reset at $61.1 billion.

Secretary Cheney says he based his recommendation on the calculation that two operational wings of thirty aircraft each, plus fifteen training and maintenance aircraft, would provide an acceptable number of B-2s. The fleet, he claims, would be large enough to enhance deterrence, put pressure on Soviet air defenses, and justify a complex support infrastructure. He suggested that the requirement for 132 B-2s was obviated by changed strategic conditions, noting that US strategic nuclear targeting plans are under review. He said that potential B-2 targets, such as Soviet divisions assigned to eastern Europe, are being reduced and that strategic targets were expected to decline after the START Treaty is ratified.

Secretary Cheney argued that the US must maintain an effective penetrating bomber force. Without one, he added, Soviet defenders could concentrate on defeating cruise missile carriers such as the B-52. B-2 conventional capabilities, he added, will become "increasingly important as forward forces decline and the need for rapid, decisive global power projection increases," but he emphasized that the B-2 was first and foremost a strategic nuclear weapon.

C-17 Airlifter

Cheney's plan cuts the projected buy of C-17s from 210 to 120 aircraft. FY 1991 acquisition falls from six C-17s to only two aircraft. Peak production declines from twenty-nine to twenty-four aircraft a year. Total C-17 program cost, once pegged at $41.8 billion, falls to $29.9 billion.

In effect, the C-17 reduction caps the cargo-carrying capability of Air Force airlift at today's 48,000,000 ton-miles per day and abandons the goal of 66,000,000 ton-miles per day. New C-17s would replace capacity lost by retirement of older planes.

Secretary Cheney justified C-17 reductions by pointing to what he saw as a reduced requirement for rapid reinforcement of Europe. The US was committed to moving ten divisions within ten days of a decision to mobilize. The Secretary says that, given the disintegration of the Warsaw Pact and the disengagement of many Soviet troops from eastern Europe, warning time now is much longer. Conflicts in the Third World will require rapid airlift, said Secretary Cheney, but these actions would not be as demanding as war in Europe.

The Pentagon leader argued that airlift was a national asset, useful not only for war but also in other crises. The unique attributes of the C-17—high payload, maneuverability on the ground, ease of loading and unloading, and ability to use short or rough runways—add substantially to US capabilities. Secretary Cheney left the door open for a buy of more than 120 C-17s, if Congress agrees.

Advanced Tactical Fighter

Production of the Air Force's next-generation air-superiority fighter would be delayed by two years, from FY 1994 to FY 1996. The requirement for 750 ATFs was not revised, but Secretary Cheney warns that it is a "very notional number" and could be changed later.

Secretary Cheney claims the production slip will "permit orderly completion of the [ATF's] demonstration/validation phase and a gradual production profile" and "should substantially reduce concurrence [simultaneous procurement and development of a system] and facilitate orderly testing." The maximum annual production rate drops from seventy-two to forty-eight.

The ATF delay, Secretary Cheney argued, could be accommodated as a result of the lower probability of conflict in Europe, reduced Soviet/Warsaw Pact air and ground threat in eastern Europe, and delays in the fielding of new Soviet tactical aircraft. The expected delay in introduction of next-generation Soviet aircraft, he noted, stems from massive Soviet economic problems. He also noted that there are "indications" that the F-15 airframe life could be extended from the cur-

rently projected 6,000 hours to 8,000 hours.

The Defense Department chief maintained that he approved changes in the ATF program only with "great reluctance" because he remains convinced of the critical nature of air superiority for success on the battlefield. He noted that Soviet aircraft deployments tend to lag behind US deployments by some eight to ten years, but that new Soviet MiG-29 and Su-27 aircraft have "reached essential technological parity" with F-15 and F-16 fighters. He also pointed out that the Soviets have exported hundreds of their most modern aircraft.

Production of a Navy variant of the ATF, slated to replace the F-14 Tomcat on aircraft carriers, also slips two years, from FY 1998 to FY 2000. In addition, the Navy requirement was reduced from 618 to 546 aircraft, contingent on a reduction in the number of carrier battle groups from today's fourteen to twelve and perhaps fewer. The possibility of using variations of the Navy's F-14 and F/A-18 for the new fleet-defense aircraft was examined and found wanting. However, said Secretary Cheney, "new capabilities . . . in the [forthcoming] A-12 . . . may be able to pick up some of that slack" in fleet air defense before introduction of the Navy ATF.

A-12 Attack Aircraft

Secretary Cheney's plan keeps the Navy A-12, the stealthy replacement for the current carrier-based A-6 aircraft, on its current production schedule. The Defense chief proposed reducing the total A-12 buy from 858 to 620 aircraft and cutting the maximum annual production rate from forty-eight to thirty-six. Total program cost for the 620-plane A-12 program would be $52 billion, of which $5.1 billion has already been spent.

The reduction of the A-12 requirement, says Secretary Cheney, is based on two factors: the projected decline in the size of the Navy's carrier fleet and the decision of the Marine Corps to forgo its planned use of the new aircraft. Keeping the A-12 on schedule was critical, according to Secretary Cheney.

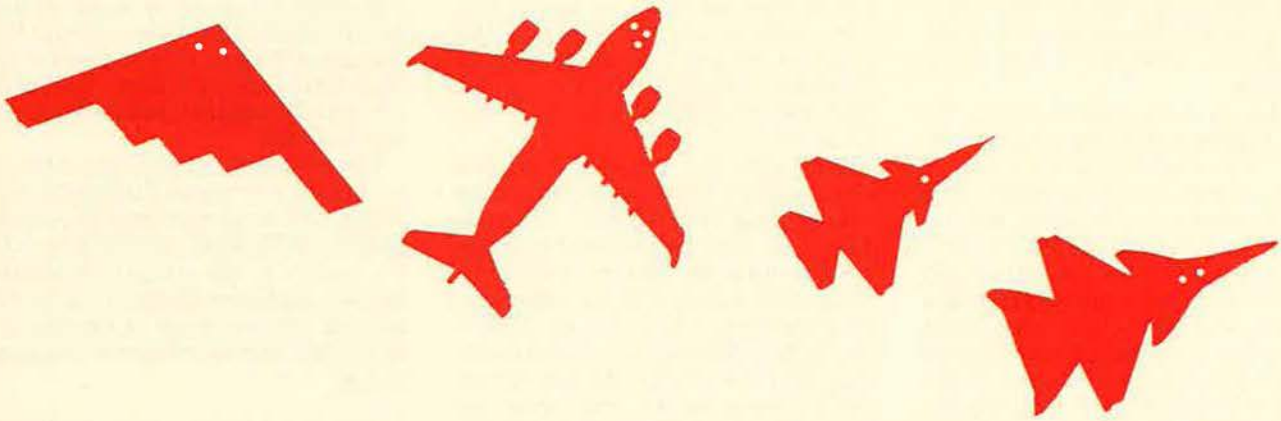
The Cheney plan also defers initial procurement of the Advanced Tactical Aircraft (the generic name for a prospective Air Force variant of the Navy bomber). Plans call for the ATA to replace the aging F-111 and FB-111 aircraft now in service. ATA production, once set to begin in 1993, slips beyond 1997, the last year of the upcoming 1992–97 six-year defense plan. The Pentagon gave no firm date for initiating production. The Air Force requirement for 400 aircraft remains in force, but Secretary Cheney says it is subject to change.

The ATA delay was justified on the basis of the reduced threat in Europe and lessened need to interdict massive Soviet and Warsaw Pact forces moving against NATO. The Secretary argued that the Air Force has many assets capable of fulfilling many of the ATA's proposed missions. These assets, he said, include the F-111, the F-117A, and F-15E. He contended that Navy experience with the A-12 would provide valuable experience for the Air Force prior to ATA acquisition. "It's important . . . to keep the Air Force connected to this program," said the Secretary.

Reactions

Congressional reaction to the Cheney proposals was muted and focused on the cost of program stretchouts and the justifications for shifting requirements.

Lawmakers were quick to note that the Cheney proposals greatly increase the unit costs of the aircraft. "On all these programs," complained Rep. John Kasich (R-Ohio), "you've cut them a little bit and you're stretching them a lot, and when you cut and stretch, you drive up the cost."



Under the revised program, the cost of each B-2 bomber rises from $570 million to $815 million and each C-17 airlifter from $200 million to $250 million. Says Sen. Carl Levin, a Michigan Democrat serving on the Armed Services Committee, "Eight hundred million dollars a copy raises immense problems for me."

Other members question the credibility of the new lower requirements. "If we can go from 132 [B-2s] to seventy-five, I may start saying, 'Well, maybe sixteen is fine,' " Sen. Trent Lott (R-Miss.) told the Secretary. Bills before the House and Senate propose to terminate the B-2 program at sixteen aircraft.

Several congressional insiders suggest that Secretary Cheney's proposals may have done little good for the aircraft programs, inasmuch as Congress is likely simply to pocket his concessions and use them as new points of departure in further negotiations to cut the defense budget. Secretary Cheney himself sees major problems ahead. His words: "You think I got troubles now, wait until Congress passes [even deeper cuts in its] budget mark for '91." ■

Aerospace World

By Jeffrey P. Rhodes, Aeronautics Editor

★ Ten years after development of the Hubble Space Telescope (HST) began, the $1.7 billion instrument was finally placed in orbit during space shuttle mission STS-31 in late April. The thirty-fifth shuttle mission was a great success, despite two major delays and a frustrating series of minor problems.

In late January, concerns that the lower segment of the right solid rocket booster had not been properly leak-checked prompted NASA officials to replace the segment and the nozzle. This delayed the launch for a month. Loading the 25,500-pound HST in *Discovery's* payload bay was delayed when the "clean room" used for payload preparation was invaded by midges (tiny two-winged flies). Preparations then went well, and the launch date was actually advanced two days to April 10.

Four minutes before liftoff, a valve in an auxiliary power unit failed, and the APU had to be replaced. Once in space, the shuttle only needs two APUs working, but safety-of-flight rules require three operative APUs at launch. This marked the first time an APU was replaced on the launchpad. The 42.5-foot-long HST's six nickel-hydrogen batteries were taken out and recharged. The batteries were needed to warm the telescope's instruments in orbit before its solar panels, which generate needed electricity, were unfurled.

Discovery lifted off for the tenth time (which ties the record for launches held by *Challenger*) at 8:34 a.m. on April 24. A computer glitch at T minus thirty-four seconds threatened to postpone the launch, but the affected system was recycled, and the countdown was able to proceed. The orbiter was placed in a 330-nautical-mile orbit, the highest ever for a civilian shuttle mission.

The next day, with the payload bay facing Earth, astronaut Steven Hawley (aided by Marine Col. Charles Bolden, *Discovery's* pilot) used the orbiter's remote manipulator arm to grapple the telescope out of the payload bay. The forty-foot-long solar panels then began to unfurl, much like a window shade, but one panel got stuck one fifth of the way out. Astronauts Bruce McCandless, a Navy captain, and Kathryn Sullivan, who were standing by in spacesuits in preparation for such an eventuality, got ready to go out to repair the problem, but ground controllers fixed it before that became necessary. The HST was released at 3:38 EDT over Ecuador.

Air Force Col. Loren Shriver, the mission commander, then backed the orbiter away from the HST. The crew flew forty miles behind the telescope for the next two days so that if anything went wrong with the telescope, they could fix or retrieve it. While waiting to be released from stationkeeping, the crew conducted several scientific experiments. Once done, the crew flew the orbiter under the telescope and prepared to return to Earth.

The telescope, which scientists think will be able to see fourteen billion light-years into space, proved temperamental in its first couple of days, as the HST's on-board computer overrode ground commands that it deemed dangerous. Ground controllers had difficulties opening the telescope's "lens cap" and had significant problems getting one of the two high-gain antennas to work. It will take the telescope's controllers at the Goddard Space Flight Center in Greenbelt, Md., up to eight months to get the HST desensitized and operating normally.

The veteran crew brought *Discovery* in for a landing on Runway 22, the 15,000-foot-long concrete runway at Edwards AFB, Calif., at 9:50 a.m. EDT on April 29. On rollout, Colonel Shriver used most of the runway, as he applied minimal force to test the orbiter's new carbon-carbon composite brakes.

★ Things have been busy in the world of unmanned spaceflight as well. Here is a brief rundown:

On April 5, the **first launch of the Pegasus air-launched winged space booster was a success.** After takeoff from NASA's Dryden Flight Research Facility at Edwards AFB, Calif., pilot

The Hubble Space Telescope (at left, over chalky spot) floats free of Discovery's remote manipulator arm (right) after release of the 42.5-foot-long instrument on April 25. The Lockheed-built HST is expected to have a useful life of fifteen years. This photo was taken by a member of the crew some 330 miles over Ecuador.

Gordon Fullerton flew the NB-52 to a point sixty miles southwest of Monterey, Calif. There, at an altitude of 43,000 feet, Pegasus was released from under the NB-52's wing at 12:10 p.m. PDT. The booster fell for several seconds, then ignited. The first stage carried the 41,000-pound rocket to an altitude of nearly 250,000 feet. The second and third stages then carried the 422-pound, three-function Pegsat payload into a 320-mile polar orbit. Pegsat consists of an experimental Navy communications satellite, two canisters of barium for a NASA atmospheric experiment, and instrumentation to measure in-flight stresses on the vehicle. Pegasus, a joint venture between Orbital Sciences Corp. and Hercules, is designed as a low-cost way to boost small payloads. Each launch will cost about $7 million.

The **seventh Navstar Global Positioning System satellite was successfully launched** on March 25 after two postponements. The Rockwell Block II GPS satellite was carried aloft by a McDonnell Douglas Delta II booster that lifted off from Launch Complex 17 at Cape Canaveral AFS, Fla. It was the third successful Navstar launch this year. The twenty-one operational GPS satellites and three on-orbit spares will be placed in six different orbital planes at an altitude of 10,900 nautical miles to provide highly accurate navigational data.

Two commercial satellites that had been in space before got second chances in early April. The satellites, built by Hughes, had been released from the space shuttle on Mission 41-B in 1984, but were stranded in useless orbits because their upper stages failed to ignite. The satellites were retrieved by the Mission 51-A astronauts and brought back to Earth. On April 7, Westar VI, now known as Asiasat, was carried aloft by a Chinese Long March II booster launched from the remote site at Xichang. Special precautions were taken so that no US satellite technology was transferred to the Chinese. On April 13, Palapa B2R was launched on a Delta II from Cape Canaveral.

General Dynamics test engineer Rich Fagan inspects strain gauges that measure contraction and expansion of the stainless-steel structure of the Centaur upper-stage space booster. The Centaur, built in San Diego, Calif., is used to boost payloads to geosynchronous orbit after launch from a Titan IV space booster.

The **nineteenth consecutive successful Atlas launch from Vandenberg AFB, Calif., was carried out** on April 11. The Atlas-E vehicle (designated Atlas 28E) was originally built as an HGM-16 intercontinental ballistic missile in 1961. After refurbishment as a booster, it was redelivered to the Air Force in 1987. The Atlas carried a combined Air Force/Navy payload (nicknamed Stacksat) that was actually three small satellites containing four atmospheric and geodetic experiments. Seven Atlas-Es remain to be launched.

★ **APPOINTED—Gen. Michael J. Dugan,** currently Commander in Chief of United States Air Forces in Europe, has been selected to become the thirteenth Air Force Chief of Staff. He will replace Gen. Larry D. Welch, who will retire June 30. **Lt. Gen. (Gen. selectee) Mike Loh,** currently the Commander of Air Force Systems Command's Aeronautical Systems Division, will become the new Vice Chief of Staff upon the retirement of Gen. Monroe W. Hatch, Jr.

★ **AWARDED—**The **96th Bomb Wing B-1B crew** that made a successful emergency landing at Edwards AFB, Calif., last October 4 after their aircraft's nosegear failed to extend **has been named as the winner of the Mackay Trophy** for 1989. The crew, based at Dyess AFB, Tex., was cited for demonstrating the highest standards of airmanship and professionalism during the flight and subsequent landing that resulted in minimal damage to the aircraft and no

The latest Escape and Evasion chart is much more than a map. It contains information on vegetation, celestial navigation, and first aid. The muted colors serve as camouflage, and because it's made of spun olefin, it's waterproof. The new E&E charts, five years in development, are printed by the Defense Mapping Agency.

injuries. The Mackay Trophy is presented annually by the National Aeronautic Association to the Air Force crew that makes the most meritorious flight of the previous year. *[See "Aerospace World," December 1989 issue, for more information on the flight and landing.]*

Dr. Lew Allen, head of NASA's Jet Propulsion Laboratory and former Air Force Chief of Staff, **was awarded the Robert H. Goddard Trophy** in ceremonies March 16. Dr. Allen was cited for his distinguished and significant contributions to the nation's advancement in space, both during his thirty-six-year Air Force career and for his work since 1982 at the Pasadena, Calif., laboratory. The Goddard Trophy is presented annually by the National Space Club and is awarded to individuals who have made great achievements in advancing spaceflight programs contributing to US leadership in astronautics.

The maintenance complex of the **28th Bombardment Wing** at Ellsworth AFB, S. D., has been named the **Daedalian Maintenance Award winner for 1989.** The award recognizes the most outstanding maintenance organization in the Air Force for the previous fiscal year. The award has been presented since 1974 by the Order of the Daedalians, an organization started by pilots who flew in World War I.

Tactical Air Command claimed the top two Air Force safety awards for 1989. TAC's ground, weapons, and flight safety programs topped the other major commands' for the Secretary of the Air Force Safety Award. TAC greatly reduced off-duty fatalities and weapons mishaps last year and recorded its best fiscal year, in terms of fewest accidents, in 1989. Air Force Systems Command took the Secretary's Safety Award for Category II commands (those that fly fewer hours than the operational commands). TAC's flight safety program was also honored as the Maj. Gen. Benjamin D. Foulois Memorial Award winner, given to the command with the most effective aircraft mishap prevention program. The Foulois Award is presented by the Daedalians.

★ **PURCHASES—Raytheon's Equipment Division** received a $62.2 million Air Force Systems Command's Electronic Systems Division contract on April 6 **to modernize the one-of-a-kind Cobra Dane phased-array radar** on Shemya AFB, Alaska. The contract calls for installation of new signal and automated data-processing systems, as well as a new receiver, displays, and other equipment in the single-face, ninety-five-foot-diameter radar. Cobra Dane, used to collect intelligence on foreign ballistic missile tests, contains 15,000 active elements and provides 120-degree coverage. The 16th Surveillance Squadron operates the radar, which was built by Raytheon in the early 1970s.

On March 30, **Martin Marietta** signed an $8.9 million contract **with Rafael for coproduction of** the AGM-142A **Have Nap** conventional standoff missile for Strategic Air Command. Rafael, Israel's armament development authority, was awarded a $92 million initial contract for eighty-six missiles and four guidance sets last year. Martin Marietta, brought on as a partner so the missile can meet the "Made in America" act requirements, will initially produce airframe components, but the company's role is expected to increase on future US contracts. Have Nap (originally called Popeye) has a 720-pound, blast-fragmentation warhead, an imaging infrared seeker, and a range of about sixty miles. Operational in Israel, Have Nap will be launched from Air Force B-52s.

Ten firms each received $50 million Air Force Systems Command's Aeronautical Systems Division contracts on April 13 **for collection, testing, analysis, and reporting of hazardous and toxic waste** in water, soil, and sediment at various Air Force locations worldwide. The awards are part of a larger effort by the Department of Defense to deal with hazardous materials that have been stockpiled without treatment at numerous government installations. The firms include Earth-Technology Corp.; Engineering-Science; ICF Technology, Inc.; Jacobs Engineering Group, Inc.; Law Environmental, Inc.; Nus Corp.; O'Brien and Gere Engineers, Inc.; Radian Corp.; Tetra Tech, Inc.; and Roy F. Weston, Inc. The contracts are expected to be completed in April 1995.

Rockwell signed a memorandum of understanding with NASA on April 2 **for development of a cryogenic pallet** that will be a major element of the space agency's extended duration orbiter (EDO) program. This effort will allow for space shuttle missions of up to sixteen days. The pallet will hold spherical tanks of liquid hydrogen and liquid oxygen, valve panels, and avionics boxes. To be installed in the back of the payload bay, the pallet will feed additional cryogenic fluids to the orbiter's electricity-generating fuel cells, allowing the mission to continue beyond the current eight-day maximum. Rockwell will fund the design and construction of the EDO pallet, and NASA will reimburse the company in three yearly installments after delivery in 1991. The first EDO mission will be STS-53, scheduled for March 1992.

LTV received a $2 million LHTEC (Light Helicopter Turbine Engine Company, a joint venture between Allison and Garrett) contract on April 11

—USAF photo by Sgt. David Jablonski

The first 38th Tactical Missile Wing transporter/erector/launcher, with its four BGM-109G ground-launched cruise missiles, is loaded aboard a 60th Military Airlift Wing C-5A on April 11. Twelve other missiles and their TELs were airlifted to Davis-Monthan AFB, Ariz., where they were destroyed under the terms of the INF Treaty.

to reengine one Coast Guard HH-65A Dolphin short-range rescue helicopter. The HH-65 will be reengined with the LHTEC T800 engine designed for the Army's Light Helicopter (LH, formerly LHX) program. The reengine effort, funded by the Army through LHTEC, will enhance the Aérospatiale HH-65A's capability and will give the Army early operational data on the LH engine. If successful, the twenty-month demonstration effort could lead to the reengining of the Coast Guard's entire ninety-six-aircraft HH-65A fleet.

In early April, **Israel became the first foreign country to buy the McDonnell Douglas AH-64A Apache** attack helicopter. The Israeli Air Force will get eighteen AH-64s and spares in a deal worth approximately $150 million. Deliveries of the aircraft will begin in the third quarter of this year, and the first Israeli Apache attack squadron will become operational sometime in 1991. A cadre of Israeli pilots and maintainers will receive training on the AH-64 in the US. The Israelis have unspecified options for additional AH-64s. Egypt and several other countries are also considering a buy of the helicopters. Israel will receive AGM-114 Hellfire antiarmor missiles for its Apaches in a separate Foreign Military Sales deal.

★ **DELIVERIES—General Electric Aerospace turned over to the Air Force the East Coast** Over-The-Horizon Backscatter **(OTH-B) radar** in ceremonies on April 24. The first of four planned OTH-B systems, the East Coast OTH-B covers an area roughly from Iceland to the Caribbean by bouncing high-frequency signals off the ionosphere and collecting the returns. The result is the ability to "see" every aircraft in the coverage area. This leads to a secondary role of tracking suspected drug smugglers in addition to its primary role of looking for Soviet bombers and cruise missiles at very long ranges. The East Coast OTH-B consists of an operations center at Bangor ANGB, Me., a 3,630-foot-long transmit antenna at Moscow, Me., and a 4,980-foot-long receiver 100 miles away in Columbia Falls, Me. After further testing, the AN/FPS-118 radar will be turned over to Tactical Air Command in 1991. The East Coast OTH-B was recently used to help Canadian air traffic controllers find and help land a crippled Cubana Airlines Il-62 that had experienced engine trouble and had descended below normal radar coverage.

Kaman staged a "flyout" of the SH-2G, the latest version of the Navy's Sea Sprite helicopter family, at its plant in Bloomfield, Conn., on March 21. The SH-2G, a much-improved variant of the SH-2F LAMPS Mk. 1 (Light Airborne Multipurpose System) that is used primarily for antisubmarine and antisurface warfare, features an automatic acoustic processor that can monitor four sonobuoys at once, a forward-looking infrared sensor (the same FLIR used in the Air Force's MH-60G), chaff and flare dispensers, and other mission avionics. The major difference in the SH-2G is the installation of General Electric T700-GE-401 engines, which gives the twin-engine helicopter a single-engine capability. Kaman will build six new SH-2Gs and will refit two SH-2Fs. Plans call for the refit of ninety-seven Sea Sprites to the SH-2G configuration.

One coming out, one going in. **Grumman rolled out the first production F-14D** Super Tomcat for the Navy in ceremonies at its Calverton, N. Y., facility on March 26. The F-14D features General Electric F110-GE-400 engines, which allow the aircraft to be catapulted from carriers without af-

FOR SALE.

The Soviet MiG-29 is a potent air superiority fighter. It is exceptionally agile and tenacious in a dogfight, an unflinching equal to Western fighters.

It's also being sold on the open market.

The export of advanced technology and weapons, like the MiG-29, is integral to the Soviet Union's vaunted economic restructuring. And it poses a unique challenge to U.S. air power. For as Third World countries acquire sophisticated fighters and air defense systems, geopolitical instability will increase. So, too, will the likelihood that our tactical fighters may encounter frontline Soviet aircraft outside of Europe.

The United States must stand ready to provide a stabilizing influence, to safeguard our own global interests and those of our allies. Without the ability to unleash potent air superiority, this will be impossible.

We need an advanced tactical fighter with unmatched agility; a stealthy, powerful aircraft to carry the banner of air superiority into the 21st century.

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With this revolutionary aircraft, U.S. commanders will have the flexibility and strength to respond to multiple scenarios, from brushfire skirmishes to all-out conventional conflict.

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ATF AIR SUPERIORITY
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June Anniversaries

• *June 23, 1905:* The first flight of the Wright *Flyer III* is made at Huffman Prairie, outside Dayton, Ohio. The Wright brothers' first fully controllable aircraft is able to turn and bank and remain aloft for up to thirty minutes.

• *June 5, 1920:* A provision in the FY 1921 appropriations bill restricts the Army Air Service to operating from land bases only.

• *June 21, 1930:* The Army Air Corps dedicates its "University of the Air," Randolph Field, outside San Antonio, Tex.,

• *June 11, 1940:* Flying obsolete Gloster Sea Gladiators, three Royal Air Force pilots repel the first Italian air attack on Malta. The first (and only) line of defense for the British garrison on the island, these pilots and their biplanes (which, legend has it, were named *Faith, Hope,* and *Charity*) hold off the *Regia Aeronautica* until reinforcements (four Spitfires and several Hurricanes) arrive on June 28.

• *June 11, 1945:* Crews from the 393d Bomb Squadron (VH) arrive on Tinian in the Marianas after making their way from Wendover, Utah. Their Boeing B-29s, the only combat aircraft assigned to the 509th Composite Group, would later be used to drop atomic bombs on Japan.

• *June 29, 1955:* The Boeing B-52 Stratofortress enters operational Air Force service, as the first RB-52B is delivered to the 93d Bomb Wing at Castle AFB, Calif. Thirty years later to the day, the first operational Rockwell B-1B bomber is delivered to the 96th Bomb Wing at Dyess AFB, Tex.

• *June 20–27, 1960:* Operation Big Star, a series of tests to determine the feasibility of using railroad cars as a means to deploy the in-development Minuteman intercontinental ballistic missile operationally, is carried out across the western and central sections of the US.

• *June 3–7, 1965:* The Gemini 4 mission is notable for several reasons, the principal one being the first US spacewalk by Air Force Maj. Ed White. This is the first US spaceflight to be controlled from the Manned Spaceflight Center in Houston, Tex., and the crew, which also includes Air Force Maj. Jim McDivitt, stays aloft for a record sixty-two orbits.

• *June 14, 1965:* Carl L. Norden, inventor of the highly accurate Norden bombsight used in World War II, dies at his home in Zurich, Switzerland, at age eighty-five.

• *June 6, 1970:* The first operational Lockheed C-5A Galaxy transport is delivered to the 437th Military Airlift Wing at Charleston, S. C. The debut, made before Rep. L. Mendel Rivers and most of the House Armed Services Committee, is less than auspicious: The giant aircraft loses a wheel, and several other tires are punctured on landing.

• *June 19, 1970:* The much-improved, three-warhead Boeing LGM-30G Minuteman III ICBM becomes operational as the 741st Strategic Missile Squadron at Minot AFB, N. D., accepts the first flight of ten missiles.

• *June 30, 1975:* The last Douglas C-47A Skytrain in routine Air Force use is retired to the Air Force Museum at Wright-Patterson AFB, Ohio. The first military "Gooney Bird" was delivered in 1941.

terburner, a Hughes APG-71 radar, and digital avionics. Grumman will build thirty-seven of the politically controversial F-14Ds and will remanufacture four F-14As to the D model standard. Grumman is in competition with the Navy depots for the rework of an additional 400 F-14As. In a related note, the **number five F-14 prototype went on display** at the National Museum of Naval Aviation at NAS Pensacola, Fla., on May 10. Mounted on a special pylon designed to withstand hurricane-force winds, it is the first F-14 to be displayed anywhere.

Boeing delivered the second of two KC-135 Operational Flight Trainer **(OFT) development units** in ceremonies at Barksdale AFB, La., on March 20. The OFT, a complete refurbishment and upgrade of the MB-26 (KC-135A) cockpit procedures trainer, features digital simulation equipment and software, a four-window dusk/night visual system, and an on-board instruction station. Boeing will deliver seventeen additional OFTs (reworked into either KC-135A or KC-135R simulators) by next June under contracts totaling $95 million. Boeing also provides contractor logistic support for the OFT.

The **last McDonnell Douglas KC-10A Extender was turned over to Strategic Air Command** in ceremonies at the Douglas plant in Long Beach, Calif., on April 4. The last of sixty KC-10s, the tanker had been accepted by the Air Force last year, but had been involved in the flight testing of the new wing-mounted drogue refueling pods that will allow the Extender to refuel three aircraft at the same time. All fifty-nine operational KC-10s (one was lost in a fire on the ground) will be modified to accept pods, but the Air Force only plans to buy an additional thirty-nine sets. The last KC-10, nicknamed "Spirit of Kitty Hawk," was flown to the 68th Air Refueling Wing at Seymour Johnson AFB, N. C., on April 5 by Gen. John T. Chain, Jr., Commander in Chief of SAC.

★ **MILESTONES—SAC,** USAF's largest command, **has changed its thirty-two-year-old motto.** Instead of "Peace is Our Profession," SAC's slogan is now "War is Our Profession—Peace is Our Product." General Chain noted that the change was made because "SAC's men and women are warriors, and, through their daily efforts, our country has been successful in deterring conflict. It is SAC's warfighting capability that helps produce the peace." The new motto became official on January 25 and was announced on March 15. The old motto had been in use officially since 1958.

The **first BGM-109G Gryphon** ground-launched cruise missiles **were removed from Wueschheim AB, West Germany,** under the terms of the Intermediate-range Nuclear Forces (INF) Treaty on April 11. The eight BGM-109s and their four transporters were loaded on a C-5 and flown to Davis-Monthan AFB, Ariz., where they will be destroyed. After the last of the 38th Tactical Missile Wing's sixty-four missiles are removed, the wing will be deactivated.

The McDonnell Douglas **NF-15B S/MTD** (STOL/Maneuvering Technology Demonstrator) **demonstrated in-flight thrust-reversing for the first time** on April 2. Air Force pilot Maj. Erwin "Bud" Jenschke was flying at 30,000 feet with a speed of 435 mph over Edwards AFB, Calif., and he reported "a rapid deceleration" when the reversers were activated. The performance figures were not quantified, however. The plane's two-dimensional, vectoring, reversing nozzles and its F100-PW-220 engines are made by Pratt & Whitney. Thrust-reversing is an essential part of the program's goal of landing the NF-15B on a bomb-damaged runway fifty feet wide by 1,500 feet long. Once the landing tests are completed, the NF-15B will be used to demonstrate in-flight reversing in the air combat arena. The plane will be pitted against regular F-15s in tests.

Two diverse groups hit the 1,000,000-flight-hour mark this past spring. The worldwide fleet of more than 900 McDonnell Douglas F/A-18 Hornet strike fighters, which includes

The first self-sufficient system that can monitor and neutralize electrical charge buildup on the surface of satellites has been delivered to the U.S. Air Force. The Flight Model Discharge System (FMDS), developed and built by Hughes Aircraft Company, will monitor the outer surface of space satellites, quickly detecting and neutralizing excess electrical charges caused by ionized gases. These charges can send sparks arcing around the spacecraft, possibly damaging the delicate electronic circuits inside. FMDS can sense the onset of charging and neutralize within 30 seconds. When the charging has been neutralized, FMDS returns itself to monitoring mode.

The innovative deployment of a new sonar system provides an improved means of detecting, identifying, and tracking of ocean targets. The Surveillance Towed Array Sonar Segment (SURTASS), developed by Hughes for the U.S. Navy, allows antisubmarine warfare commanders to have capabilities never before possible for the collecting and processing of undersea acoustic data. The system consists of a long line of sonar arrays towed behind a noncombatant craft. Target data is transmitted through a satellite link to land-based centers where operators can review the data on a detailed display.

Advanced polishing techniques and a dry etching process are combining to improve the yields of Gallium Arsenide Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC). In the final processing steps, MIMIC wafers must be reduced in thickness from .025 inches to .004 inches, keeping the upper and lower surfaces parallel, and via holes must be created through the wafer for future electrical connections. With technology developed by Hughes, wafers are embedded in wax during polishing, and holes are created using reactive ion etching, a dry rather than wet etching process. These processes can reduce the number of wafers that have to be scrapped, significantly improving the yield of MIMIC technology.

A new missile that allows aircraft to attack targets from ranges in excess of 50 nautical miles has performed flawlessly during its first three airborne launches. The Stand-off Land Attack Missile (SLAM), manufactured by McDonnell Douglas Missile Systems Company, incorporates a production version of the Hughes-built Maverick imaging infrared seeker, a global positioning satellite receiver/processor, and a Walleye video data link for aircraft control of the missile during the final moments of flight. The SLAM is designed for deployment from carrier-based aircraft and allows the aircraft to attack land targets, ships in port, or ships at sea from great distances, increasing the chances of success for the mission.

A night vision system has demonstrated it can increase the operational effectiveness and survivability of M1 Abrams tanks and Bradley Fighting Vehicles. The Driver's Thermal Viewer (DTV), under development at Hughes for the U.S. Army, is a low-cost thermal imaging system that enables drivers to see through darkness, dust, battlefield smoke, haze, and rain. During simulated combat exercises, the DTV demonstrated that it improved both vehicle maneuverability and crew safety and target acquisition. The DTV, designated AN/VAS-3, can replace the existing AN/VVS-2 image intensifier driver's viewer without modification to the vehicle's armor or driver station.

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

HUGHES

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US Navy and Marine Corps, NASA, Canadian Forces, Royal Australian Air Force, and Spanish Air Force planes, passed the million hour mark on April 10. Lt. Cmdr. Randy Causey, flying off the USS *Dwight D. Eisenhower* (CVN-69), recorded the milestone hour. It was also Commander Casey's 1,000th flight hour in the F/A-18. On March 27, the Royal Air Force's fleet of sixty-two Lockheed C-130Ks passed the landmark level, reportedly a first for any aircraft the British have flown. The crew (now all retired) that flew the first RAF C-130 from Marietta, Ga., to England in 1966 was on hand at RAF Lyneham to watch as the millionth hour was flown.

The **first F-16 to be powered by a Pratt & Whitney F100-PW-229 engine made its first flight** from the General Dynamics facility in Fort Worth, Tex., on April 2. The F-16B crew achieved supersonic speed (Mach 1.15) at 30,000 feet in a climb without afterburner during the flight. The 3,650-pound -229 engine is rated in the 29,000-pound-thrust class and will power F-15Es and some F-16C/Ds. The F-16B is now back at Edwards AFB, Calif., undergoing tests.

★ **NEWS NOTES—A 21st Tactical Fighter Wing F-15C pilot inadvertently fired an AIM-9 Sidewinder missile that hit another F-15 during air combat maneuvering** on March 19. The Arctic Cover exercise, held 150 miles from Anchorage, Alaska, was immediately canceled. When the first pilot realized a missile had been launched, he radioed a warning, and the other pilot took evasive action, but the AIM-9 did substantial damage to the rear of the second F-15. Both pilots landed safely at Elmendorf AFB, and the second pilot was unhurt. The Air Force is investigating the incident.

In early April, **the awarding of the Armed Forces Expeditionary Medal for military members who directly supported Operation Just Cause,** the US action in Panama last December, **was approved** by Gen. Colin Powell, the Chairman of the Joint Chiefs of Staff. Those who served in the area of operation (defined as the land area of Panama, including internal waters, territorial seas, and the airspace above and adjacent to the country) from December 20, 1989, to January 31, 1990, are eligible for the medal.

On March 21, **a ripple-fire test of the AIM-120A** Advanced Medium-Range Air-to-Air Missile (AMRAAM) **was successful.** Launched from an F-15 flying at 15,000 feet over the Gulf Test Range near Eglin AFB, Fla., two unarmed missiles pursued four QF-100 drones flying at altitudes of 5,000 and 10,000 feet. Other aircraft in the area attempted to jam the F-15 and the radar-guided missiles. The lowest flying target also carried a jammer. One missile scored a direct hit, and the second passed within lethal range of target. After release, the F-15 pilot performed evasive maneuvers. This test paved the way for the retest of the "World War III" scenario (four AMRAAMs vs. four targets in heavy jamming) that failed dismally last August.

Taking a cue from the neighborhood dry cleaner, **Air Force Logistics Command has come up with an innovative way to store and protect aircraft external fuel tanks.** Using an overhead monorail chain conveyor, tanks for all tactical aircraft can now be stored in any building that has a twenty-five-foot clearance. Much like suits, the tanks are hung on the system at a natural attach point—their pylons and lugs. At Hill AFB, Utah, a prototype system has been set up that holds 252 tanks. The system offers a number of advantages, and it will save considerable amounts of money. Every three years the Air Force spends up to $2,000 per tank in renovations or repairs. Storing the tanks indoors will at least double the time between repair cycles. The conveyor system costs about $250,000, and shelters cost an additional $100,000. Over fifteen years, more than $1 million would be saved in maintenance costs alone.

Starting October 1, 1991, **the active-duty service commitment for officers entering undergraduate pilot training will be ten years.** The previous commitment was eight years. Chief of Staff Gen. Larry Welch said that the change is being made "to ensure that the American people get a fair return on a very large investment." It costs more than a $1 million to train a pilot.

Three Marine Corps test pilots recently became the first military aviators qualified to fly the Bell-Boeing V-22 Osprey tilt-rotor aircraft. Lt. Col. James Casler, Maj. Gerald Hammes, and Maj. Bob Price went through a three-phase course that included ground school at the Naval Air Test Center at NAS Patuxent River, Md., twenty hours of simulator time, and five hours of flight time at Bell's Flight Research Center in Arlington, Tex. Since flight testing began in March 1989, more than 100 flights and flight hours have been accumulated with the three flying V-22s. The fourth aircraft (of six to be involved in the flight test program) was scheduled to be flying by May. Finally, a recent study, done using Department of Defense data, determined that an assault force of V-22s and CH-53s was able to deliver more Marines and combat equipment safely to the landing zones, and do it in less time, than the proposed all-helicopter alternatives. The study was funded by Bell-Boeing but was

Marines Maj. Gerald Hammes, Lt. Col. James Casler, and Maj. Bob Price are the first military aviators qualified to fly the Bell-Boeing V-22 Osprey. The V-22 shown here (prototype #2) was recently flown from Bell's Arlington, Tex., facility to Boeing's Wilmington, Del., plant in 5.2 hours at a speed of 230 mph. The trip of 1,210 nautical miles only required one stop en route.

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Exactly twenty years ago this month, Fleagle made the first trip from his home on Pea Island up to Langley AFB, Va., to appear in the pages of Tactical Air Command's safety magazine* TAC Attack. *Over the years, the misadventures of the hapless bird have taught pilots by negative example. Fleagle's creator, artist Stan Hardison, recently retired as* TAC Attack*'s art director. Fleagle, however, will continue to fly.

conducted by BDM International, a respected defense analysis firm with a reputation for fairness.

The **Department of Defense will unify the separate commissary systems of the Army, Navy, and Air Force.** Taken together, the various commissary systems constitute one of the largest grocery store operations in the US. By combining them, the commissary system can achieve the kinds of efficiencies and economies of scale available to a commercial chain, resulting in better service and lower costs. A recent study indicates that a single commissary system with central distribution could save approximately $90 million a year.

One of two remaining World War I **Caproni Ca 36 bombers went on dis-**

Senior Staff Changes

RETIREMENTS: M/G Thomas P. **Ball,** Jr.; M/G John E. **Griffith;** M/G William J. **Grove,** Jr.; B/G Paul L. **Roberson;** M/G Larry N. **Tibbetts.**

CHANGES: B/G (M/G selectee) Edgar R. Anderson, Jr., from Command Surgeon, Hq. SAC, Offutt AFB, Neb., to Cmdr., Wilford Hall USAF Med. Ctr., JMMC-SA, Lackland AFB, Tex., replacing M/G Vernon Chong . . . **M/G Richard E. Carr,** from C/S, CFC; C/S, United Nations Cmd. Korea; and C/S, Ground Comp. Cmd., Hq. United Nations Cmd. Korea/CFC/USKOREA, Yongsan, South Korea, to Dep. Dir., Foreign Intel., DIAC, DIA, Bolling AFB, D. C., replacing M/G Frank B. Horton III . . . **M/G Vernon Chong,** from Cmdr., Wilford Hall USAF Med. Ctr., JMMC-SA, Lackland AFB, Tex., to Cmdr., JMMC-SA, and Command Surgeon, Hq. ATC, Randolph AFB, Tex., replacing retired M/G Thomas P. Ball, Jr. . . . **B/G Brett M. Dula,** from Dep. Dir., Legislative Liaison, OSAF, Washington, D. C., to Dir., Legislative Liaison, and Dir., Air Force Issues Team, OSAF, Washington, D. C., replacing M/G Burton R. Moore.

B/G Jeffrey T. Ellis, from Cmdt., AFROTC, ATC, Maxwell AFB, Ala., to Dep. Cmdr., 5th ATAF, AFSOUTH, NATO, Vicenza, Italy, replacing B/G Joel T. Hall . . . **B/G Phillip J. Ford,** from Ass't DCS/Ops., Hq. SAC, Offutt AFB, Neb., to Cmdt., ACSC, Hq. AU, Maxwell AFB, Ala., replacing B/G Charles D. Link . . . **B/G Paul D. Gleason,** from Command Surgeon, USAFE, Wiesbaden, West Germany, to Dir., Prof. Affairs and Quality Assurance, AFOMS, Bolling AFB, D. C., replacing B/G Michael J. Torma . . . **B/G Joel T. Hall,** from Dep. Cmdr., 5th ATAF, AFSOUTH, NATO, Vicenza, Italy, to Dir., Aerospace Safety, Hq. AFISC, Norton AFB, Calif., replacing B/G James M. Johnston III.

B/G James M. Johnston III, from Dir., Aerospace Safety, Hq. AFISC, Norton AFB, Calif., to Vice Cmdr., 5th AF, PACAF, Yokota, Japan, replacing retiring B/G Keith B. Connolly . . . **B/G John P. Jumper,** from Cmdr., 57th FWW, TAC, Nellis AFB, Nev., to Dep. Dir., Pol. Mil. Affairs, J-5, Joint Staff, Washington, D. C. . . . **B/G (M/G selectee) Charles D. Link,** from Cmdt., ACSC, Hq. AU, Maxwell AFB, Ala., to Cmdt., AWC, and Vice Cmdr., Hq. AU, Maxwell AFB, Ala., replacing M/G David C. Reed . . . **Col. (B/G selectee) John O. McFalls III,** from Cmdr., 4th TFW, TAC, Seymour Johnson AFB, N. C., to Dep. Dir., Legislative Liaison, OSAF, Washington, D. C., replacing B/G Brett M. Dula.

M/G Burton R. Moore, from Dir., Legislative Liaison, and Dir., Air Force Issues Team, OSAF, Washington, D. C., to Dir., Ops., J-3, Hq. USCENTCOM, MacDill AFB, Fla., replacing M/G James F. Record . . . **Col. (B/G selectee) David Oakes,** from Dep. Dir. for Resources, DCS/P&R, Washington, D. C., to Cmdr., 830th AD and Dep. Cmdr., Joint Forces, Panama, TAC, Howard AFB, Panama, replacing B/G Robin G. Tornow . . . **M/G James F. Record,** from Dir., Ops., J-3, Hq. USCENTCOM, MacDill AFB, Fla., to C/S, CFC; C/S, United Nations Cmd. Korea; and C/S, Ground Comp. Cmd., Hq. United Nations Cmd. Korea/CFC/USKOREA, Yongsan, South Korea, replacing M/G Richard E. Carr . . . **M/G David C. Reed,** from Cmdt., AWC, and Vice Cmdr., Hq. AU, Maxwell AFB, Ala., to Cmdr., Air Force Military Training Ctr., ATC, Lackland AFB, Tex., replacing retired M/G Larry N. Tibbetts.

Col. (B/G selectee) Charles H. Roadman II, from Cmdr., USAF Med. Ctr., Wright-Patterson AFB, Ohio, to Command Surgeon, USAFE, Wiesbaden, West Germany, replacing B/G Paul D. Gleason . . . **B/G (M/G selectee) Ralph R. Rohatsch, Jr.,** from Cmdr., AFDW, Bolling AFB, D. C., to Cmdr., TUSLOG, USAFE, Ankara, Turkey, replacing retired M/G William J. Grove . . . **Col. (B/G selectee) James S. Savarda,** from Cmdr., 9th SRW, Beale AFB, Calif., to IG, Hq. SAC, Offutt AFB, Neb., replacing B/G James L. Vick . . . **Col. (B/G selectee) F. Keith Tedrow,** from Exec. Officer to USCINCTRANSCOM/CINCMAC, Scott AFB, Ill., to IG, Hq. MAC, Scott AFB, Ill., replacing B/G James L. Cole, Jr.

B/G Michael J. Torma, from Dir., Prof. Affairs and Quality Assurance, AFOMS, Bolling AFB, D. C., to Command Surgeon, Hq. SAC, Offutt AFB, Neb., replacing B/G (M/G selectee) Edgar R. Anderson, Jr. . . . **B/G Robin G. Tornow,** from Cmdr., 830th AD and Dep. Cmdr., Joint Forces Panama, TAC, Howard AFB, Panama, to Cmdt., AFROTC, ATC, Maxwell AFB, Ala., replacing B/G Jeffrey T. Ellis . . . **B/G James L. Vick,** from IG, Hq. SAC, Offutt AFB, Neb., to Cmdr., AFDW, Bolling AFB, D. C., replacing B/G (M/G selectee) Ralph R. Rohatsch, Jr. . . . **Col. (B/G selectee) W. Thomas West,** from Cmdr., 31st TFW, TAC, Homestead AFB, Fla., to Cmdr., 57th FWW, TAC, Nellis AFB, Nev., replacing B/G John P. Jumper.

AIR FORCE RESERVE CHANGE: B/G Robert A. McIntosh, from Cmdr., 10th AF, AFRES, Bergstrom AFB, Tex., to Reserve Forces Policy Board.

SENIOR EXECUTIVE SERVICE (SES) RETIREMENTS: Joseph P. **Popple;** Gordon W. **Sommers.**

SES CHANGE: C. Ronald Hovell, from Ass't DCS/P&P, Hq. AFLC, Wright-Patterson AFB, Ohio, to Principal Dep. Ass't Sec'y (Financial Mgmt.), OSAF, Washington, D. C., replacing retired Joseph P. Popple. ■

play at the Air Force Museum at Wright-Patterson AFB, Ohio, on March 31. The three-engine Ca 36, one of just a handful of surviving World War I multiengine aircraft, is on long-term loan from the Caproni family. The aircraft, which had been disassembled and stored for the duration of World War II in an abandoned monastery, was shipped to the Museum in fourteen crates carried by an Air Force C-141B. Restoration took nineteen months. After being trained by the Italian Air Force, seventy-five Americans, under the command of Capt. Fiorello La Guardia, flew Ca 36s in combat during World War I. The Ca 36 was one of the first strategic bombers.

The Air Force's newest pilot, **Captain Barbie, will report for duty** at base exchanges and several major retail chains this summer. The doll, first produced by Mattel Toys in 1959, will come complete with boots, scarf, overseas cap, green flightsuit, and a leather-look jacket with American flag patch. The Air Force worked with Mattel in designing the doll, but Captain Barbie is out of regulation 35-10 in one respect—her hair is too long. Mattel reports that it is difficult to attach short hair to a doll. Mattel has sold more than 60,000 copies of Army Captain Barbie since her "commissioning" last year. Barbie will go to sea as a Navy quartermaster in 1991.

★ **DIED—Lester Maitland,** pilot of the first plane to fly from the US mainland to Hawaii nonstop, of unreported causes at a Scottsdale, Ariz., rest home on March 27. He was ninety-one. On February 28, 1927, Lieutenant Maitland and his navigator, Lt. Albert Hegenberger (who died in 1983), left Oakland, Calif., in the Army's Fokker C-2 Trimotor, which the crew had christened *Bird of Paradise.* The duo completed the 2,407-mile journey in twenty-five hours, fifty minutes, and were later awarded the Mackay Trophy for 1927. A test pilot at McCook Field, Lieutenant Maitland was the first American pilot to pass the 200-mph barrier. He was the Commander of Clark Field in the Philippines when the Japanese attacked on December 8, 1941. In later life, he was an ordained Episcopal minister.

Ronald Evans, command module pilot on Apollo 17, of a heart attack at his home in Scottsdale, Ariz., on April 7. He was fifty-six. Mr. Evans, a Naval aviator, flew F-8 Crusaders in Vietnam and was selected as an astronaut in 1966. He served as backup command module pilot on Apollo 14 and the Apollo-Soyuz Test Project. His only trip into space (December 7–19, 1972) was the last manned mission to the moon, with Eugene Cernan and Harrison Schmitt. He left the space program in 1977.

Margaret Polk, immortalized during World War II as the "Memphis Belle," of cancer at her home in Memphis, Tenn., on April 5. She was sixty-seven. Lt. Robert Morgan, after meeting Ms. Polk in Seattle, Wash., fell in love with her and decided to name his newly assigned B-17F in her honor. Christened *Memphis Belle,* the B-17 became the first US bomber to complete twenty-five missions over Europe and was the subject of a famous documentary. Sent home for a bond tour, Captain Morgan and his crew flew to Memphis for a huge ceremony and the much-celebrated reunion of the flyer and his fiancée. Ironically, the relationship had cooled, and the couple never got married. ■

C. R. Smith Dies

Cyrus Rowlett (C. R.) Smith, airline pioneer, former Secretary of Commerce, and third president of the Air Force Association, died of heart failure in a retirement community in Annapolis, Md., on April 4. He was ninety. Starting out as treasurer of Texas Air Transport, Inc., he rose in the ranks, and (after the company merged several times) became president of American Airlines in 1934. Except for three years in the Army Air Forces, where he helped organize Air Transport Command, he remained as head of American until 1968. Mr. Smith then served as Secretary of Commerce in the last year of the Johnson Administration. He served as American's interim chairman of the board from September 1973 to February 1974. He was President of AFA in 1948 and Board Chairman in 1949.

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The Pentagon will refocus on the Third World, even if it makes some forces "less optimal" for Europe.

—Staff photo by Guy Aceto

Low Intensity— High Priority

By Robert S. Dudney, Executive Editor

WHEN US forces engage in the next "low-intensity conflict," they most probably will disappoint public expectations. The event may not be a daring commando raid or a short, tidy bush war.

"Often, people view us as just 'shooters,' but we're not," asserts Assistant Secretary of Defense James Locher, the Pentagon point man for low-intensity conflict forces and policies. "We're a lot more than that. We're nation-builders."

Indeed, says Locher, the prime peacetime task of Special Operations Forces is to provide friendly Third World nations with training, security assistance, professional advice, and even humanitarian aid —vital activities all, but indirect and not very glamorous.

Direct conflict, if it comes, will require more than commandos. Many Third World countries possess large, sophisticated arsenals, even ballistic missiles. Some have chemical weapons. Subjugation of Panama's defense forces required a large, regular American force, conventional weapons, and access to a nearby US base.

"Anybody who suggests that Special Operations Forces are the answers to all of our Third World problems," observes Locher, "is not correct."

Now that the Warsaw Pact has collapsed, Washington has become preoccupied with these "low-intensity" affairs. President Bush wants the Pentagon to reorient its forces toward use in the Third World, "even if it means that some forces are less optimal for a conflict on the European central front." Congress agrees.

Locher himself has a large agenda. He wants to sharpen US goals in the Third World, convince a skeptical bureaucracy to get with the program, integrate Third World factors into national strategy, maintain SOF budgets, expand Pentagon nation-building efforts, increase the US security assistance program, and make greater use of US high technology in Third World struggles.

The Pentagon seems to be getting serious about preparation for low-intensity conflict. This is true despite some signs that the phenomenon may be ebbing: the Soviet defeat in Afghanistan, Cuba's plans to leave Angola, the end of the Namibian war, Vietnam's retreat from Cambodia, the Palestine Liberation Organization's avowed rejection of terrorism, and the collapse of the Marxist Sandinista regime in Nicaragua.

Direct armed conflict in the Third World would require more than a handful of commandos. In Operation Just Cause, the US force included armored fighting vehicles, high-performance aircraft, and other advanced hardware, plus a large number of regular troops.

Problems of Definition

Few grasp the concept of low-intensity warfare. "We have found," concedes Locher, "whether we're talking about the Defense Department, the rest of the federal government, or Congress, that there is really very limited understanding."

In the last days of the Reagan Ad-


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ministration, the President's Commission on Long-Term Integrated Strategy concluded that "to defend its interests, the United States will have to take low-intensity conflict much more seriously." By that time, however, the Pentagon had been going at this matter for a while. In 1985, the Joint Chiefs of Staff adopted the first joint definition of low-intensity conflict. Writing the definition took almost two years. The Army/Air Force Low-intensity Conflict Center at Langley AFB, Va., has collected fifty terms that closely resemble "low-intensity conflict"—"countersubversive warfare," "subterranean warfare," "concealed aggression," and so on.

Despite the ambiguities, former Defense Secretary Frank Carlucci's view was that such warfare "threatens to isolate the United States" from allies and the Third World alike. The consequences, in his view, could be loss of access to strategic minerals and oil, loss of overseas bases, and "gradual accommodation of friends and allies" to anti-US groups and states.

"It's not the individual terrorist event that is the danger," adds Locher, "but the cumulative effect of terrorist attacks and what it can do to the international order. The same with insurgencies. Over time, they could have a cumulative effect, which can be much larger and much more threatening."

The Pentagon view today is that low-intensity conflict comprises five distinct types of missions: counterterror, counterinsurgency, counternarcotics, peacekeeping operations, and peacetime contingency operations (the most recent examples of the latter being US military actions in the Persian Gulf and Panama).

Low-intensity conflict, say officials, describes a particular type of environment, with several distinctive characteristics. Military forces are engaged in a protracted struggle. Political principles and ideology are involved. Military force is not necessarily the dominant factor. Economics also plays a major role.

"It's an environment in which we need to bring together [US] political, military, economic, and informational instruments in an integrated effort," Locher explains. "If we were to go to war in Europe, the military is the dominant instrument, and everything else has to fall into line to support it. When we look at these low-intensity conflict situations, we're talking [about] much more of a balance between the military and political considerations."

Calibrating the Efforts

So heavy is the political component, in fact, that US actions in most cases will be orchestrated not by the Pentagon but by the local US ambassador. This personal representative of the President would be in charge of calibrating the efforts of special operations forces and civilian organizations such as the State Department, Agency for International Development, US Information Agency, and Central Intelligence Agency.

As Pentagon officials see it, low-intensity conflict is a two-faceted problem. One facet is the sporadic violence that threatens to weaken or topple a friendly government and its institutions. The second is the combination of indigenous economic, social, and political problems that Locher calls "the seedbed" of violence. If a low-intensity conflict is to be won, both facets must be addressed.

In US efforts to help Third World nations combat violence, Army, Air Force, and Navy SOFs are cast in starring roles.

Over the last two years, say officials, 500 SOF teams have deployed to more than sixty nations. Green Berets and SEALs have provided security assistance training; more than forty Mobile Training Teams have deployed to twenty countries. There have been sixty-six bilateral training events. SOFs have trained Drug Enforcement Agency personnel in the US and at the Jungle Operations Training School in Panama. To help train local counternarcotics police, the US has deployed a twelve-man Special Forces team to Bolivia, a fifteen-man unit to Peru, and a five-man team to Colombia.

The Army's Special Forces, Rangers, and other units, USAF's Special Operations units, and the Navy's SEALs, numbering nearly 40,000 active and reserve troops, have rarely been in better shape.

One reason is the expansion of the SOF force structure throughout the 1980s. Between 1981, when the Reagan Administration launched a buildup, and 1989, the number of active and reserve Army Special Forces groups grew from seven to eight; Ranger battalions grew from two to three, and psychological operations battalions from three to four. The number of Navy SEAL teams grew from two to six, a number that includes two former underwater demolition teams reconfigured to the SEAL mission. The number of USAF special operations squadrons, active and reserve, rose from eight to thirteen. Two Army aviation battalions were also assigned to SOF duty.

From a level of less than $500 mil-

—Staff photo by Guy Aceto

Navy SEALs such as these (shown here on a training exercise) have not only a critical combat mission but also a major role in the training of friendly Third World forces. The SEAL force is set to grow from fifty to sixty platoons.

lion per year in 1981, SOF funding has grown to more than $3 billion per year in 1990. Overall, the Pentagon invested $11.8 billion in SOF improvement during the decade.

The SOF units also have enjoyed striking success in recruiting and retaining high-quality personnel. Overall retention rates exceed ninety-five percent.

In addition to its US-based aircraft, the 23d Air Force has established two overseas special operations wings, one at Clark AB in the Philippines and another at Rhein-Main AB, West Germany. Both will get more aircraft this year. Today, dedicated Air Force SOF units are equipped with MC-130 transports, AC-130 gunships, and EC-130 electronic combat planes, plus MH-53, CH/HH-3, and MH-60 aircraft.

—Staff photo by Guy Aceto

A prime SOF airlifter, the MC-130E Combat Talon I aircraft, saw action in the Panama fighting and was used to bring deposed dictator Manuel Noriega back to the United States for prosecution. USAF is buying twenty-four upgraded models.

Major Modernization Program

The Air Force has a major modernization effort under way. Current plans call for the delivery of twenty-four upgraded MC-130H Combat Talon II aircraft, with the first to become operational soon. All forty-one of the Air Force's CH/HH-3 helicopters by the end of 1990 will be modified to the MH-53J Pave Low III configuration.

The special operations wings also are about to get new, improved versions of the AC-130 gunship. Twelve AC-130U aircraft are to enter the force over the next few years. When they arrive, the Air Force will retire ten outdated, thirty-year-old AC-130As currently deployed with reserve forces at Duke Field, Fla.

The growth in SOF structure is expected to continue, albeit on a modest scale. Currently approved programs call for expansion of SEAL strength by ten additional platoons. The Army's Gen. James Lindsay, the recently retired Commander in Chief of US Special Operations Command at MacDill AFB, Fla., also is confident that Washington will soon approve the creation of another active Special Forces group, the Army's fifth.

In the view of the former USSOCOM chief, who was succeeded by Army Gen. Carl W. Stiner, the command's great weakness is a lack of long-range exfiltration aircraft, which he calls "a serious problem." Such aircraft would be needed to retrieve forces dropped behind enemy lines or into areas to which access has been denied for political reasons. Today, SOF units would have to make do mostly with helicopters.

At one time, the Pentagon thought it had the answer: the V-22 Osprey tilt-rotor aircraft. The Air Force had planned to buy fifty-five of them. In the wake of Defense Secretary Dick Cheney's decision to cancel the program, however, its future is problematic and depends on the willingness of Congress to revive it.

General Lindsay says the command is assessing ways to develop and procure a suitable alternative airframe. It would have to be "something that's reasonably fast," a requirement that rules out a new type of helicopter. It would have to have a one-way range of about 750 miles and be agile enough to land on austere airstrips. Nothing suitable is on the horizon.

"That's the dilemma right now," says the General, a problem he ascribes in part to the fact that SOFs have always been obliged to accept "hand-me-down" equipment from the services.

In the future, the SOFs are in a better position to prevent such problems. Under provisions of the 1986 law that gave birth to USSO-

The war is over for these members of the Panamanian Defense Forces, captured by US troops in the early stages of the assault. US success in Panama was made possible, in part, by flawless execution of a huge air operation.

COM, the Pentagon has created a new "Major Force Program"—its eleventh—combining all SOF programs formerly executed by the military departments. The command has just completed its six-year Program Objective Memorandum (POM) for Fiscal 1992–97. It calls for spending $3 billion each year on SOF units.

A "Skunk Works" for SOFs

The most striking innovation of General Lindsay's POM is allocation of some $600 million per year for research to create a technological base for SOF equipment. A new Special Operations Research, Development, and Acquisition Center (SORDAT), soon to start operations, will use the money to finance development of SOF-specific equipment. "SORDAT will be the highly specialized kinds of things," says Locher, "that the military departments have never been able to provide to the special operations forces."

There's no lack of ideas. For starters, General Lindsay suggests research into applications of stealth technology to SOF aircraft and how to make low-probability-of-intercept radios.

The Presidential Regional Conflict Working Group, in a 1988 report, asserted that high technologies could greatly improve SOF tactical intelligence, critical to any small operation. It urged greater consideration of advanced information-processing systems for storage, sorting, retrieval, and collation of enormous amounts of data about insurgents or terrorists; low-cost space systems, long-endurance airships, and robotic reconnaissance vehicles; networks of sensors and processors that could monitor activities or hostile groups; biomechanical sensors to detect explosives and illegal drugs; and vivid digital graphics to allow rehearsal of military operations.

James D. Williams, an official at Sandia National Laboratories in Albuquerque, N. M., proposes other systems that the lab has developed. Among them: SAFER, a portable intrusion-detection system for small units; interchangeable weapon scope mounts that would allow the user to exchange day and night-vision scopes on rifles without affecting rifle accuracy; nonelectric explosive initiators that are immune to accidental detonation by radio-frequency fields; and a "return-fire" simulator that mimics M16 live-fire rounds, making an enemy think a site is occupied when it actually has been abandoned.

USSOCOM hasn't exactly been idle. In a recent review of R&D and acquisition, the command found there were 146 SOF programs under way. Of these, forty-seven belonged to the Army, twenty-four to the Air Force, twenty-four to the Navy, and twenty to the Marine Corps. There were four joint projects and twenty-seven "Special Technology" projects, including projects to create new SEAL delivery systems, high-speed boats, high-technology transports, imaging systems, acoustic detection devices, and soft body armor.

For all the strengthening of US units, say officials, the Pentagon does not view SOFs as a thing apart.

"When we employ special operations forces," notes Locher, "they often will be employed in conjunction with conventional forces, as we did in Panama. We had a substantial number of special operations people involved. They were sort of the leading edge [of the US assault force], but they were very well integrated with conventional forces."

Phenomenal Air Operation

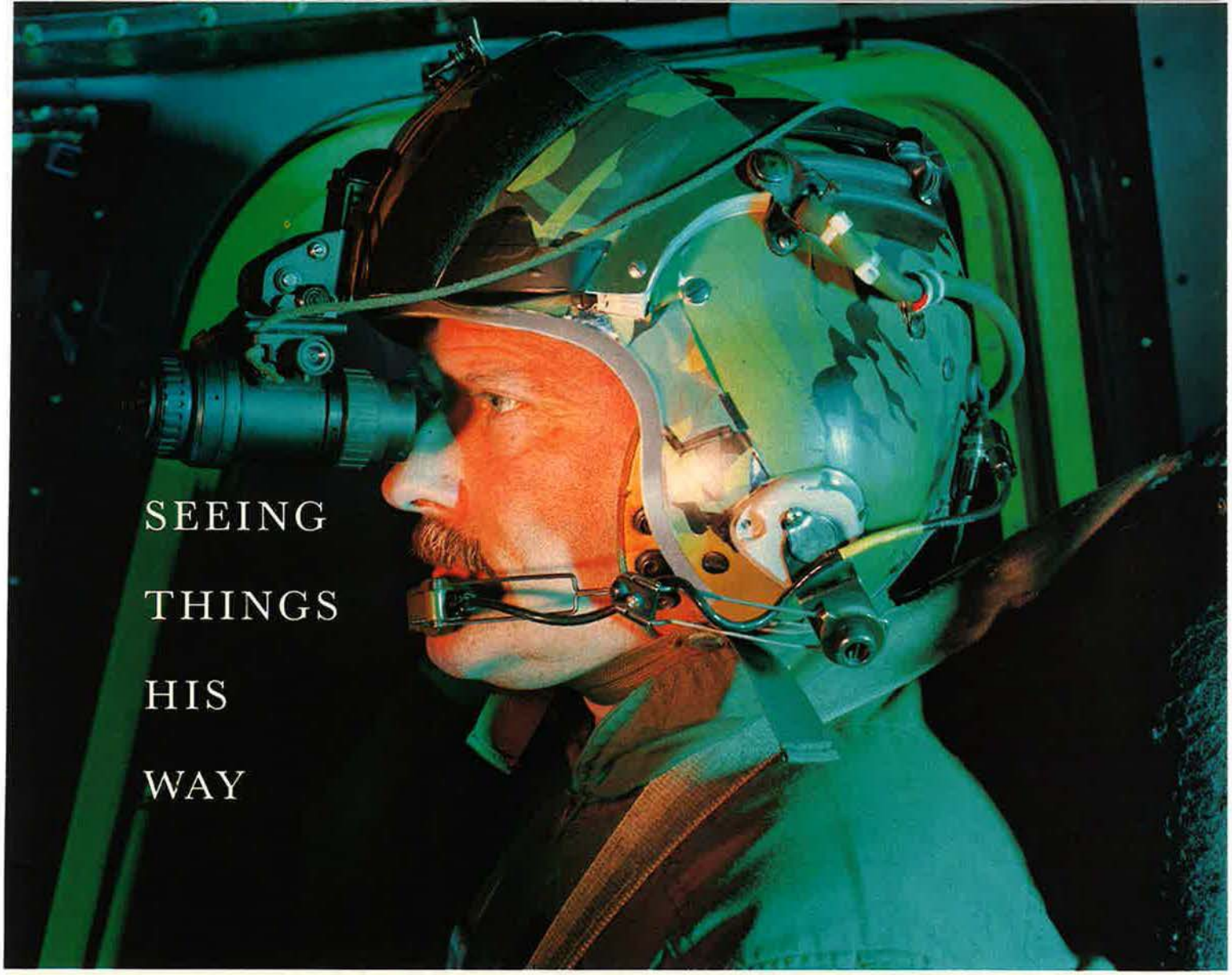
General Lindsay points with particular satisfaction to the success of the complicated air operation put together for the Panama assault. "I had a total, at H-Hour, of seventy-one of my own aircraft working and 103 supporting aircraft," says the former special operations commander. "That doesn't count the tankers. So I had about 200 airplanes, and I'll tell you what: That was awesome. That was about as complex an air operation as I've ever been involved in, and I've been doing this for about thirty-eight years."

Even so, say officials, Panama was an exceptional case. Most low-intensity conflicts, they warn, will have more ambiguous goals, less certain domestic political appeal, and less advantageous logistics. Locher maintains that coming to grips with the challenge, in its totality, will confront Washington with its greatest postwar political challenge.

"When you had the Soviet threat to Europe, it was easy to get the attention of the American people and focus the energies of the US government," he says. "With these Third World threats, that's not so easily done. Most of these are going to be protracted struggles. They're not going to be solved in a short period of time. The United States is going to have to make a long-term commitment. For the American people and the United States government, that's quite a challenge." ■

—Staff photo by Guy Aceto

A Navy SEAL holds a signal flare aloft. In the past two years, some 500 teams of Special Operations Forces—Army, Navy, and Air Force—have deployed to more than sixty nations. Their mission, say Pentagon officials, is sure to grow.



Night operations in USAF MH-53J Mission Rehearsal Trainer. A multi-channel COMPU-SCENE V visual system provides out-the-window and correlated sensor imagery for this GE-led program.*

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Down the canyon, flying low at eighty knots, the mission is joint training with Navy SEALs.

Special Operations Live

By Jeffrey P. Rhodes, Aeronautics Editor

Photos by Guy Aceto, Art Director

For the squad of SEALs riding in the cargo hold, there wasn't much to do yet. Most of them were asleep, leaning against their inflatable boat. They missed the startled expression of the quarry worker below as the Air Force MH-53J helicopter zipped past him at an altitude of fifty feet and a speed of eighty knots, with a CH-3E flying in formation behind.

The MH-53J—known as Pave Low III—is the latest word in Air Force special operations helicopters. Its navigation and other capabilities far surpass those of the Vietnam-vintage CH-3E.

Most aspects of the 150-mile flight through the canyons and around the mountains of central New Mexico were routine for the 1550th Combat Crew Training Wing (CCTW). The helicopter crews operate in this area often, usually in darkness, wearing night vision goggles (NVGs) and flying at faster speeds.

The unusual part of it was having the SEAL (Sea-Air-Land) platoon along for a joint training exercise of a kind that's becoming more popular at Kirtland AFB, N. M., USAF's special operations "schoolhouse," as the months go by.

This exercise was the second in a series called Chili Flag. The name, like the exercise itself, was thought up by the participants. The concept originated with the units, not at US Special Operations Command headquarters. Both the Air Force and the Navy units have to meet certain training requirements. Why not meet them jointly, getting a little closer to what it would be like if they ever had to do it for real?

On this particular mission, the Air Force special operations crews would insert the Navy commandos into a reservoir, deploy them in boats, let them do their work, and then extract them from the area.

This kind of live, joint operation benefits everybody. "It's a lot different for our crews when people actually go out the back [of the helicopters]," says Col. Charles Holland, the 1550th CCTW Commander.

The 1550th CCTW has trained USAF helicopter crews at Kirtland since 1976. Joint operations started last year, soon after the wing began formal training for Air Force special operations crews.

After traversing a low-level route on board an Air Force MH-53J (above), a Navy SEAL (right) prepares to designate a target with a portable laser at the Red Rio Range near Kirtland AFB, N. M.

New Roles for Kirtland

This new role for Kirtland took some pressure off the 1st Special Operations Wing, the Air Force's main SOF contingent, based at Hurlburt Field, Fla. Previously, the 1st SOW ran initial qualification training for special ops crews, along with performing its prime mission. That stretched the Air Force's main special operations contingent pretty thin, so "the decision was made to let the operators operate and the trainers train," says Col. W. G. Dennis, the 1550th CCTW's Vice Commander.

"We have the perfect place to train here at Kirtland," adds Colonel Holland. "We have low-level routes, the White Sands Missile Test Range, and ECM [electronic countermeasures] ranges that are close by. We have drop zones, landing zones, and more than two million acres of land available to us. We have desert, trees, mountains, and water—everything you need to train for special operations." As an added bonus, the area enjoys perpetually good weather—at least 320 days of sunshine a year.

The unit conducts initial and mission-qualification training in seven helicopter types or models (UH-1N, UH-60A/MH-60G, CH/HH-3E, MH-53J, and CH-53A) and in the HC-130 aircraft. Including the Air Force Pararescue School, the wing teaches forty-three different courses attended by almost 1,300 students each year.

"We serve two masters—Air Rescue Service and Special Operations Command," notes Colonel Holland. "We have to do the training for both, and we have to have quality training."

Taking on the special operations training mission brought extensive changes to the wing. For example, over the last several years, the HC-130 mission has shifted from straight rescue work. There is now more emphasis on refueling special ops helicopters. Consequently, there is less flying of standard refueling track orbits in the training, and more work on low-level, nighttime formation flights and assault landings.

"We have changed the curriculum to align ourselves with the way the special operators are doing the mission," notes Colonel Dennis. "We used to be strictly a daytime operation, but now we are open nearly twenty hours a day. Instead of just teaching them to fly the aircraft, we now give students transition training for low-level flying, exposure to working in night vision goggles, and learning to use the mountains for terrain masking."

"The Pave Low III was a big change for us," reports Col. John Davis, the Wing's Director of Operations. "It is a real wizard aircraft, and the buildup in operations and in maintenance, particularly in the avionics shop, was huge."

The Sikorsky MH-53J Pave Low III is the largest, fastest, most sophisticated helicopter in the US inventory. To perform low-level penetration missions at night and in bad weather, the helicopter has a full set of special equipment, including terrain-following and -avoidance radar, a forward-looking infrared set, and Global Positioning System satellite receivers.

The arrival of that equipment meant the logistics operation had to be restructured. "There is always a problem when you start from scratch. We took people experienced in systems like Pave Tack, Pave Penny, and Pave Spike and used them as a base to get the shop up to speed," says Maj. Michael Wetherall, the 1550th's Avionics Maintenance Squadron Commander. "The two tech reps [from Texas Instruments] took basic knowledge we had and built specific Pave Low system knowledge on that."

Major MH-53 avionics work is shared by two groups, with radar and FLIR systems handled in one area and the Enhanced Navigation System in another. Sixteen avionics technicians are required for just four Pave Lows.

The maintenance troops have responded to the new mission with enthusiasm and motivation. When no test sets were provided for the KY8-79 data burst radio used to relay messages from the ground to the Pave Low helicopters, a 1550th AMS technician fabricated one from scratch.

The MH-53J's forward-looking infrared system (green screen, center) enhances visibility for Maj. James Eustace (right), a pilot with the 1551st Flying Training Squadron, and MSgt. Arthur Burkett, flight engineer (left). The FLIR is especially important for low-level night flight.

Unit-to-Unit Planning

Because of their sophistication, Pave Lows are expensive to operate. To aid in training, the wing obtained four low-flight-time CH-53A Sea Stallions—"vanilla" versions of the MH-53—from the Marine Corps and converted them to basic qualification trainers. The main modification was installing uprated General Electric T64-GE-416 engines (the same as those on the Pave Lows), as well as some other standard Air Force equipment. All of these modifications were done by 1550th CCTW technicians.

With further planned modifications to the aircraft, student pilots will be able to fly troop insertions

and extractions, refueling missions, and other basics in these "TH-53s," which not only saves money but also reduces wear and tear on the Pave Lows. The wing will receive two more CH-53As by 1992.

The joint training at Kirtland began as a unit-to-unit program, and that has not changed. Special Operations Command likes the idea and encourages participation, but leaves the planning and organizing to the units.

"We took the initiative and told other special operations units that they would be welcome," said Colonel Holland. "We said, 'We have to train anyway, and here's what we can do for you.' "

Early joint operations were exploratory and experimental. The first unit to participate, a SEAL platoon, was well satisfied with the experience, and the news spread unofficially that there was a good training opportunity at Kirtland. An Army Special Forces unit from Fort Lewis, Wash., met ninety percent of its annual joint training requirements in two weeks in the desert near Kirtland. Today it is a popular place for all services to train.

The second "official" Chili Flag exercise ran for fourteen days this spring. A SEAL platoon from Navy Special Warfare Group 1 at Coronado Island, Calif., and the Air Force SOF crews each learned a great deal about the other's techniques.

"Finding out the capabilities of the Air Force is really beneficial," says the SEAL platoon's training officer (who, for security reasons, cannot be identified). "We do a lot of things differently. But if a real-world situation came up now, having worked with them, we are at least familiar with their jargon and know what's going on."

The SEALs and the 1550th set up the week's events with emphasis on the tasks in which they might someday have to join forces. Among other things, there was practice on infiltration, exfiltration, and target designation.

Targeting Red Rio

Target designation training took place at Red Rio Range, part of the White Sands reservation. F-100, F-4, F-102, and F-106 aircraft carcasses, stripped of anything remotely usable, stand in revetments and on the runway. There are simulated SAM sites, radars, and even fuel trucks in a nearby valley. Also in the area, a truck convoy spreads along a road leading into a tunnel, and behind the road there is a dam.

Close crew coordination is essential for low-level flight, but it is especially critical in a helicopter because of the rotor blades. Above, MSgt. Robert Beecroft, a scanner on an MH-53, keeps watch on the terrain as well as on the CH-3E flying in formation (below) during a Chili Flag II low-level flight.

The SEAL platoon was ferried to Red Rio in one MH-53J and one CH-53A flown at high speed and low level. UH-1N crews, ferrying in a support group, also flew low-level formation, using minimal radio communication for additional training. Any opportunity to train is taken.

Once on the ground, the SEALs plotted the position of selected trucks in the convoy, the tunnel, and the dam. Platoon radiomen called the information to New Mexico Air National Guard pilots, orbiting nearby in A-7Ds, and gave them the standard nine-line target briefing. Meanwhile, another SEAL set up a portable laser designator. (SEALs carry an extraordinary amount of equipment and personal gear. All on this mission, for example, had laser-safe goggles in one of their many pockets.)

With the targets illuminated from long range, the A-7 pilots were set for either straight-in passes or pop-up maneuvers to deliver their BDU-33 practice bombs. A majority of the bombs were either direct hits (one went into the mouth of the tunnel) or close enough to put the targets out of commission, had they been operational.

Several pairs of fighters went through the attack procedure, and the SEALs took turns at designating and plotting map coordinates.

The next phase of the designation exercise brought on an Air Force Reserve AC-130A gunship from the 711th Special Operations Squadron at Duke Field, Fla. To an attentive platoon of SEALs, Reserve Technician MSgt. Stanley Long explained the Selectable Strike Beacon, used by Combat Control Teams to identify targets and locations without voice communication. He also

MH-53J rear scanner SSgt. William Nelson (above), propped against the Navy SEALs' Zodiac inflatable boat, looks out the back of the helicopter on the way to Elephant Butte Reservoir. Only one SEAL (below right) seemed interested in sightseeing at fifty feet.

talked about basic gunship operations.

This was the first look at a gunship for most of the SEALs, and they had practical questions: "Do we have to worry about spent shell casings raining down on us?" (Answer: No, empties stay in the airplane.) "What about establishing contact?" (Answer: Always wait for the gunship crew to call you, or you may give away your position.) The SEALs took turns directing the gunship's fire on selected targets.

The Capstone Exercise

The capstone exercise, infiltration/exfiltration, took place at the end of the second week. Briefed thoroughly, the SEALs walked out to the helicopters in their wet suits, their fins and masks strapped to their belts.

"When you include SEALs or Rangers in an exercise, I think everybody gets a little more motivated and the end product comes out better," Colonel Holland says. "The maintainers really get excited seeing guys in camouflage come out and get on their airplanes."

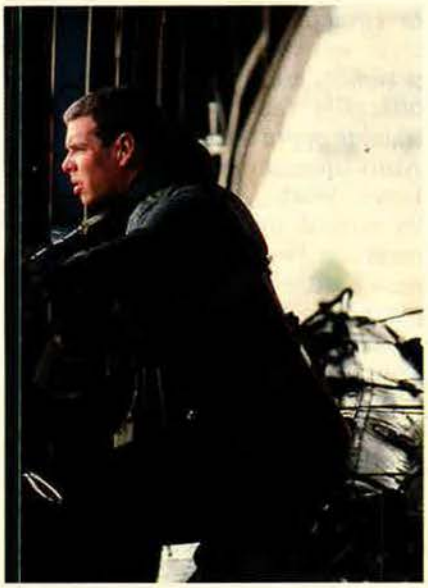
Weight and balance are constant worries on board helicopters, so the SEALs and their Zodiac boat (called a "soft duck") were put on the MH-53 and CH-3 in the order in which they would exit. The flight crew checked the Pave Low's hover coupler (which provides an automatic hover capability) at the end of the runway. Then the two helicopters rose and headed toward the mountains.

There was nothing for the SEALs to do until the helicopters reached Elephant Butte Reservoir. Temporarily free from duties, the SEALs all got some sleep. Special operators keep irregular hours and welcome any chance to nap.

The helicopter crew must display extraordinary coordination. At each turning point along the route, the Pave Low pilot got help from three scanners—one looking out on each side and another on the cargo ramp, which stays open throughout the flight. Their job was to watch for obstacles and warn the pilot when the aircraft was too close to a canyon wall before making a turn. The pilot and copilot concentrate on Pave Low's sensors to fly the aircraft. The flight engineer monitors other instruments and even adjusts the throttles.

The two helicopters proceeded in tandem, with radios silent. Ten minutes away from Elephant Butte, the pilot signaled one of the scanners to wake up the SEALs. The Pave Low crew pulled into a hover, exactly on time.

The 1550th Combat Crew Training Wing, the Air Force's Special Operations "schoolhouse," is also responsible for teaching MH-60K and (above) HC-130 operations.



The MH-53 held steady, just feet above the water, and the SEALs pushed their boat out. Once his squad was in the water and giving him a "thumbs-up," the SEAL NCO turned to the Pave Low crew, saluted, and disappeared down the ramp.

While the SEALs worked in the reservoir, the Pave Low crew practiced precision tactical approaches and landings on a rock formation in the area. At the appointed time, the helicopters returned to the reservoir.

The CH-3 crew landed the amphibious craft in the water and shut

down engines, and the SEALs and scanners brought the rubber boats aboard. Nearby, the SEALs were treading water in single file. The Pave Low pilot put the swimmers under the right sponson of the helicopter. The rear scanner unrolled a metal ladder down the ramp for them.

In less than a minute, the SEALs were back aboard. One even turned with his waterproof camera to take photos of his mates as they came up the ladder. The Pave Low pilot pulled up and made his way out of the area as the ladder was rolled up. The CH-3 rose and followed.

It Begins With Basics

Some of what's learned in joint training is simple and straightforward, which does not mean it's unimportant.

"Joint operations start with the basic things," Colonel Holland says. "We asked one group if they knew how to get the door of a helicopter open. They said, 'Sure.' When it came time to get out, they didn't know how. Now, we start with familiarization training. We show them and they show us."

There were instances in Chili Flag II when communications problems hindered, but did not thwart, the operation. During the designation exercise, for example, the SEALs could not signal the gunship with some of their equipment. They worked around the difficulty using other equipment, including signal mirrors. During the aquatic exercise, the Pave Low crew never picked up the signal from the SEALs' beacon.

Such unforeseen difficulties are not unusual. The SEAL training officer recalled an exercise involving his group and the Marines. "We both had basically the same radios, but we couldn't talk to one another because the crystals were tuned differently. Those are the kinds of things we really have to work on. If we do joint training, we find out about it then—not during an actual operation."

There are other equipment problems that hinder the special operators. The HC-130 rescue and refueling aircraft date back to the 1960s, when nighttime operations were flown at high altitude and with clear visibility. As a result, the cockpit lighting is not compatible with use of night vision goggles. The goggles amplify the available light from the moon and stars, allowing the crews to fly under cover of darkness.

The cockpit lights cannot be used in such operations, however, since they are so bright that they wash out the effect of the goggles. The crews fly with chemical lightsticks taped to the dashboard and wait for a modification.

Likewise, the tanking indication lights on the underwing refueling pods (amber, green, and red lights to give receivers directions without use of the radio) are too bright, even on "dim," for helicopter crews wearing NVGs.

Many of the HC-130s are now undergoing the Self-Contained Navigation System (SCNS, or "skins") modification. In addition to improving navigation, the new system will accomplish what one navigator called "all kinds of cosmic stuff," such as adjusting the flight path automatically. The aircraft are also getting NVG-compatible lights, new communications gear, and rheostats to adjust the Benson refueling pod lights.

An Expanding Mission

With special operations gaining a larger role in operational thinking every year, the 1550th CCTW is looking ahead to an expansion of its mission.

Training in the Sikorsky MH-60G Pave Hawk special operations helicopter begins at Kirtland this year. The wing will add the Lockheed MC-130H Combat Talon II special operations airlifter to its curriculum in 1991, with further expansion on Combat Talon aircraft training to come later.

An MH-53J weapon system trainer (WST) will soon be in operation at Kirtland, and this will allow sorties in the helicopter to be further reduced. Operational Pave Low units will use these ultrarealistic simulators for full mission rehearsal. Construction begins soon on a new avionics-repair building, a field training facility, and a three-bay simulator building for the Combat Talon and Pave Hawk WSTs.

The Albuquerque civilian community shares some of the wing's enthusiasm. A local businessman, Weldon Burris, offered the use of land behind his house for an assault runway and as a parachute drop zone. Expansion of the mission will soon require the airdropping of heavy equipment from time to time.

"I told him that we miss the target once in a while, and I asked him if he wanted heavy equipment crashing through his house," Colonel Holland says. "He said, 'No,' but he also said he would buy some additional land and we could use that instead." ■

At the end of a long day of designating targets, the SEALs board the CH-53 by climbing up a ladder rolled down the cargo ramp. The CH-53s are used to teach pilots basic Pave Low operations skills without having to use the MH-53s, thus reducing wear on these specialized helicopters and greatly reducing costs.

The Panama operation went well, even without the C-17. But what if the distance had been greater? Or if there had been no friendly airfield nearby?

—USAF photo by MSgt. Patrick Nugent

Airlift for the Next "Just Cause"

By Gen. H. T. Johnson

It was just hours before the start of Operation Just Cause, and the Army commander had a message for Military Airlift Command crews. "Together," the general began, "we're going to give the Panama Defense Forces and the Panamanian people an opportunity to experience democracy."

Then the commander, perhaps recalling the harsh, after-the-fact criticisms that have been leveled at earlier US operations, delivered a blunt reminder to all: "There will be a lot of Monday-morning quarterbacking after this is over. I never want it said that we, the Army and Air Force, didn't go at this as a team."

On both counts, he was right. The success of Just Cause restored hope for democratic government to Panama. And, despite near-universal praise for the professionalism of US forces, there was no shortage of Monday-morning quarterbacking.

Just Cause demonstrated that US military services, when they work together, can confront the adversary with a most formidable military team. In Just Cause, the US combined the unique capabilities of special operations forces, the strength and agility of the Army's airborne units, the firepower of Air Force tactical aircraft, and the speed and flexibility of MAC's airlifters. Together they formed an integrated and cohesive military arm, able to get the job done.

The overwhelming bulk of informed commentary on Just Cause —whether coming from the highest levels of the US government or from elsewhere—extols the quality of the American forces and the skill with which they carried out their assignments.

MAC conducted the largest combat airlift since the days of Vietnam, with precision, professionalism, and courage. In the first hours of the operation, eighty-four MAC aircraft picked up some 3,500 Army Rangers and paratroopers, plus their equipment, at four US locations and delivered them to the combat zone.

This was an extremely complicated operation, entailing the use of sixty-three C-141s and twenty-one C-130s in the initial deployment. The C-141s and C-130s deployed forces directly to drop zones at three separate locations. One drop zone (DZ) was at Rio Hato airfield. At Tocumen International Airport, there were two personnel DZs and two heavy equipment DZs. The airdrops were conducted in concert with land and air operations carried out by US forces already stationed in Panama.

Classic *Coup de Main*

Our special operations forces provided unique support for the airdrop and ground operations. MAC special operations aircraft and forces spearheaded the airdrop as Just Cause got under way. Combat controllers from various special operations units were inserted by MAC special operations aircraft to control the airdrop. AC-130 gunships were a critical resource providing firepower for the attack on the *Commandancia,* stopping a column of advancing enemy forces, and protecting the airdrop.

One national magazine, assessing the performance of US forces, characterized the operation as being a classic *coup de main,* a sudden attack in force that found US units being deployed quickly and quietly to strategic locations in sufficient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numbers to deny enemy forces any chance for effective response. Speed and stealth were essential, and the US airlift operation provided both.

Some commentators are maintaining that the operation might exemplify a type of military operation that will be required to support the nation's security interests in the years ahead. Indeed, prospects for reductions in the Soviet threat and complementary reductions in US forward deployments increase the emphasis that US forces are likely to place on these types of short, sharp, overwhelming operations.

The informed consensus is that US success in Panama is further evidence of the increasing importance of airlift in national defense. MAC's delivery of sufficient forces to the combat area quickly and with minimum notice enabled US forces to surprise most of the PDF. Certainly, casualty figures on both sides might have risen dramatically had regular Panamanian forces and the irregular "Dignity Battalions" been alerted and repositioned strategically.

Further, the level of damage to the Panamanian people, their economy, natural resources, and facilities—including the Canal—might well have been far higher if the operation had turned into a protracted struggle. It is, therefore, essential to ask if we will be able to achieve the same success in the future and also to discover the legitimate lessons to be learned from Just Cause.

One major lesson is immediately apparent: Airlift, and lots of it, is a crucial, irreplaceable requirement in this variety of military operation. In fact, the need for improved airlift grows daily, and with it the need to add the proposed C-17 aircraft to the MAC fleet of aircraft.

A key ingredient of successful airlift operations is an appropriate balance of airlift forces. In Just Cause, we employed C-130 aircraft to take advantage of their tactical versatility and survivability, C-141s to take advantage of their range and ability to drop 110 paratroopers at a time, and C-5s to handle outsize cargo and heavy lift during prepositioning and resupply efforts.

Proximity Made It Possible

Even so, we must point out that the proximity of Panama (Miami, for example, is closer to the Panama Canal than it is to New York) and that the availability of a friendly airfield at Howard AFB made it possible to augment air-refuelable C-141s with the shorter-range, non-air-refuelable C-130s.

Army vehicles fit comfortably, side by side, in this mockup of the C-17 cargo bay. During the Just Cause operation, eight C-141s were required to deliver eight Sheridan tanks to the drop zone. Four C-17s could have done the job—and dropped other supplies at the same time.

Both aircraft were able to deploy from the US without refueling. The C-130s refueled at Howard AFB prior to departing for home, while the C-141s headed for SAC tankers on the return leg. Further, the limited size and firepower of the opposing force and the presence of about 12,000 US troops on the ground reduced the airlift requirements—in forces and equipment.

Gen. Colin L. Powell, Chairman of the Joint Chiefs of Staff, told Congress that although MAC's airlifter resources proved to be sufficient in Panama, the C-17 would have increased airlift capability and efficiency during Operation Just Cause.

The C-17's potential contributions to Operation Just Cause cannot be addressed fully here. Still, that potential can be appreciated by considering a few simple questions.

What might interservice planners have done if the C-17 had been available? With the C-17's high degree of survivability, speed, large payload, and great maneuverability, might US forces have been deployed more quickly to concentrate greater force more rapidly against the enemy? Would airdropping outsize equipment from the C-17 have provided additional firepower and flexibility to achieve success more expeditiously? Might the C-17's more precise airdrop capabilities have offered alternative DZs, giving US forces more of an edge over the enemy?

Those are not the only pertinent questions. How might planners have capitalized on the C-17's ability to carry almost as many paratroopers as a C-130 can, plus a heavier payload than the C-141's at the same time? One could speculate endlessly, but to ask the questions is to answer them: The C-17 would have provided Just Cause planners with a wider range of additional options yielding a safer, more efficient, and more effective armed operation.

If the C-17 Had Been There

It is possible to investigate the effect of using the C-17 in place of some C-141s and C-130s for an indication of how this aircraft will enhance MAC's airlift fleet.

In Just Cause, we employed a mixed force of strategic and tactical airlifters to meet the requirements of the mission. The C-17 can be especially useful in such a scenario. It combines the advantages of a strategic airlifter—range, speed, large cargo-carrying capacity, and ability to refuel in flight—with those of a

tactical airlifter—survivability, maneuverability in the air and on the ground, and precise, speedy delivery capability.

The C-130s have limited range, payload, and speed. The C-17 will carry more than the C-130 can, carry it farther, and cruise 170 knots faster. In Just Cause, C-130s had to refuel at Howard AFB. This limited the use of the airfield for other purposes, such as airlanding additional forces and cargo.

The C-17, with self-inerting (and thus less likely to explode) fuel tanks, redundant and separated components, and other protections, is more survivable than other airlifters, which would be a great benefit in any operation. MAC lost no aircraft in Just Cause, but eight of the eleven battle-damaged C-130s took hits in the fuel system. All recovered safely; however, the outcome might not have been so positive if C-141s had taken similar damage. In addition, the C-17's greater speed approaching and departing the DZ, tactical maneuverability, and ability to perform precise night airdrops provide for reduced risk during airdrop missions.

The C-17 uses a smaller crew than do the C-141 and the C-130. In fact, each C-17 would carry a crew of three on an airdrop mission. A similar mission, such as Just Cause, requires a crew of six on a C-130 and seven on a C-141. The manpower savings with the C-17 would be huge. Therefore, far fewer highly skilled airmen would be exposed to enemy fire.

With the C-17's capabilities, fewer aircraft would have been needed during Just Cause. In the days preceding the airdrop, the C-17's ability to carry more than twice the payload of the C-141 would have meant fewer prepositioning missions. Fewer missions mean less unusual activity and, therefore, greater chance for surprise.

Including C-17s in the mix of MAC forces would reduce the number of aircraft required during the initial airdrop. Fewer aircraft mean less chance for detection during upload in the US, while passing over the potentially dangerous areas off the coast of Cuba, and during ingress to the DZs. Although the C-17 was not designed principally for personnel airdrop, its flexibility and payload capability could have reduced the size of the airlift force required during the Just Cause initial deployment.

For example, at one of the DZs at Tocumen airport, eight C-141s delivered eight Sheridan tanks. Only four C-17s would be needed to perform the same job. What's more, each C-17 would drop two tanks plus additional ammunition, fuel, and other supplies, thereby eliminating the need for resupply at a later time.

Because the C-141 drops more paratroopers than do other aircraft, not all C-141s would have been replaced with C-17s. However, on heavy equipment and cargo drops, the C-17 would offer increased efficiency.

Replacing all C-130s with C-17s would yield two fewer sorties per plane. During Just Cause, DZ lengths did not allow a full C-141 load of paratroopers to be deployed at one time on some DZs. Replacing twenty-four C-141s with nineteen C-17s saves five missions. Using the C-17 to complement the C-141 would have allowed seventy-seven aircraft to perform the same mission as did eighty-four in Just Cause. Consider the savings: seven aircraft missions and 178 fewer crew members (565 as flown vs. 387 with the C-17). The mission would also take advantage of the C-17's precise night airdrop capabilities, enhanced survivability, and ingress and egress speed—and Howard AFB would not have to be reserved for refueling C-130s.

The Teeth and the Tail

Just Cause, obviously, did not end with the initial deployment. Resupply and augmentation forces began flowing into Panama later on the first day of action. The C-17 offers significant improvement over the C-141 when it comes to these missions. Payload, ground time, maintenance requirements, maximum number of aircraft on the ground, and a variety of other C-17 advantages would have reduced the size of the force needed to meet follow-on requirements. For example, between December 20 and December 24, thirty-nine C-141s and five C-5s airlifted part of the 7th Infantry Division (Light) from the commercial airfield at Monterey, Calif. With the C-17's maximum payload more than twice that of a C-141, significantly fewer C-17s would deliver the same forces and cargo. Similar resource savings would be realized throughout the resupply effort.

In this mission, the C-5's massive payload was useful. However, compared to the C-141, the C-17 would be a better complement to the C-5. In addition, the C-17's short-field ability eliminates the need for transshipment. During follow-on deployment operations into Rio Hato,

—USAF photo by SSgt. Dean Wagner

In any military operation, getting the troops and tanks to the scene is only part of the job. Twenty-five tractor-trailers delivered 900 tons of Meals, Ready to Eat to MAC at Charleston AFB, S. C., for airlift to Panama.

After a major aircraft review this spring, the Pentagon announced that the requirement for C-17 aircraft could be reduced from the 210 aircraft originally planned to 120. The number could still rise or fall in congressional action. FY 1991 production has been slowed to allow time for more flight testing.

transshipment by C-130s was required from primary airfields. The C-17 could have carried forces and equipment directly between the US and Rio Hato.

In spite of these possibilities, Operation Just Cause does not represent a real challenge to the C-17's capabilities. The aircraft's versatility is its most significant advantage over current airlifters. It has the range of a strategic airlifter and the ability to operate into smaller airfields. The proximity of Panama to the US and the availability of sufficient runways and ramps for the C-141 and C-5 did not require the C-17's capabilities.

Still, threats to the vital interests of the United States will not all arise from such conveniently located nations as Panama. Indeed, it does not stretch the imagination to envision a requirement for military action in farther corners of the globe—in South America, the Middle East, or the Far East.

Landing on Less

In those areas, the US may not have the luxury of an 8,500-foot runway with a million square feet of ramp space set in the immediate vicinity of enemy forces. In Panama, the *Commandancia* was adjacent to Howard AFB. That happy circumstance is not likely to be repeated in the future, and the C-17 may be the only way to deploy US forces rapidly to the right location.

The C-17's ability to operate on 3,000-foot runways is a significant benefit for US forces. It provides strategic airlift forces with the freedom to land on more than 6,000 additional landing fields worldwide. In the Middle East alone, the C-17 can deploy US forces directly from the US to twice the number of airfields that could accommodate the C-5 or C-141. As in Panama, when speed is essential to the success of a military operation, direct deployment to airfields near enemy forces is essential to success. In effect, the C-17 will eliminate the need for transshipping forces from a major airport to smaller airfields closer to the enemy. US combat forces will be able to engage an enemy more quickly, with an increased chance for surprise. That could be the difference between a quick resolution, as in Panama, and a protracted conflict.

We at MAC have evaluated past operations to determine how the C-17 would have contributed to success in those particular missions. The results are illuminating.

In the case of Operation Urgent Fury, the October 1983 operation in Grenada, the C-17's payload and short-field advantages could have reduced the total number of airlift sorties required by thirty-nine percent—from 858 to 526.

During the 1983 Ahuas Tara training deployment to Honduras, MAC flew two C-5s and thirty-two C-141s to LaMesa's airport, which was the only field able to handle these strategic airlift aircraft. An additional 232 C-130 sorties were required to move US forces from LaMesa to smaller fields at Puerto Lempira and Tegucigalpa, closer to employment locations. Using the C-17 to deliver forces directly to Puerto Lempira would have required only nineteen aircraft. Those same C-17s could have shuttled forces to Tegucigalpa. We estimate that the C-17 would have brought about an eighty-six percent reduction in total sorties required for the operation.

C-17s Into Iran

In 1988, an Air Force officer described the value of the C-17 in a scenario involving a US response to an advance by Soviet armed forces into Iran. Several computer simulations evaluated various airlift alternatives. The C-17's direct delivery to secondary airfields allowed US forces to engage enemy troops significantly further forward than would otherwise have been the case, thus slowing their advance and offering time for additional airlifters and sealift ships to position needed forces and equipment. In these simulations, the C-17 contributed greatly to success.

Amid all the controversy about MAC's new airlifter, this much is clear: The C-17 offers the United States the power to protect vital national interests at distances far beyond those that had to be overcome in Operation Just Cause. The C-17's great range, large cargo-carrying capacity, and ability to deliver troops directly to the combat zone were not required in Panama. In a sense, the US was lucky this time. Conditions were favorable for the airlifters currently deployed in the MAC fleet.

Future crises, however, may not prove quite so congenial to the US and its existing equipment. It is for the next "just cause" that the United States needs the C-17. ■

Gen. H. T. Johnson is Commander in Chief of US Transportation Command and USAF's Military Airlift Command.

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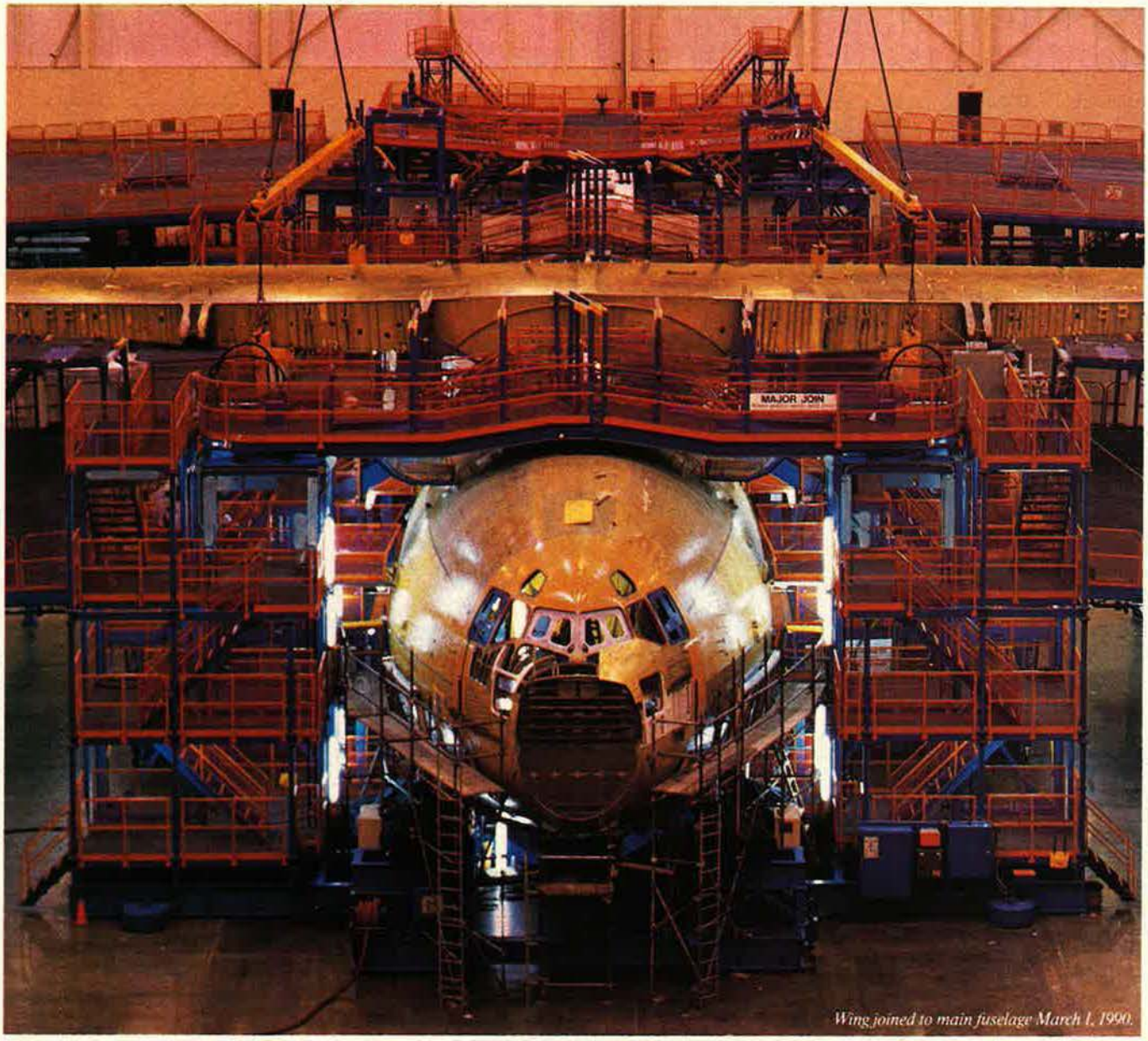

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Longer Reach for

The first full-deck carrier is at sea, and more are coming. They add a new capability for operations in the Third World.

The 65,000-ton carrier Tbilisi.

Soviet Seapower

By Norman Polmar

THE Soviet Navy, long viewed erroneously as a mere coastal defense force, has now put to sea its first full-deck aircraft carrier. This carrier, and sister ships still under construction, will provide the Soviet leadership new capabilities for naval warfare, especially for operations in the Third World.

Recent political and economic changes in eastern Europe and the USSR have led to major reductions in the Soviet armed forces and cutbacks in development and production of equipment. However, three areas of military endeavor seem to be suffering only minor reductions: space systems, strategic missiles, and naval forces.

Indeed, last year's construction of submarines and surface ships was at its highest level of the decade. The four nuclear subs and one diesel sub that entered service in 1989 represented the most submarine tonnage completed by the USSR in any year since 1980. The tonnage of surface warships delivered in 1989 was greater than in any twelve-month period for the past *twenty years*.

The largest warship completed in 1989—and the largest ever built in the USSR—is the 65,000-ton carrier *Tbilisi*. Another carrier of this type is under construction at the Nikolayev south yard on the Black Sea, as is a third flattop that will displace an estimated 75,000 tons. Moscow states that "at least" one more carrier will be built. These come on top of four vertical/short takeoff and landing (V/STOL) decks of the 43,000-ton *Kiev*-class and two 19,000-ton *Moskva*-class antisubmarine helicopter ships.

The Soviet Union has made a major commitment to aircraft carriers. This program to produce large *and* expensive ships has obviously survived the cutbacks that have constrained production of tanks, aircraft, and other weapons. Some Western analysts argue that Soviet shipbuilding programs continue from "momentum," their machinery, electronics, and other components having been in the pipeline for several years, and hence the cost of completing these ships is low. This explanation does not hold up under scrutiny. Keels for two of the large carriers were laid after Mikhail Gorbachev became General Secretary in 1985.

The *Tbilisi* was completed late in 1989 and began flight trials in November. Rear Adm. Thomas Brooks, Director of US Naval Intelligence, says it went to sea "well ahead of our estimates." He adds, "The fact that flight operations were conducted so early in *Tbilisi*'s sea trials suggests that the Soviet Navy felt the need to convince policymakers of the carrier's importance and viability during last fall's budget debate."

Peacetime Roles and Missions

Probably the most perplexing question for Western naval leaders

Soviet Aircraft Carrier Characteristics

Name	Laid Down	Launched	Completed	Status
Tbilisi	Jan. 1983	Dec. 1985	1990	Trials
Riga	Dec. 1985	Nov. 1988	(1992)	Building
Ulyanovsk	Nov. 1988	(1992)	(1996)	Building
(Unnamed)	(1992)	(1996)	(2000)	Planned

Builder:	Black Sea Shipyard, Nikolayev (south)
Displacement:	Approx. 65,000 tons full load except *Ulyanovsk*, approx. 75,000 tons
Length:	Approx. 921 feet 8 inches at waterline Approx. 1,000 feet overall
Beam:	Approx. 124 feet 8 inches
Extreme width:	239 feet 5 inches
Draft:	Approx. 36 feet
Propulsion:	Four steam turbines; 200,000 + shp; 4 shafts
Boilers:	Eight, turbopressure type
Speed:	30 + knots
Aircraft:	MiG-29 "Fulcrum" STOL Su-25 "Frogfoot" STOL Su-27 "Flanker" STOL An-74 "Madcap" STOL (?) Ka-27 "Helix" helicopters
Missiles:	Twelve SS-N-19 antiship launchers (?) Twenty-four SA-N-9 antiair vertical launchers Four combined 30-mm gun/SA-16 type antiair launchers
Guns:	Six 30-mm/65-cal close-in (Gatling type)
ASW weapons:	Two modified RBU-6000 rocket launchers
Torpedoes:	None
Radars:	Four Cross Sword (fire control) One Plate Steer (3-D air search) Four Sky Watch (multipurpose) One Strut Pair (air search)
Sonars:	Unknown

concerns the Soviets' future employment of the *Tbilisi* and its successors. Into the 1980s, the Soviet Navy rationalized most of its large warships—including the *Kiev* and *Moskva* carriers—for the antisubmarine warfare (ASW) role of hunting US submarines and protecting Soviet subs. But warships are highly versatile. It has been clear from the start of the program that aviation ships could fulfill other roles, especially in Third World regions.

The *Moskva*-class ships operate only helicopters. The *Kiev*-class ships operate helicopters and Yak-38 "Forger" fighter-attack craft rated at Mach 0.95 speeds. Though Forger is suitable for attacking poorly defended ASW surface warships and patrol/ASW aircraft, its effectiveness against land-based tactical aircraft is severely limited. Even so, these carriers could perform the "political presence" role intrinsic to large surface warships.

Since the 1960s, ownership of large, modern, long-range warships has permitted the USSR to employ its fleet in this role in the Third World. As the late Adm. Sergei Gorshkov, ex-Commander in Chief of the Soviet Navy, once observed: "Friendly visits by Soviet seamen offer the opportunity to peoples of the countries visited to see for themselves the creativity of socialist principles in our country, the genuine parity of the peoples of the Soviet Union and their high cultural level. In our ships they see the achievements of Soviet science, technology, and industry."

Moscow has long used carriers for such political purposes. The two *Moskva*-class ships, completed in 1967–68, have operated regularly in the Mediterranean. Egyptian President Gamal Abdel Nasser visited on board as the Soviets sought to show off their new military technologies and capabilities. Many more, politically oriented operations followed. The second ship of this type, the *Leningrad*, operated in the Caribbean in the spring of 1984 as part of the twenty-third Soviet naval deployment to the area. The *Leningrad* was the largest Soviet warship ever to operate in the Caribbean. With its escorts, it conducted exercises there for seven weeks.

Deployment of the larger *Kiev* class, beginning in 1975, gave the Soviets a more impressive platform for Third World political-military operations. On its maiden cruise, the second ship of the class, the *Minsk*, crossed the Mediterranean, passed through the Strait of Gibraltar, rounded Africa, crossed the Indian Ocean, and arrived in the Far East in 1979. On that voyage, initiation of port visits to Angola, Mozambique, and South Yemen and avoidance of visits to Guinea and South Africa had significant political implications. So did the *Minsk*'s visit to Cam Ranh Bay in 1980, a move that inaugurated Soviet use of that Vietnamese facility.

Similarly, the Commander in Chief of the Soviet Pacific Fleet, Adm. G. A. Khvatov, last May led the third *Kiev*-class ship, the *Novorossiysk*, and two destroyers into Wonsan harbor as Soviet-North Korean military cooperation increased.

The availability of the full-deck carrier *Tbilisi* and later carriers will provide still more impressive examples of Soviet military capabilities.

Wartime Roles and Missions

How the *Tbilisi* and other Soviet carriers might be used in wartime is more difficult to predict. According to the recently published official Soviet volume *The Navy: Its Role, Prospects for Development, and Employment*, three missions are listed:

- "Repulse of enemy aerospace attack" (which could entail operations against US strategic-missile submarines, carriers, and submarine-launched cruise missiles).
- "Neutralization of enemy military-economic potential" (which could include direct strategic attack on US territory with submarine-launched ballistic and cruise missiles and attacks on Western sea lines of communications).
- "Destruction of groupings of enemy armed forces" (which could include establishment of local sea supremacy, support of friendly ground troops, and protection of

Soviet strategic missile and attack submarines).

Though the initial air wing of *Tbilisi* and its sister ships will mainly comprise fighters, the carriers should be able to contribute to each mission. Obviously, for other missions and as new aircraft become available, the carriers will be able to accommodate various mission-oriented aircraft, like US carriers.

The current top-priority Soviet naval mission is repulsing Western missiles, bombers, and naval attack planes. This, however, is not a mere coastal defense mission. Countering Western missile submarines and aircraft carriers will require Soviet naval forces to operate thousands of miles to sea, positioned both to hit Western naval forces and to support Soviet military objectives in the Third World.

In this regard, the Soviet leaders harbor special concern about US ship-launched and submarine-launched cruise missiles (SLCMs). Widespread deployment in large numbers, strike azimuths, and other factors make SLCMs more of a threat to the USSR than manned bombers are. According to Admiral Brooks, "The Soviets would much rather negotiate away SLCMs (or at least reduce the threat they pose) than bear the expense of developing effective counters. . . . US Navy SLCMs help ensure that the Soviet Navy adapts a 'defensive doctrine.' " Soviet carrier-based aircraft must be viewed as a means of countering SLCMs.

Similarly, carriers can support "neutralization of enemy military-economic potential" by protecting Soviet missile and attack submarines from Western ASW forces. The "destruction of groupings of enemy armed forces" on land and at sea has been a traditional role for aircraft carriers.

In all these roles, Soviet carriers will be more effective against Third World forces than against major Western powers.

The Warships

Preparations for construction of the *Tbilisi* were initially observed by Western intelligence in 1979, apparently through US reconnaissance satellites. By the end of 1979, Admiral Gorshkov had formally acknowledged to US diplomats in Moscow that the ship was under construction. This indicates that a decision to construct the carrier was part of the five-year economic/defense plan launched in 1976.

The big carriers are constructed in the same building dock at Nikolayev that is used for the *Kiev*-class ships. The *Tbilisi* was launched and a second unit laid down in December 1985. Ceremonies marking the event may have been related to the retirement that month of Admiral Gorshkov, apparently ill at the time. (He died in May 1988.)

Though the *Kiev* and *Moskva* classes were built as aviation ships, the *Tbilisi* was the first to truly equate to Western carriers. The earlier carriers had the weapons and sensors of missile cruisers, in addition to aviation facilities. Western carriers, by comparison, have only short-range defensive guns and missiles. The *Tbilisi* has heavy defensive armament of short-range guns and missiles. Unlike its predecessors', the bow of this ship is part of the flight deck and is not devoted to guns or missiles.

An angled flight deck projects over the port side of the ship at 5.5 degrees to the centerline. The large island structure on the starboard side carries antennas for electronic and optical systems such as tactical air navigation, search radars, aircraft control radars, weapon guidance radars, and electronic warfare gear. Immediately forward and aft of the island are large hatches, perhaps covering vertical launchers for a dozen SS-N-19 antiship missiles, weapons with a range exceeding 500 kilometers. Radomes associated with ship-targeting satellites are fitted on the *Tbilisi*.

For the handling of aircraft, the *Tbilisi* has two large deck-edge elevators on the starboard side of the flight deck and probably a centerline elevator amidships. It has four arresting wires, similar to the arrangement on US carriers. Unlike American carriers, which are equipped with steam catapults for launching aircraft, the *Tbilisi* has a ski ramp, angled at about twelve degrees from the horizontal. The ski ramp is similar to that found in British V/STOL carriers. The Soviets have been experimenting with catapults at the Saki naval air development center in Crimea. One Soviet aviation officer, however, admits the USSR is experiencing major problems with catapults as well as with elevators. Western intelligence analysts believe the second and later carriers will have catapults for launching aircraft.

The sheer mass of the *Tbilisi*—the largest warship built by any nation since World War II except US aircraft carriers—is indeed impressive. Initial intelligence estimates indicated that the *Tbilisi* would have nuclear propulsion, with the Soviets also constructing nuclear-propelled cruisers, icebreakers, surveillance ships, and cargo ships. The *Tbilisi* and the second full-deck carrier, the *Riga*, have conventional powerplants. There is no consensus in the West about whether the third ship of the class will have nuclear or oil-burning engines.

Aircraft Carrier Deployments

Name	Completed	Fleet
Helicopter Carriers		
Moskva	1967	Black Sea
Leningrad	1968	Black Sea
V/STOL Carriers		
Kiev	1975	Northern
Minsk	1978	Pacific
Novorossiysk	1982	Pacific
Baku	1987	Northern

The Aircraft

The first fixed-wing aircraft to touch down on the *Tbilisi* was an Su-27 "Flanker" piloted by Victor Pugachev, Hero of the Soviet Union and senior test pilot at the Sukhoi design bureau. Pugachev's landings and ski-ramp takeoffs last November were followed by initial flight trials of the MiG-29 "Fulcrum" and Su-25UT "Frogfoot-B" aircraft.

—TASS/Sovfoto

The Su-27, the first fixed-wing aircraft to land on the* Tbilisi, *will probably be the carrier's long-range interceptor. Though not expected to be a match for a US carrier, the* Tbilisi *should be quite effective in Third World conflicts.

The Su-27 will probably fulfill the role of long-range interceptor. The MiG-29 is likely to serve as a medium-range interceptor with ability to perform ground attack. The Su-25, which saw extensive service in Afghanistan, is a ground attack aircraft.

Another aircraft expected to fly from the *Tbilisi* and then from later carriers is the airborne early-warning and control (AEW&C) configured An-74 "Madcap." This adaption of the An-72 "Coaler" transport, a highly maneuverable turbofan aircraft with STOL characteristics, has a large, flat rotodome mounted on the tail fin. The rotodome's unusual location is dictated by the placement of the engines; a more conventional dorsal mounting would expose the rotodome to interference and damage from engine exhaust. Soviet writings, especially those addressing the vulnerability of British ships in the Falklands war, emphasize the need for fleet AEW&C aircraft.

Other aircraft available for the *Tbilisi* are the Yak-38 "Forger" and Yak-41 V/STOL aircraft and the Ka-27 "Helix" helicopter. The latter flies in both ASW and utility-troop versions. It is unlikely that the *Tbilisi* would be used to carry out amphibious troop landings, but the new Ka-41 "Hokum" naval gunship helicopter could be based on a carrier and used to protect amphibious units as they land.

The air wing of the *Tbilisi* is expected to total sixty to sixty-five aircraft. More could be accommodated if a part of the wing were parked on the flight deck, as is the case on US carriers. While not capable of countering a modern US Navy carrier with its eighty-odd high-performance aircraft, this *Tbilisi* air wing could be effective in naval engagements with noncarrier forces such as those found in Third World waters.

To Sea—and Controversy

The *Tbilisi* is expected to continue trials and fitting out through 1990 and undertake its first operational deployment in 1991. It will be assigned to the Northern Fleet, based on the Kola Peninsula, for operations in the Atlantic.

The *Tbilisi* is already under heavy flak. Salvos are being fired by several enemies of carriers within the Soviet Union, led in part by Georgi Arbatov, a People's Deputy and director of the influential Institute of the USA and Canada. Arbatov, a longtime advisor to Soviet leaders, has publicly attacked the cost of the *Tbilisi* and questions the need for carriers in the new Soviet defense policy of "sufficiency." Arbatov's allies include Adm. Nikolai Amelko, who was Deputy Chief of the Main Naval Staff until 1986. He too has criticized the carrier's cost and role.

The Soviet Navy establishment, led by Adm. Vladimir Chernavin, the Navy's Commander in Chief and a Deputy Minister of Defense, has strongly defended carriers. Admiral Chernavin's allies include Marshal of the Soviet Union Sergei Akhromeyev, the former Chief of the General Staff, who now serves as personal military advisor to President Gorbachev. Akhromeyev is quoted as saying that he disagrees "completely" with Arbatov's anti-carrier position.

Even deciding the type of these large warships generates controversy. In a *Pravda* interview last October, for example, Admiral Chernavin repeatedly described the *Tbilisi* as an "aircraft carrier." Three days later, however, *Pravda* had this to say: "[T]hrough no fault of the author, the material contained a technical inaccuracy. *Tbilisi* falls within the category of heavy aircraft-carrying cruisers and not within that of aircraft carriers, as said in the feature."

The sensitivity apparently stems from perceptions that the 1936 Montreux Convention places restrictions on the passage of carriers through the Turkish Straits—as the Soviet carriers would have to do to reach open ocean. On the subject of carriers, the wording of that treaty is ambiguous. The official Soviet Navy magazine *Morskoy Sbornik* has maintained that "from a legal point of view the passage through the straits of any warships of the Black Sea states can be considered not to contravene the letter and spirit of the Convention." Others disagree.

The various controversies over aircraft carriers can be expected to continue in the Soviet Union, as they have in Western countries. But the flexibility, mobility, and endurance of carriers makes them highly useful at various levels of conflict, especially in the Third World. ■

Norman Polmar, who specializes in US and Soviet naval and strategic issues, is author of the US Naval Institute's Guide to the Soviet Navy *and* The Ships and Aircraft of the US Fleet. *From 1967 to 1977 he was Editor of the US sections of the annual* Jane's Fighting Ships. *His most recent article for* Air Force Magazine, *written with Thomas Allen, was "The Crypto Bandits" in the June 1989 issue.*


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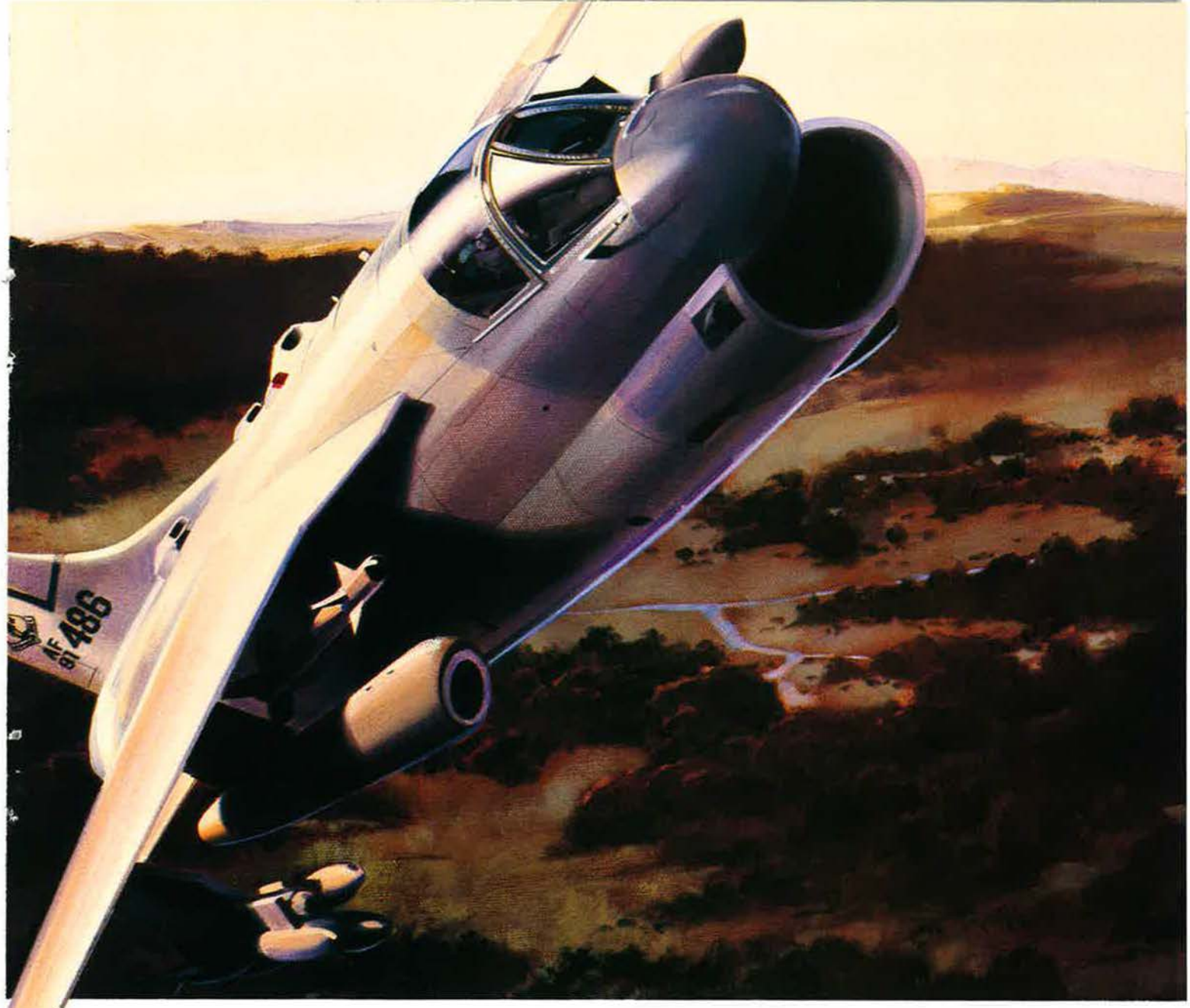

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L T V : L O O K I N G A H E A D

Valor

By John L. Frisbee, Contributing Editor

A Very Special Ace

Only one Air Force pilot was both an ace in two wars and a three-time winner of the DSC.

Lt. William Whisner joined the 352d Fighter Group's 487th Squadron at Bodney, England, in the fall of 1943. He had the great good fortune to study air combat under two men who were to become masters of the art: Squadron Commander Maj. John C. Meyer and Capt. George Preddy, whose wing he often flew.

As with many of the top aces, Bill Whisner's score mounted slowly at first. On January 29, 1944, while flying a P-47, he downed his first enemy aircraft, an FW-190. The 352d converted to P-51s in April. At the end of the following month, Whisner shot down a second -190 in a fifteen-minute dogfight against the best German pilot he encountered during the war. The next day, he shared an Me-109 kill with George Preddy; then it was home to the States on leave.

Whisner, now a captain, rejoined the 487th Squadron in the fall of 1944. On November 21 he led a flight of P-51s on an escort mission to Merseburg, Germany. As the bombers left their target, a large formation of enemy fighters struck. John Meyer (now a lieutenant colonel) told Whisner to take a straggler in one of the enemy's three six-ship cover flights. In a linked series of attacks, Whisner shot down four FW-190s in the cover flight and probably got another.

With no more than two -190s left in the cover flight he had attacked, Whisner turned his attention to the main enemy formation, exploding a -190 that had not dropped its belly tank. Evading three -190s on his tail, he shot down another that was closing on one of his pilots. Then, low on ammunition, he joined up with Meyer and returned to Bodney.

Bill Whisner was credited with five -190s and two probables that day. His score later was revised by the Air Force Historical Research Center to six destroyed, making that day one of the best for any USAAF pilot in the skies over Europe. For that achievement, Captain Whisner was awarded his first Distinguished Service Cross —second only to the Medal of Honor.

During the Battle of the Bulge, which started on December 16, the 487th Squadron was moved forward to airfield Y-29 near Asche, Belgium.

On New Year's Day 1945, Bill Whisner was one of twelve Mustang pilots led by John Meyer that had started their takeoff roll when a large formation of FW-190s and Me-109s hit the field. In the ensuing battle, fought at low altitude and before the 487th had time to form up, Whisner shot down a -190, then was hit by 20-mm fire. With his windshield and canopy covered by oil and one aileron damaged, Whisner stayed in the fight, shooting down two more -190s and an Me-109. He was awarded a second DSC for that day's work—one of only fourteen USAAF men to be so honored in World War II. (Colonel Meyer received his third DSC, the only Air Force pilot to win three DSCs in World War II.) At the end of the war, Whisner had fifteen and a half victories, which put him in the top twenty USAAF aces of the European Theater.

Bill Whisner returned to combat in Korea, flying F-86s—first with the 4th Fighter Interceptor Wing. He downed two MiG-15s in November 1951, then was assigned as a squadron commander to the 51st Fighter Interceptor Wing, which was converting from F-51s to F-86s. The wing was commanded by Col. Francis "Gabby" Gabreski. Whisner scored single victories over MiG-15s on January 6 and 11, 1952, and on February 20 shared a kill with Gabreski. Whisner was a half-victory away from becoming a jet ace.

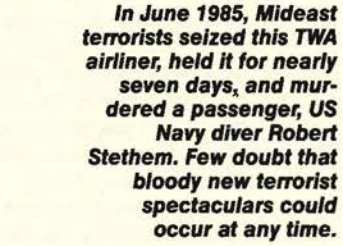
Three days later, Major Whisner led a formation of F-86s in a full-scale battle with MiG-15s. He broke off his attack on an enemy fighter and dived into a swarm of MiGs to rescue one of his F-86 pilots who had a MiG on his tail. Whisner lined up on the MiG, ignoring fire from another MiG on his own tail. In a brief, violent encounter, he shot down the MiG in his sights to become the seventh jet ace of the Korean War and the first in the 51st Wing. For that action, Bill Whisner was awarded a third Distinguished Service Cross, the only Air Force man other than Colonel Meyer to earn that distinction. He also became one of only six Air Force pilots who were aces in both World War II and Korea.

In the post-Korea years, Bill Whisner continued his career as a fighter pilot, winning the Bendix Trophy Race in 1953. After retiring as a colonel, he finally settled down in his home state of Louisiana. Several "Valor" stories have told of tragic ironies that too often have befallen Air Force heroes. None could be more poignant than the fate of Col. William Whisner. On July 21, 1989, he died of a yellow jacket sting. ■

The writer is indebted to William Hess, author of Whizz: Two-War Ace, *for information not available from the USAF Historical Research Center.*

These are the groups about which the US government is most concerned.

Profiles in Terror



—Reuters/Bettmann Newsphotos

In June 1985, Mideast terrorists seized this TWA airliner, held it for nearly seven days, and murdered a passenger, US Navy diver Robert Stethem. Few doubt that bloody new terrorist spectaculars could occur at any time.

By Colleen A. Nash, Associate Editor

ONCE again, an American President is assigning high priority to combating terror groups. It promises to be a long and difficult struggle.

For George Bush, the stakes are no less than they were for Jimmy Carter in 1979 when Iran took US hostages or for Ronald Reagan after the 1983 Beirut truck-bomb massacre of 241 US servicemen.

Today's terrorists are different and perhaps more resourceful. State sponsorship, once unusual, now is commonplace, posing what the Pentagon calls "the greatest" terror threat. Six nations—Libya, Iran, Cuba, North Korea, South Yemen, and Syria—are said to be lengthening the reach of terrorist groups.

Terrorists increasingly use advanced arms, and there is concern they may obtain mass-destruction weapons. Compounding the problem are new, nonideological terrorists: drug traffickers.

The Administration concludes that it must be ready to respond with any and all means—including military force. Asserts Defense Secretary Dick Cheney, "Incidents involving Americans may increase. This will enhance the likelihood of US counterterrorist actions requiring [Pentagon] support."

The West has made some progress. Better intelligence gathering, stronger embassy security, tighter airline protection, and more rigorous efforts at preemption have paid off. The State Department reports that the number of international terror attacks in 1989 dropped thirty-nine percent from 1988.

Still, few doubt that terrorists pose a threat or that new, bloody "spectaculars" could occur at any time. In a gloomy assessment in the Los Angeles *Times,* US terrorism expert Brian Jenkins warned that the war on terrorism "defies tidy reckoning. There is no bottom line. No unconditional surrender. No final victory."

Where are US forces most likely to engage in antiterror operations? Experts agree that western Europe, though it does not want for terrorists, is making headway against them and that US operations there would be inappropriate in any event.

The Third World is seen as the most probable venue. Latin America, the Middle East, and parts of the Pacific rim of Asia—areas of vital US economic and military interests—seethe with anti-Western political violence.

"Terrorist Group Profiles," the Pentagon's most recent assessment of the problem, identifies thirty-six groups, large and small, that operate in these areas. The list stirs controversy; there is still much disagreement on what constitutes a terrorist. Though many of the groups target US interests directly, not all do. But all, in President Bush's words, "deliberately target noncombatants for their own cynical purposes"; especially targeted are those "who defend the values of civilized society."

Following are sketches of the regions and groups of principal concern to Washington.

Latin America

In 1989, the overwhelming majority of the anti-US terrorist attacks—a total of 106—occurred in Latin America. The Pentagon attributes increased terrorism in this area over the past decade to "inspiration pro-


MEA

vided by the success of the Sandinista movement in Nicaragua, as well as renewed Cuban enthusiasm for promoting revolutionary violence." Both factors are certain to subside in light of the collapse of Sandinista power in Managua and Cuba's deepening economic and political isolation.

• *Sendero Luminoso* ("Shining Path"). Based in Peru's rugged Andean outback, an estimated 5,000 Senderistas espouse a vicious, fanatic mixture of Maoism and Marxism. Their leader, Manuel Ruben Abimael Guzman, is a former university professor. Under Guzman, the Senderistas have become a threat to the internal security of Peru. The unit, which in 1981 bombed the US Embassy in Lima and branches of the Bank of America and Coca-Cola, focuses on rural Peru, but in recent months it is thought to have assassinated Gen. Enrique Lopez Albujar, a former defense minister.

• *Farabundo Martí National Liberation Front*. The Marxist FMLN, formed in 1980 to unite the forces of five guerrilla groups in El Salvador, has about 7,500 fighters. Its biggest anti-US terror spectacular came in 1985, when the FMLN machinegunned to death four US Marine security guards and eight others as they sat in a San Salvador café. The recent Sandinista defeat at the polls delivered a major blow to the FMLN, which relied on Nicaragua as a source of arms and as a safe haven. The FMLN's fighters, however, are hard-core Communists, capable of carrying on their low-level guerrilla war indefinitely.

• *Drug cartels*. The major drug trafficker, having no ideological motivations, is a new phenomenon on the terror scene, and his role is becoming more evident. The Pentagon describes the relationship between some drug traffickers and leftist insurgents as "a marriage of convenience." In Colombia, it notes, several assassination-for-hire arrangements have been struck between drug lords and leftist terrorists. Expanded US antidrug operations in recent months have provoked retaliatory terrorist attacks.

The Middle East

Four of the six nations deemed to be backers of terrorism—Libya, Syria, Iran, and South Yemen—are in the Middle East; not coincidentally, the region racked up the highest number of international terrorist attacks over the past year. The Israeli-Palestinian conflict, intramural Arab rivalries, and religious conflicts all have made the region for many years the cockpit of international terrorism.

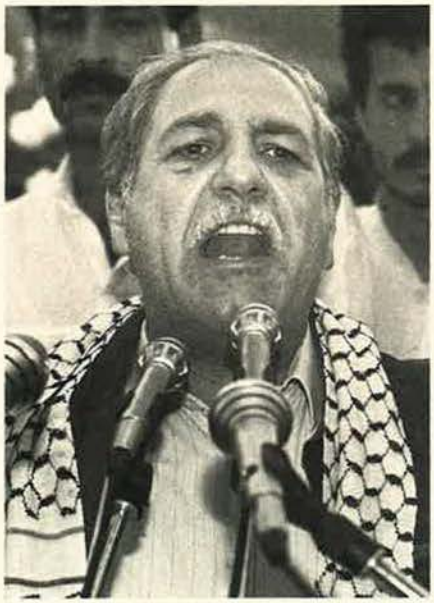
• *Abu Nidal Organization*. The ANO, an extremist Palestinian organization thought to be based primarily in Libya, remains bent on Israel's destruction and on thwarting Mideast peace efforts. Founded in 1974 by Sabri Khalil al-Banna (whose *nom de guerre* is Abu Nidal), the ANO has an estimated strength of 500 and is, in the view of the Pentagon, "the most dangerous terrorist organization in existence." The ANO is responsible for some of terrorism's bloodiest spectaculars of recent years, including December 1985 attacks on Rome and Vienna airports in which eighteen persons, including a child, were killed and 114 were injured. Since then, the group has hijacked a Pan Am flight in Pakistan, killed twenty-two Jewish worshipers in a synagogue in Istanbul, and launched attacks in Sudan that killed eight and wounded twenty-one, including five Americans.

• *Popular Front for the Liberation of Palestine–General Command*. Led by Ahmad Jibril and headquartered in Syria, the PFLP-GC is viewed as one of the most extreme of Palestinian groups. The PFLP-GC is widely viewed as the prime suspect in the bombing of Pan Am Flight 103 over Lockerbie, Scotland, in December 1988. All 259 aboard the aircraft and eleven on the ground were killed. Iran is thought to have hired Jibril's group to retaliate for the downing of an Iranian Airbus by the US Navy in the Persian Gulf. The group, formed in 1968 as a breakaway from George Habash's PFLP, counts some 500 members. Jibril once declared that "there will be no safety for any traveler on an Israeli or US airliner."

• *Hezbollah (Islamic Jihad)*. The Iranian-backed Lebanese group holds hostage six Americans and a large number of other Westerners. Dedicated to building a Shiite Islamic state in Lebanon, Hezbollah continues to target Western inter-

—Reuters/Bettmann Newsphotos

Joaquín Villalobos, (also known as Rene Cruz), shown here at a news conference in Mexico City, is a top military commander of El Salvador's Farabundo Martí National Liberation Front. In 1985, members of the FMLN killed four US Marines and eight others at a sidewalk café in San Salvador.



Ahmad Jibril, a pivotal figure in Palestinian terrorist operations, runs the Popular Front for the Liberation of Palestine–General Command. Jibril, whose group is a suspect in the 1988 bombing of Pan Am Flight 103, vowed there would be "no safety" for travelers aboard US or Israeli airliners.

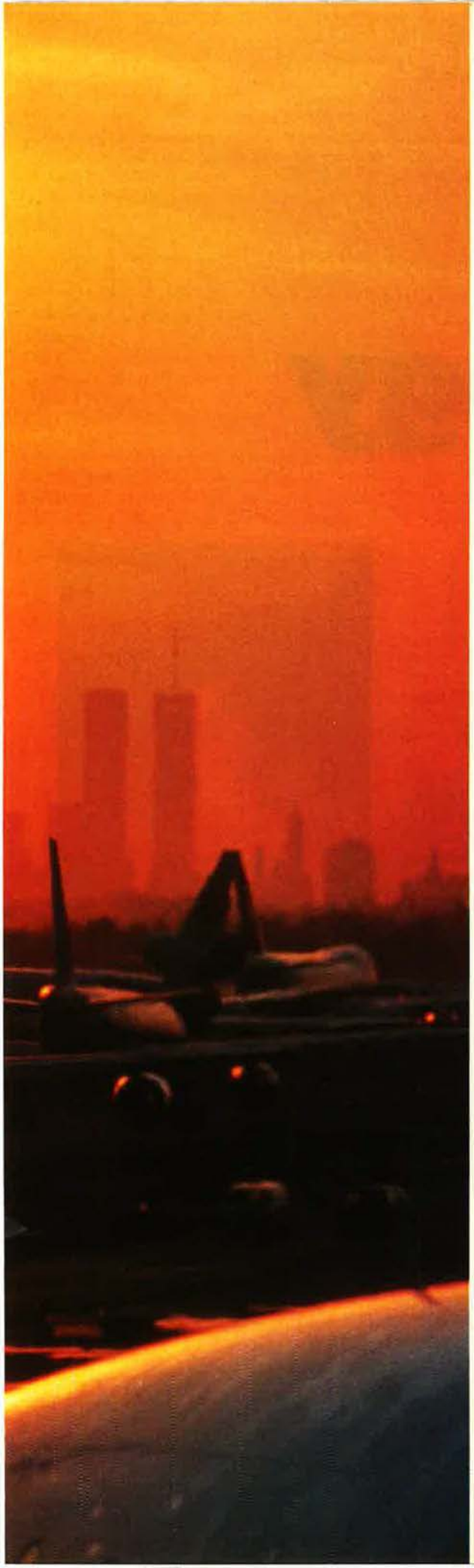
Rolando Kintanar, former chief of the Communist New People's Army in the Philippines, was captured in 1988 along with seven other top rebels. Today control of 20,000 NPA fighters is probably exercised by Benito Tiamzon. The group recently assassinated US Army Col. James "Nick" Rowe.

ests as it did in the 1983 truck-bombing of US Marines. Hezbollah announced last year that it had murdered Lt. Col. William R. Higgins, a kidnapped US Marine. When a French airliner exploded over Niger last year, killing all 171 passengers, anonymous callers claimed credit for Islamic Jihad. Formed in 1983, Hezbollah is said to have some 3,000 members, with 500 directly involved in terror work. Its center of operations is in west Beirut and the Bekaa Valley of Lebanon, and the group receives "spiritual" guidance from Sheikh Muhammad Hussein Fadlallah, a Beirut cleric.

The Far East

Compared to the carnage in the Middle East, terrorism in the Far East has been limited. Most operations are directed at domestic rather than foreign targets. There are, however, important exceptions. The Pentagon also warns that Iran and Libya, the two top bankrollers of transnational terror, are showing new interest in east Asia, attempting to recruit followers among poorer Muslims in the region.

- *New People's Army.* This group, formed in 1969 as the military wing of the Communist Party of the Philippines, opposes the large US military presence on the islands. Its principal aims include the ouster of US military forces from Clark AB and Subic Bay Naval Base and the overthrow of the government of President Corazon Aquino. The NPA has an estimated strength of some 20,000 fighters that operate throughout the country but mostly in northern Luzon. Rolando Kintanar, a top leader, was thrown into prison, and now control probably is exercised by Benito Tiamzon. No outside nation is known to provide substantial support. In 1987, the NPA claimed credit for the murder of three Americans outside Clark AB. In 1989, the NPA assassinated Col. James Rowe, an Army counterinsurgency expert. The NPA is thought to be responsible for the ambush murders of retired USAF officers Donald Buchner and William Thompson, US defense contractor employees at the time.
- *Japanese Red Army.* Formed in 1971, this group's membership is thought to be tiny—no more than twenty-five full-time operatives. However, it has shown itself over the years to be one of the most extreme of all Marxist-Leninist groups, responsible for some of the most infamous terrorist acts. These include the 1972 machine-gun and grenade attack at Israel's Lod Airport, killing twenty-six; the 1977 hijacking of a Japan Airlines plane and 159 passengers for a $6 million ransom; and the 1988 bombing of a US servicemen's club in Naples, killing five. Many JRA attacks are carried out in cooperation with other—principally Palestinian—gangs. The JRA's primary source of funding is thought to be Palestinian groups and Libya. Core members operate from a base in Lebanon, but operations range throughout Asia, the Middle East, and western Europe. ■



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Before computerized systems, pilots sometimes aimed by the TLAR ("That Looks About Right") process.

Bombology

By James P. Coyne

If the F-15E is ever required to fire shots in anger, the above will be a common sight for enemies of the US. F-15Es, such as the ones over Edwards AFB, Calif., pictured at right, bristle with lethal ordnance (though these are practice bombs), and their lethality is increased by the LANTIRN pods (under fuselage), which enable attacks at night and in adverse weather.

THE art of air-to-ground attack was born in the smoke and flames over World War I battlefields, when low-flying fighter pilots used machine guns to strafe enemy troops in the trenches. The troops, of course, fired back at the fighters. At about the same time, airmen began to perform rudimentary, level bombing from two-seater aircraft. The pilot guided the biplane over a target, and the observer, leaning out of his cockpit, hand-dropped small bombs on troop formations, road intersections, buildings, bridges, and other "strategic" targets. By the end of the war, military airmen had developed simple bomb racks for larger bombs, which were fastened under the wings or fuselage of a plane.

Level bombing was not very accurate at the time, mainly because there were no reliable ranging systems. After the war, the US Navy developed dive-bombing, which was more accurate, and the modern form of warfare, now called "tactical surface attack," began. The pilot could aim a bomb at a target, release it, and pull out of his dive at reasonable risk (for a fighter pilot), in hopes of being above the lethal envelope of small-arms fire, but he had to maintain a steady course as he flew along his delivery path toward the release point over the target. This requirement made a diving plane vulnerable to antiaircraft fire, which rose much higher than small-arms fire.

The aircraft's vulnerability was lessened somewhat by its rapidly changing altitude. This complicated the defender's firing task, because each antiaircraft round was preset to detonate at a specific altitude. A round might be well aimed, passing near the aircraft, but if it exploded at an altitude that was significantly different from that of the diving plane, it was ineffective.

The Proximity Fuze

Eventually, military technicians invented proximity fuzing for antiaircraft rounds. Proximity fuzes could sense the nearness of a targeted aircraft and detonate the warhead, no matter what its preset detonation altitude. The tactical pilot's risk increased considerably. Further, the development and refinement of radar during and after

World War II meant that the enemy could know attackers were coming. Advance warning mitigated a key attack advantage: the element of surprise.

Next, fire-control radar was integrated to provide exact target altitude and bearing information to antiaircraft batteries, making their fire more deadly.

The risk to aircraft rose exponentially with the development of surface-to-air missiles (SAMs) and their extensive employment by North Vietnamese forces during the Vietnam War. With direction from a combination of on-board and site-located radar, the missiles could accurately track US fighters. The best way to defeat the SAMs, US pilots found, was to outmaneuver them and dive for the earth. This put the Americans within reach of potentially devastating small-arms fire. As a result, US pilots faced a deadly threat both high and low. They could fly low only in daylight because of the danger of flying into terrain that was not visible at night.

Fortunately, the US developed equipment that returned some of the advantage to the pilot. Soon perfected were new inertial navigation systems that could accurately keep track of a fighter's position, even in constant high-G maneuvering. On-board air data computers, which gathered sensor information on air temperature and density, were added. A central computer could use inertial navigation system information, combined with altitude, wind direction and speed, and data from ground-mapping radar, to tell a pilot his exact position and the position of the target. The central computer, manipulated by the pilot, could direct armament systems to employ weapons.

Today, cockpit video displays, navigation radios, sensors, on-board computers, ground-mapping radar, forward-looking infrared systems, inertial navigation sets, integrated tactical electronic countermeasures devices, and programmable armament control sets are standard equipment aboard modern surface attack aircraft such as USAF's F-15E. These enable the fighter pilot to strike a target with precision. In many cases, they can employ certain types of ordnance without having to fly over a heavily defended target.

Using the two-pod AN/AAQ-13/14 Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system, a two-man F-15E crew can take off from a blacked-out airfield and fly a moonless night attack mission only 100 feet above rough terrain, traveling at airspeeds greater than 500 knots. The infrared picture, which the pilot sees through the head-up display (HUD) in his windscreen, "reads" heat emissions to show him the terrain ahead, which shows up almost as bright as in daylight.

The terrain-following equipment enables the pilot to stay below enemy radar acquisition horizons. Once in the attack area, the aircrew can "see" the target, using ground-mapping radar or infrared return data displayed on one or more of their cockpit multifunction displays (MFDs), and attack it before the defenders know they are threatened.

Even as the pilot flies his high-performance aircraft, the fighter crew must manage all the modern avionics and electronic systems at its command, interpret information provided by the sensors, make attack decisions, and, finally, operate all the systems necessary to carry out the mission.

Today almost all ordnance deliveries are made using the "magic" of the systems in the aircraft. Pilots train to use it every day. Nevertheless, because battle damage or other factors may cause the systems to fail, the pilot must practice delivering bombs the old-fashioned way, in the manual mode. The job remains the same: Put ordnance on the target, regardless of what the defenders throw at the attacking fighter.

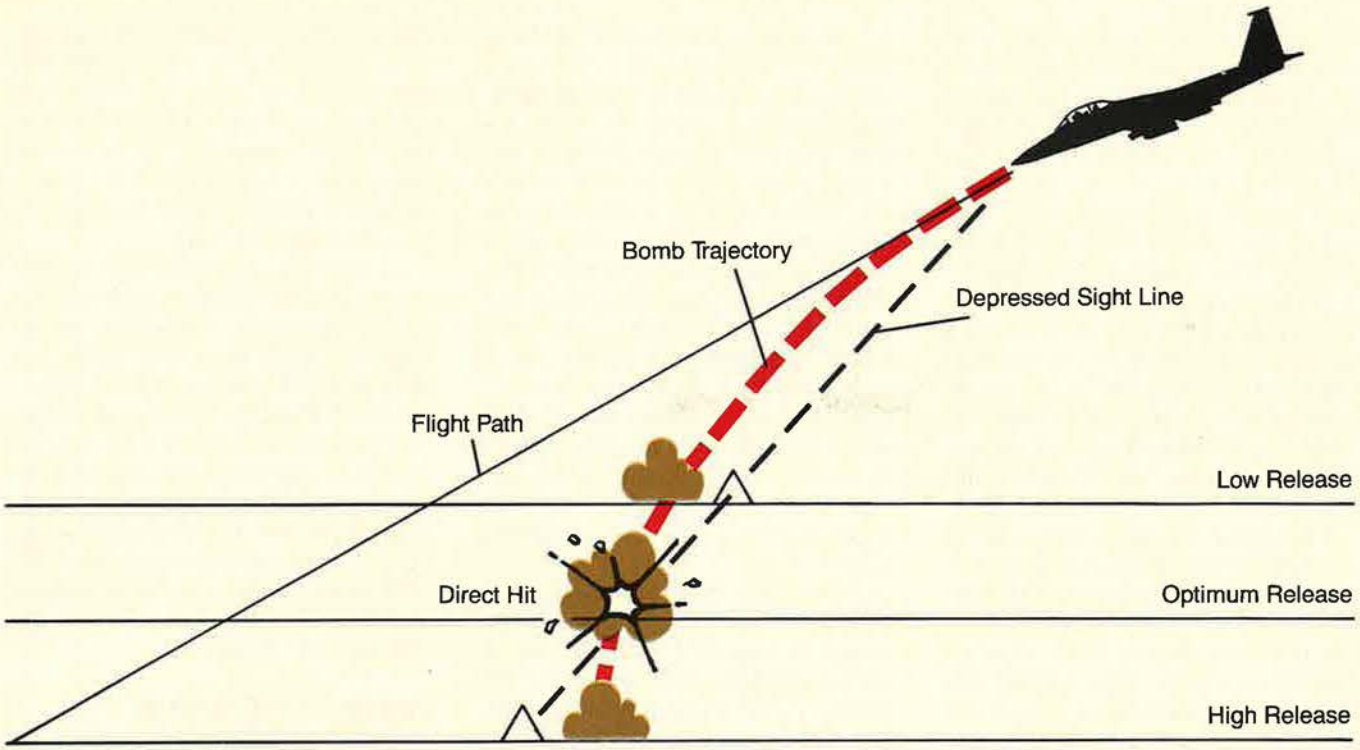
The "Pucker Factor"

This job—attacking a ground target from a fighter—might seem simple. After all, a streamlined projectile dropped from an aircraft will follow a predictable trajectory to the target. All the pilot has to do is put the aircraft's release position exactly where it should be to make sure the trajectory's starting point is correct. Getting to that point, however, is not a simple task, even if the pilot doesn't have to contend with the "pucker factor"—stress—induced by flak, enemy interceptors, and SAMs.

To determine the release point for its bombs, the aircrew starts with the target's altitude. Crew members know they must release at a high enough altitude above the target for the bombs to arm. If the bombs are not armed, they will not detonate. One often-used arming setting is six seconds. The pilot also knows that he must release at an altitude high enough to permit him to pull out of the dive and still be above the fragmentation envelope of the bombs.

From precomputed tables, the pi-

In a far cry from the days of "That Looks About Right," today's F-15E drivers familiarize themselves with the aircraft's many displays in futuristic simulators such as this one. A total of seven cathode ray tubes and the pilot's head-up display give the aircrew vast amounts of data in digestible form.



In manual bombing, all parameters—preplanned dive angle, drift, airspeed, and release altitude—must be on the money. The chart shows the penalty for releasing bombs at an altitude above or below the preplanned "pickle point." A pilot strives to release the bomb at the same speed in order to develop a "grooved" delivery.

lot can determine, for example, that the fragments from a detonated Mk 82 500-pound bomb with an M904 fuze will radiate in all directions at 1,300 feet per second in the first second after impact. By nine seconds after impact, slowing down because of friction with the air, the fragments will have traveled 2,520 feet vertically. The pilot will be pulling out of his dive during this time. He knows he must "bottom out" at least 2,520 feet above the target altitude. Actually, when he includes a safety factor of twenty-five percent, the altitude is 3,150 feet above target altitude.

Another table tells him that, if he bombs with a forty-five-degree dive angle, and if he applies 4.5 positive Gs to the aircraft within two seconds after release, he will need about 2,000 feet to pull out of the dive. Thus he knows he must release the bombs and start his pullout at just over 5,000 feet above target (3,150 feet plus 2,000 feet). The bomb trajectory differs according to airspeed, so the pilot always strives to release at the same speed in manual bombing—around 450 knots. In this way, he can develop a "grooved" delivery, much the same way that a golfer develops a grooved swing. (With automatic systems operating, the pilot can vary his delivery parameters considerably and still bomb accurately. This, of course, is highly desirable, in that defenders in a hot war cannot divine a predictable pattern that an attacking aircraft will follow.)

To reach the exact delivery point for accurate bombing, the pilot probably finds he must start his roll-in from a point 10,000 or 11,000 feet above the target. This gives him time and airspace to bring the nose of the aircraft down and around to the proper aiming and delivery position.

Shorts and Longs

It is critical that the pilot hold the aircraft in the exact computed dive angle and exact computed airspeed until he releases his bombs. When he holds his aiming "pipper" on the target and he is traveling too fast or diving too steeply, his bombs will be long or will hit past the target. If he is too slow or too shallow, his bombs will fall short. For example, a dive angle that is five degrees shallow (forty degrees) will cause the first bomb to hit about 130 feet short. If the pilot is twenty knots slow, the first bomb will hit sixty feet short. If he is exerting unwanted G-forces on the aircraft (perhaps starting the pullout too soon), the bomb impact point is affected. Exerting only one-fourth of a G at the release point can cause the first bomb to be almost forty feet short of the target. Pilots try to compensate for deviations in release conditions by moving their aiming point.

Often complicating the situation are crosswinds, headwinds, and tailwinds. At altitudes above 3,000 feet, winds of forty knots or more are common. The aircraft, like a canoe caught in the current while being paddled across a swiftly flowing river, is significantly affected by the air mass through which it is diving. A forty-knot wind from the left, for example, will displace an aircraft's diving flight path toward the right. The winds have negligible effect on the bombs as they fall through the air mass. But the bombs will tend to follow the sideways flight path of the aircraft at the release point, so the pilot has to aim to the side of the target to compensate.

Doing this accurately is not easy, especially in light of the fact that winds rarely come in directly on the nose or tail, or from ninety degrees to the centerline. They usually are

quartering winds, and it is difficult to apply a correcting rule accurately. Because of these complications, before the advent of modern computerized bombing systems like those in the F-15E, many pilots used an aiming system they jokingly called the TLAR System. TLAR meant "That Looks About Right."

In the past, complicating factors notwithstanding, dive-bombing qualification required an average "miss" of less than 140 feet from the pylon in the middle of the bombing circle. Most pilots had average accuracies of fifty feet or less, and many regularly scored bull's-eyes.

During the Vietnam War, accuracy diminished somewhat because the defenses often dictated release altitudes well above those used on the practice range. Foul weather over the targets often forced unusual release altitudes or attack patterns. Pilots were able to compensate for these by releasing multiple bombs, some of which would fall short or long, with others in the string hitting the target.

Staying Flexible

In South Vietnam, Cambodia, or Laos, many of the targets that were attacked were "targets of opportunity" located by a Forward Air Controller (FAC). The FAC would estimate target altitude by looking at his map. Over the radio, he would obtain estimated pressure altitude and winds from the command center. He would pass this information, with target coordinates and map location, to an incoming attack flight. While the FAC was marking the target with a smoke rocket, the flight members would prepare for the attack. Often, if there was fuel and time, the flight leader would drop one bomb, observe its impact point in relation to his aiming point, and then advise the rest of the flight on sight settings and offset aiming points.

In the late 1960s, modern computers, avionics, and attack systems began to appear in US fighters in southeast Asia. The venerable Republic F-105 Thunderchief, workhorse of the war over the North, was equipped with the Thunderstick modification, which gave it a computerized toss-bombing system. The McDonnell Douglas F-4E, with an internal gun and a computerized bombing system, was introduced and provided a significant increase in attack capability.

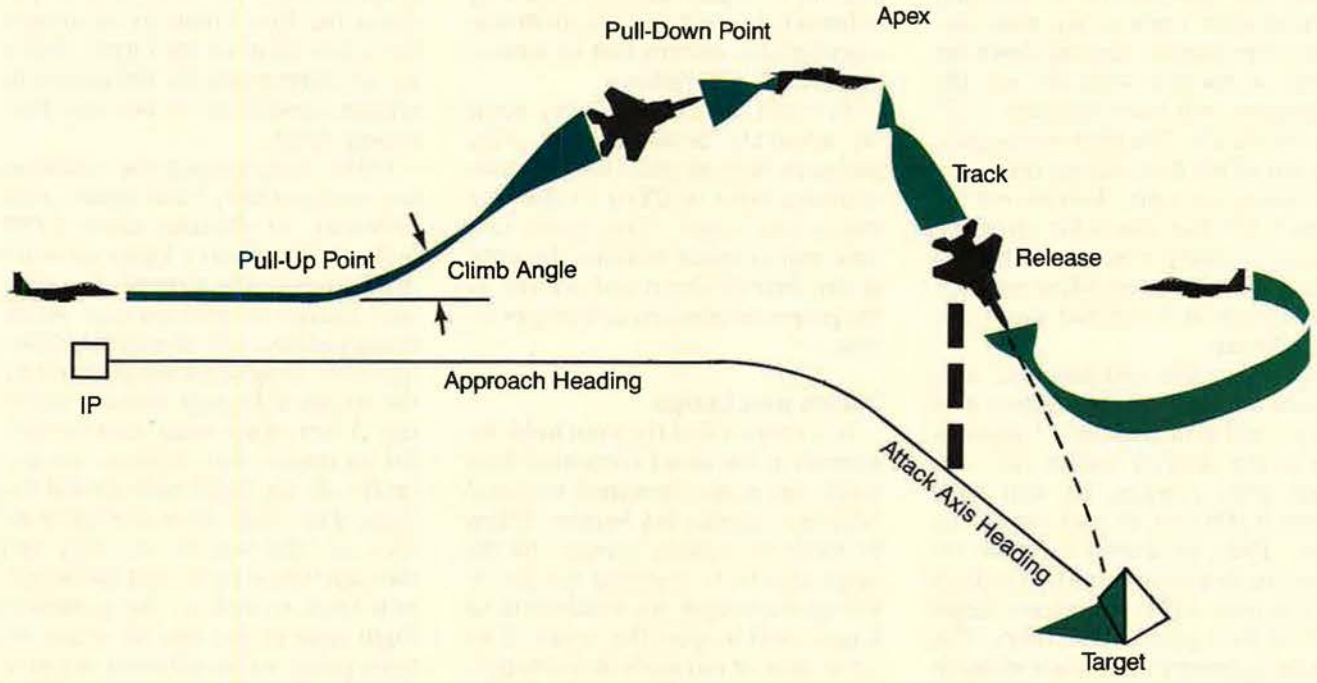
In late 1972, the LTV A-7D, which represented a quantum leap in the sophistication of ground-attack fighter aircraft, was introduced in the Vietnam War. The A-7D featured an extremely accurate inertial navigation system, a HUD, and a weapons employment system unparalleled at the time.

In the A-7, computerized systems automatically compensated for the effect of winds and other atmospheric conditions and easily accommodated varying roll in direction and altitudes, release altitudes, and airspeeds. It featured a terrain-avoidance system and a reliable radar all-weather bombing system. Equipped with the first truly accurate toss-bombing capability, the A-7D was the forerunner of today's F-16 and F-15E. The A-7D and the F-4 are still flying.

How the F-15E Does It

Today, because of the greatly increased capability of on-board navigation and ordnance employment systems, an F-15E attack fighter aircrew spends more time than ever in flight planning. In flight, the pilot and his weapon systems officer are busy managing the systems.

Assume the target is a vital, heavily defended railyard, 200 miles in-



For an angle-off, pop-up delivery, the F-15E's crew streaks over the initial point (IP) on the approach heading at an altitude of 100 feet. At the pop-up point, crew members execute a firm four-G pullup to a forty-five-degree climb. At the preplanned pull-down point, they roll inverted and pull the nose toward the surface. They check their aiming symbology and target location, turn on to the attack axis, and roll the aircraft upright in a dive. When the computerized system releases the bombs, the aircrew immediately rolls the aircraft away and descends to the deck for egress.

side mountainous enemy territory. The takeoff time is three a.m., and there is no moon. No landmarks will be visible, and all towns and cities will be blacked out because it is wartime.

Although several varieties of precision-guided munitions might be suitable, including some that are powered, assume that the best ordnance available for this mission is the M117 750-pound "iron" bomb. The F-15E can carry at least twelve of them while still carrying a full complement of AIM-120A Advanced Medium-Range Air-to-Air Missiles (AMRAAMs) for its own air defense.

To fully exploit all the capabilities of the aircraft, every aspect of the low-level flight must be planned in advance, especially the location of navigation reference points along the route and the initial point for the start of the bombing run. The systems enable the pilot to fly at low levels, over mountains and through valleys, all the way to the target at night. Staying beneath enemy radar, he uses ground clutter to fool any searching aircraft that might be equipped with look-down, shoot-down radar systems.

The aircrew can briefly pop up to an altitude from which the plane's on-board radar can take and "freeze" a picture of the target that is as crisp as a photograph. Then they quickly drop down into ground clutter again. The central aircraft computer, gathering input from on-board sensors, continuously gives their position in relation to the target and to the initial point for the attack.

Next the pilot must exactly locate the bombing pop-up point, from which he can start the ordnance-delivery phase of the mission. There he initiates a precise, forty-five-degree climb for a specified number of seconds to the pull-down point, where he then must roll the aircraft inverted and pull the nose down and around toward the target. From preflight planning, he knows the direction and distance to the target. From observation of the target, if it is visible, and from his HUD symbology and other information (presented on the aircraft's MFDs to the pilot and his backseater), he must determine whether the aircraft systems are, indeed, directing him precisely to the target or if they may be slightly off. If they are off, he must use some of the buttons and switches on his throttles and stick to align the aiming and release systems correctly.

Along with simulator training, the F-15E aircrews get to practice their techniques in the sky. This F-15E, from the "schoolhouse" (405th Tactical Training Wing) at Luke AFB, Ariz., though it boasts highly sophisticated technology, still requires a pilot with "a delicate touch and nerves of steel."

He then smoothly rolls the aircraft upright, with the nose pointed down at the preplanned dive angle (or close to it), making sure the aiming symbol in the HUD is on the target.

The systems will use data from the aircraft's sensors to compensate continuously for climb and/or dive angle, airspeed variations, distance from the target, and wind effect. The pilot's job is to be sure the aiming symbol stays on the target and then smoothly to follow directions from his HUD symbology that tell him whether to fly left or right. When he depresses and holds the "pickle button," the system will release the bombs at the proper point to enable them to "fly" to the target. This job is much harder than it sounds, and doing it right requires a delicate touch on the controls and nerves of steel.

When the pilot gets an in-range indication in the HUD, and the release cues are flashing, he depresses the bomb-release button on the stick grip and starts the pullout. When the fighter reaches the precise point that will enable the twelve bombs to "fly" to the target, the armament system ejects them. Aircraft inertia tosses them toward the target, still a mile or more away. The time on the stabilized release heading is less than five seconds. Then the pilot aggressively rolls the aircraft to start his turn away from the target and enters the egress route.

Back at the target, the bombs erupt in a destructive pattern that blows up rolling stock and puts huge craters among the twisted and shattered railroad tracks. The railyard is disabled. Antiaircraft guns are firing blindly. They don't have a target, because the attacking aircraft did not fly over their lethal horizon for more than a few seconds. The F-15E and its aircrew escape to fight again.

For the task of surface attack, the US is developing new aircraft such as the A-12 Advanced Tactical Aircraft. These planes will have even better capabilities, and they will be flown by a modern breed of tactical fighter pilots. Their mission will remain the same: Destroy the target. ■

James P. Coyne is a veteran fighter pilot. After his retirement from the Air Force in 1984 as a colonel, he served Air Force *Magazine as Senior Editor and* Signal *Magazine as Editor in Chief. His novel* Strike Eagles *was published in May. His by-line last appeared in this magazine with "Standing Up for Airpower" in the September 1986 issue.*

Today's computers are fast but simple-minded. Even snails are smarter in some respects. Tomorrow's machines may be more flexible.

Why Can't Computers Think Like Humans?

By John Rhea

THE human brain, after millions of years of evolution, has reached a point where it can perform ultracomplex computations, such as pattern recognition, in a few thousandths of a second. After fewer than fifty years of evolution, computers are able to process huge amounts of data for more straightforward, simpler tasks, such as the guidance of ballistic missiles, in a few nanoseconds, or *billionths* of a second.

Air Force researchers would like to combine these two distinctive capabilities—the speed and precision of computers and the extreme sophistication of the human brain—in the advanced weapon systems of the future.

One high-visibility example is the Pilot's Associate, a next-generation avionics system that is being developed to take over some of the more mundane functions of operating a high-performance aircraft. The Pilot's Associate, sponsored by the Defense Advanced Research Projects Agency, would allow the human pilot to devote his full attention to carrying out the actual mission.

Numerous similar projects are under way, meanwhile, at the Air Force's Wright Research and Development Center (WRDC), located at Wright-Patterson AFB, Ohio, and Rome Air Development Center (RADC), located at Griffiss AFB, N. Y. These projects cover a wide spectrum of USAF missions. All of them depend on research being carried out at the leading edge of hardware and software technology.

The hardware side is reasonably manageable. Advances in today's silicon-based electronics and in even more efficient materials guarantee that the trend toward faster and faster data-processing power will continue. That power is now increasing by a factor of 100 every ten years.

What has long proved elusive, however, is the software that could theoretically enable these awesome, superfast machines to achieve near-human performance. It is here that the Air Force is now concentrating its efforts, trying to reorganize computers so that they can learn and respond to unprogrammed situations—in other words, think.

—Illustration by David Chung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Mediocre Chess Players

These efforts fall under the catchall term of artificial intelligence, a field that is somewhat discredited these days. For years, the only tangible results seemed to be computers with the ability to play a mediocre game of chess. Critics considered this an unproductive use of resources, to put it mildly.

Today, the focus of USAF effort is shifting to what are known as "expert systems." As the name implies, these capture the best available human expertise in computers and apply it more quickly and consistently to predefined problems than any human could do. Like the Pilot's Associate, expert systems will serve as a force-multiplier by combining human knowledge with the power of computers.

—Illustration by David Chung

The state of today's non-expert-system art is exemplified by one system the Navy uses to carry out antisubmarine warfare (ASW) missions. Its human creators have programmed the system not to waste time looking for Soviet strategic ballistic missile-firing submarines (SSBNs) in the Mediterranean Sea; the Soviet Navy has never operated SSBNs in those shallow, confined waters. Less sophisticated ASW systems might let a truly dangerous Soviet attack submarine slip into the Mediterranean while it was conducting a fruitless search for SSBNs.

But what if the Soviets, against all reason and for the first time ever, were actually to deploy a "boomer" in the Mediterranean? Even the best of today's ASW systems would be stymied until a human could intercede and tell it what to look for. By that time it might be too late.

An even bigger challenge—perhaps the most formidable computing task ever conceived—is solving the battle management problem that would be inherent in any full-scale strategic defense system. This task would entail finding the real warheads in a swarm of decoys, aiming directed-energy and kinetic-energy interceptor weapons against them, and then verifying that the attacking weapons had been destroyed. Improvements of several orders of magnitude to today's computational capabilities will be required if the system is to do this job right.

The Snail's Pace

Dr. James Ionson, former director of innovative science and technology projects for the Strategic Defense Initiative Organization and now a Washington defense consultant, uses the analogy of a snail's brain to illustrate how expert systems of the future will function. His point isn't that snails are smarter than computers, but that the snail has organized what little brain power it has effectively enough to survive.

The typical snail, Dr. Ionson explains, has the equivalent of four or five neurological gates, or brain cells. "Yet it can do more than the most advanced computer."

Why? The brain of a snail—or of a human—is not entirely digital. Computers, with rare exceptions, are. The latter have to process all their information as a series of digits: ones and zeros. That's not the most efficient way, but it's the best that present computer technology allows. To do more than just process digital data, truly thinking mechanisms also must be able to handle complex analog data, as humans and other living things do to varying degrees with the five basic senses: sight, hearing, touch, taste, and smell.

The difference between this and traditional computing is the ability to adapt to changing conditions and to handle data of a type never before encountered. "In ten or twenty years, today's supercomputers will be obsolete, because they're not fault-tolerant," Dr. Ionson contends. "They're not thinking machines. They're doing machines. They do grungy calculations any human could do, if he lived two million years."

Researchers are trying to develop high-reliability expert systems that embody two characteristics of the human brain that now are beginning to find their way into computers: parallel processing and neural networks. Each has its advantages and disadvantages.

Parallel processing is the opposite of the way most computers work now. Today's computers tackle processing jobs in serial fashion (*i.e.*, working on them one at a time and completing each job before beginning on the next one). By contrast, parallel processors can break up the jobs into smaller parts and work on all the parts at the same time.

This greatly reduces the downtime suffered by the computer whenever it is waiting for the next data to process. However, it requires a much more complex system architecture, one based on an array of individual processors. Experimental machines used for the particularly demanding job of image processing, for example, consist of as many as 65,536 one-bit processors linked together in what is known as a "massively parallel" configuration.

Computer scientists call these machines "connectionist" because they use a collection of permanent knowledge stored as a pattern of connections among the processing elements. This knowledge directly determines how the processing elements interact rather than sitting passively in memory, waiting to be looked at by a single central processor. These connections can be symbols that represent the instructions needed to process the data. This is believed to be the way the brain's neural networks work, although the exact nature of the human brain and the way it functions remain mysteries.

Axons, Dendrites, Neurons, Synapses

The brain contains about 100 billion neurons representing the logic and memory functions, and they are organized in a complex, unknown interconnection structure in which each neuron is connected to several thousand other neurons. This results in more than 100 trillion synapses, which are the brain's subsystems for tackling different processing jobs.

Even though this biological computing process is about a million times slower than today's top-of-the-line electronic computers (operating at milliseconds instead of nanoseconds), the efficient routing scheme enables the brain to make tentative decisions based on partial information. The man-made computing machines, meanwhile, are still waiting to digest the last bit of data before venturing any decision at all.

This is why humans can recognize someone they know after seeing only one feature or can pick out familiar faces in a crowd. The obvious military applications of this ability involve pattern recognition, speech recognition, and motion detection.

Furthermore, some scientists, such as Dr. Carver A. Mead, a professor of computer science at California Institute of Technology, believe these biological functions can be reproduced electronically—thus combining the efficiency of the brain with the speed of electronics.

In the brain, electrical impulses must have a high enough voltage to jump from a neuron through a connection known as an axon and across the synapse to a collector, known as a dendrite, of an adjoining neuron. This whole process must be completed in sequence in order to process information.

Dr. Mead proposes to duplicate the power of the neurons with complex integrated circuits, the axons and dendrites with wires or optical fibers, and the synapses with variable resistors. The resistors would be set for a specific voltage and would only pass along to neighboring circuits those signals that meet the voltage requirement. The advantage is that, like the human brain, these electronic neural networks would develop patterns of routing signals and "remember" which ones to use the next time they had to tackle a similar problem.

"We're focusing on neural networks that interact with the environment in real time and in a closed-loop manner," explains Dr. Harry Klopf, program manager for neural network research at WRDC's Avionics Laboratory. "Neural networks are approximating the learning mechanisms and the network architectures of brains." To date, however, this has been limited to computer simulations in the laboratory.

One of Klopf's projects: "teaching" a two-degree freedom-of-motion robotic arm, now being developed by Martin Marietta, to track moving targets. The goal is to achieve a full seven degrees of motion, meaning that the arm could be used in adaptive flight controls. Seven degrees of motion is what a human needs for the relatively simple task of balancing a broom on the outstretched palm of a hand, says Klopf, but the necessary control mechanisms are far beyond the capabilities of today's robots.

Space Telepresence

Rich McKinley, a biomedical engineer at WRDC's Armstrong Aerospace Medical Research Laboratory, offers another high-payoff application: "telepresence." He envisions partially autonomous mobile robots with three-dimensional vision that could extend human capabilities in hazardous environments. The "endgame," according to McKinley, would be the ability to refuel aircraft, conduct aircraft repairs rapidly on the runway while the engines are still running, and load ordnance. In all these cases, it's desirable to have humans as far away as possible. NASA has been studying similar techniques for assembling its space station in orbit, a capability that would help to minimize costly and dangerous extravehicular activity by astronauts.

Lt. Michael Wellman, a project engineer in WRDC's Artificial Intelligence Applications Office, is applying expert systems techniques to automating the scheduling functions of the Military Airlift Command. The job calls for transforming a prototype software package, originally developed by MITRE Corp., into an operating system that can take into account such factors as types of aircraft available, numbers of takeoffs and landings, and routing and refueling.

"It's essentially a matter of sheer volume," Lieutenant Wellman explains. "There's no way to examine all possible combinations in the amount of time allowed to do the job—even with a computer. But by having some idea of how the airlift process works and what makes a good schedule, we can focus our automatic planner on the preferred solutions."

Planning and neural-net pattern-recognition systems are among the projects being tackled at WRDC, adds William R. Baker, chief of the AI office. The next systems to be

developed there include a "smart index" to help maintenance personnel using modular automatic test equipment to locate and solve maintenance problems, a neural net or pattern recognition system to reduce the number of sensors in a jet engine, a generic planning system to help managers plan more efficiently, and a neural net pattern recognition system for air-to-air targeting.

—Illustration by David Chung

This research is leading to what Ralph Duncan, a software design consultant with Control Data's Government Systems Group in Atlanta, calls the "parallel architecture for the next generation of systems." He perceives the pressing requirements as command and control and "mission planning on the fly."

These will require standardized, reusable software tools, according to Duncan, including "smart tools to generate different designs [automatically]." This requires distributed operating systems that can work with a variety of architectures. Control Data Corp. recently completed a study of fault-tolerant systems for the Avionics Lab, incorporating knowledge bases and parallel architectures.

"Bite-Size" Applications

Work at RADC, which seeks to capitalize on DARPA's Strategic Computing Initiative, includes knowledge-based mission planning, a "software assistant" that can learn from previous software development programs, and new systems engineering methods built on knowledge bases that can be applied to the Pilot's Associate. The goal, say RADC officials, is to seek immediate applications of the new technologies in narrow but useful domains. Officials call these "bite-size" applications.

DARPA will be the principal source of funding for development of the neural networks of the future. The agency has earmarked more than $30 million over two years for preliminary investigations. Dr. Craig Fields, the DARPA Director, reports mixed results. "The hard part is AI, and the harder part is the software systems," he says. "We have systems that can learn [while] working in the lab," says Dr. Fields, who adds that "there has been no great progress in reducing the cost of the systems, but we're hopeful [for] the future." He cites AI, high-speed networks, and parallel processing as the "silver bullets that are fully funded."

The Lady or the Computer?

In their less than fifty years of existence, computers have made remarkable strides. Yet it is only too apparent that they have a long way to go before they can meet the supreme test. That test was spelled out by Alan Turing, the British physicist generally acknowledged to be the father of the modern computer. In the Turing test, a computer was placed in one room and a human in another. Neither could be seen by the test conductor, who posed questions to them via a teletypewriter. Some ground rules were applied, such as not asking for complex computations that only the computer could perform (thus revealing itself). Also, although Turing never said so, it had to be assumed that both the computer and human could lie. (Otherwise the questioner could simply ask, "Are you a computer?") In this test, the computer was deemed to be a true "thinking machine" if the test conductor no longer could determine which was computer and which was human.

Given the current rate of progress in the supporting hardware and software technologies, is it likely that computers soon will be able to pass the Turing test? Nobody will say. Dr. Klopf at the Avionics Lab will only smile enigmatically and add with a shrug that there's no theoretical reason why it couldn't happen someday. ■

John Rhea is a free-lance writer who specializes in military technology issues and is a frequent contributor to Air Force *Magazine. His most recent article, "The Airborne Supercomputer," appeared in the May 1990 issue.*

JUST WHERE DO HIGH TECHNOLOGY MISSILES FIT IN A FUTURE OF LOW INTENSITY CONFLICTS?

SLAM, the Navy's Standoff Land Attack Missile, stands front and center.

It's the only long-range precision surgical strike standoff missile in America's arsenal. A highly advanced weapon, SLAM combines the reliability of its Harpoon predecessor with all the elements for precise targeting. The latest Maverick Imaging Infrared Seeker. A midcourse inertial navigator aided by the Global Positioning System (GPS). And a Walleye Data Link for man-in-the-loop aimpoint selection.

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Built by McDonnell Douglas Missile Systems Company (MDMSC), SLAM easily finds and discriminates its intended target from surrounding areas. Launched from ranges greater than 50 nautical miles and controlled from even greater distances, SLAM protects its launch platform. Simple mission planning and ease of use, make SLAM the weapon of choice when quick retaliation is in order.

Reliable. Efficient. Quick to deploy. Deadly accurate. The Navy's SLAM is all this and more right now—and the perfect fit for future challenges.

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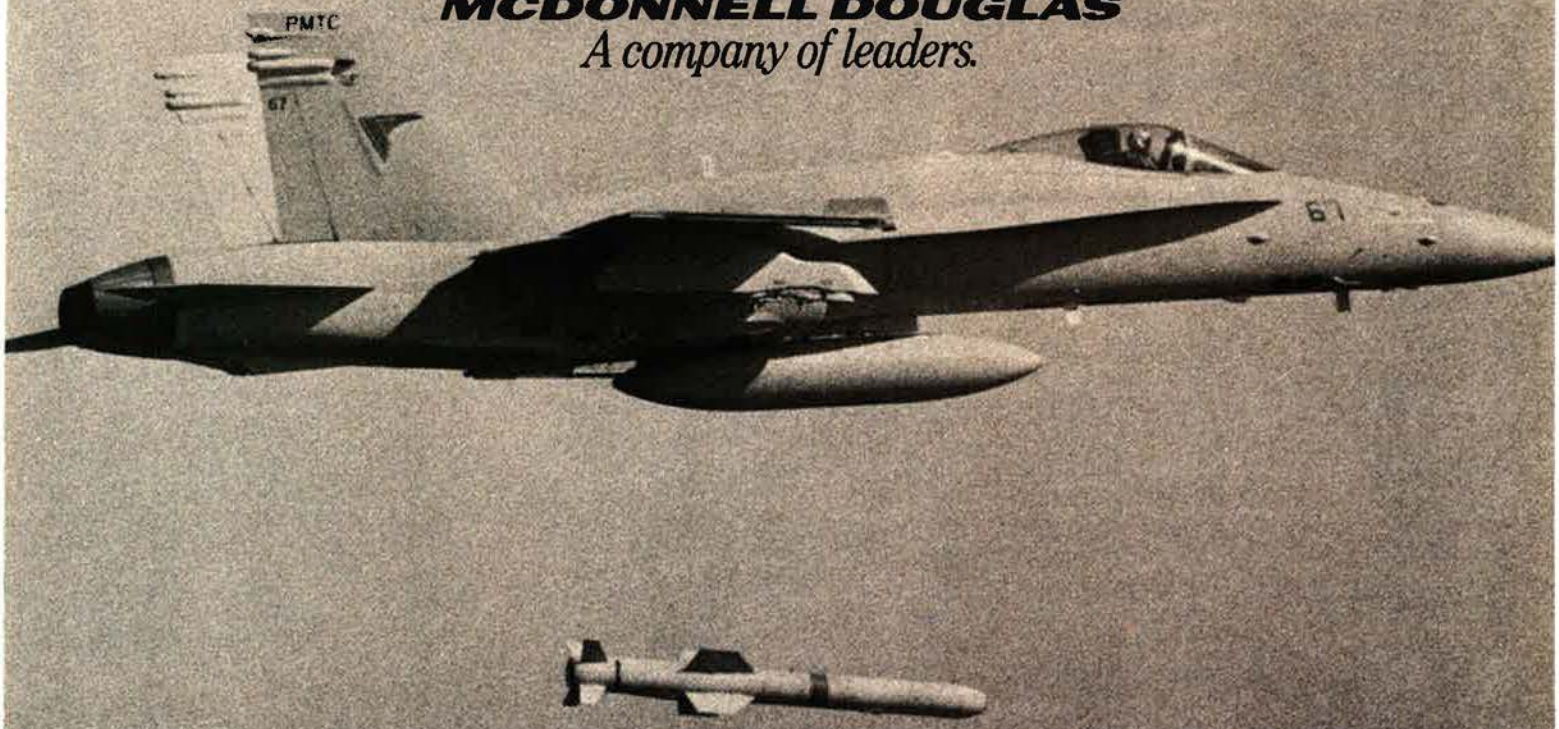
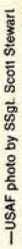


MDMSC: Smart choices for tough decisions.

The question isn't if they'll be shot at—it's whether they can shoot back.


—USAF photo by SSgt. Scott Stewart

Women in Combat

By Brian Green, Congressional Editor

"ARMY policy allows women to be *shot* first," observes Rep. Patricia A. Schroeder, "but they can't be the first *to shoot*. The logic eludes me." The Colorado Democrat, the fifth-ranking majority member of the House Armed Services Committee, finds the policies of the other US military services equally illogical.

Behind the Congresswoman's skepticism lies a simple but pertinent question. The country's 229,000 servicewomen are so thoroughly integrated into the armed forces, and in such large numbers, that their exposure to enemy fire in a future war is certain. Why, then, are women barred from taking proper combat training and from serving in combat units?

Representative Schroeder is pressing for major change in US policies toward women in the services. She has proposed that the Army conduct a four-year test, allowing women to train in combat specialties. They would then serve in designated combat units—infantry, armor, and artillery.

Even backers of the Schroeder bill concede that prospects for passage this session are not bright. Political sentiment is overwhelmingly against it. But recent history seems to be running in Representative Schroeder's favor. Not only the numbers of servicewomen, but also the scope of their contributions, expanded greatly in the 1970s and continued to grow in the 1980s.

In June 1972, women in uniform constituted a mere 1.5 percent of the force. The figure hit 8.9 percent in 1981, and today it stands at 10.8 percent. In the Air Force, 13.5 percent of the force is female. Women long ago were cleared to work in so-called "nontraditional" military jobs. Flight training was opened to women by the Army and Navy in 1973 and by the Air Force in 1976. Enlisted women operate trucks, work in chemical warfare units, and conduct ship repairs.

Today, the Army excludes women from duties that may lead to deliberate involvement in combat, a policy the Army interprets as in keeping with congressional intent. In the Army's view, that intent is most explicitly reflected in a 1948 law, which has never been seriously challenged. It bars the Air Force and Navy (and the Marine Corps) from assigning women to aircraft and ships engaged in combat missions.

1st Lt. Lori Salgado takes some instruction at a Pilot Mission Planning Class in the 71st Student Squadron at Vance AFB, Okla. Lieutenant Salgado, one of more than 75,000 women in today's USAF, finds only three percent of USAF jobs closed to her on the basis of gender.

Services Not Eager to Change

It is fair to say that the services harbor limited enthusiasm, at best, for repealing the combat exclusion law. USAF neither seeks nor encourages such a change. Even so, senior Air Force officers maintain they would not object to putting women in cockpits of combat aircraft, if that's what Congress wants. Some Pentagon civilians go further: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They wish to eliminate all restrictions.

The 1988 Department of Defense Task Force on Women in the Military found that policies serving to exclude women from combat reflect society's cultural standards and Congress's desire to "protect women from the most serious risks of harm or capture."

The practical effect of the expanded role of women in the military is to bring them closer to combat. Several Army policewomen came under fire in Operation Just Cause, the recent action in Panama. Other examples abound. Representative Schroeder notes the case of a "noncombatant" Army communications specialist who, she says, would expect to survive about seven minutes in battle—that is, until "the first bomb landed on top of her antenna." In future operations, USAF makes clear, "noncombatant" USAF women will likely be shot at because they will be piloting airlifters and tankers. Navy women on ships of the Combat Logistics Force are sure to be sailing into harm's way once these ships start resupply of battle fleet warships.

Critics of combat exclusion ask why the American military should maintain what they see as the pretense of protecting women from death or capture. Former Secretary of the Army Clifford L. Alexander, Jr., argues that the exclusion not only fails to protect women, but also weakens military effectiveness because the services are prevented from taking full advantage of the high skills of women troops.

Apart from such practical concerns, say the critics, the law raises basic issues of equity. Those with combat assignments have the inside track on promotion opportunity. Women cannot compete.

On the pro-exclusion side, convictions are equally passionate. The key complaint was put succintly by James H. Webb, Jr., a former Marine officer, Vietnam veteran, and former Secretary of the Navy, in a controversial 1980 magazine article, "Women Can't Fight." For these partisans, equity, promotion, career opportunity, and even safety are side issues. Only combat effectiveness is critical.

Many argue that women are simply not physically suited to the rigors of battle. They point to extensive Pentagon testing that has confirmed common-sense observations: Women, in general, are smaller, weaker, and slower than men, in general, and this can put them at a disadvantage in many combat situations. This point of view minimizes the physical strength and stamina of *exceptional* women.

Even more controversial—and offensive to some—are traditionalist claims that women are psychologically unsuited for combat.

Restrictions Limit Contributions

The Defense Advisory Committee on Women in the Services (DACOWITS), established in 1951 to examine the role of women in the military, has stated that current restrictions limit the contributions women can make to national defense and that the combat exclusion statute should be repealed.

Similar views are held by Mr. Alexander. The former Army Secretary pushed hard during his 1977–81 tenure to ease restrictions on women in combat. In fact, he believes that Representative Schroeder's approach is too timid. Says he: "Schroeder's approach is wrongheaded. We don't need to experiment."

He contends that plenty of women can meet all the physical requirements and that individuals need to be considered on their own merits and strengths. "Not all women will be in combat," says Mr. Alexander, "and not all men will be in combat."

Would the presence of women in a predominantly male combat unit undercut its cohesion and therefore its performance? Traditionalists say yes, arguing that social relationships between men and women would create jealousies and sexual tensions. Worse, say the traditionalists, male troops would seek to protect women from danger, thereby exposing themselves and others to higher risks.

The counterargument is that men now accept women performing perilous duties (such as police work) and that substantial evidence exists to support the claim that women and men can function together effectively in a unit.

Rules Applied Inconsistently

The 1948 law prohibits women in the Air Force from being "assigned to duty in aircraft engaged in combat missions." It also says that Navy women may not be "assigned to duty on vessels or in aircraft that are engaged in combat missions nor may they be assigned to other than temporary duty on vessels . . . expected to be assigned to combat missions." There is no statutory restriction on the Army, whose regulations nevertheless bar women from combat assignments.

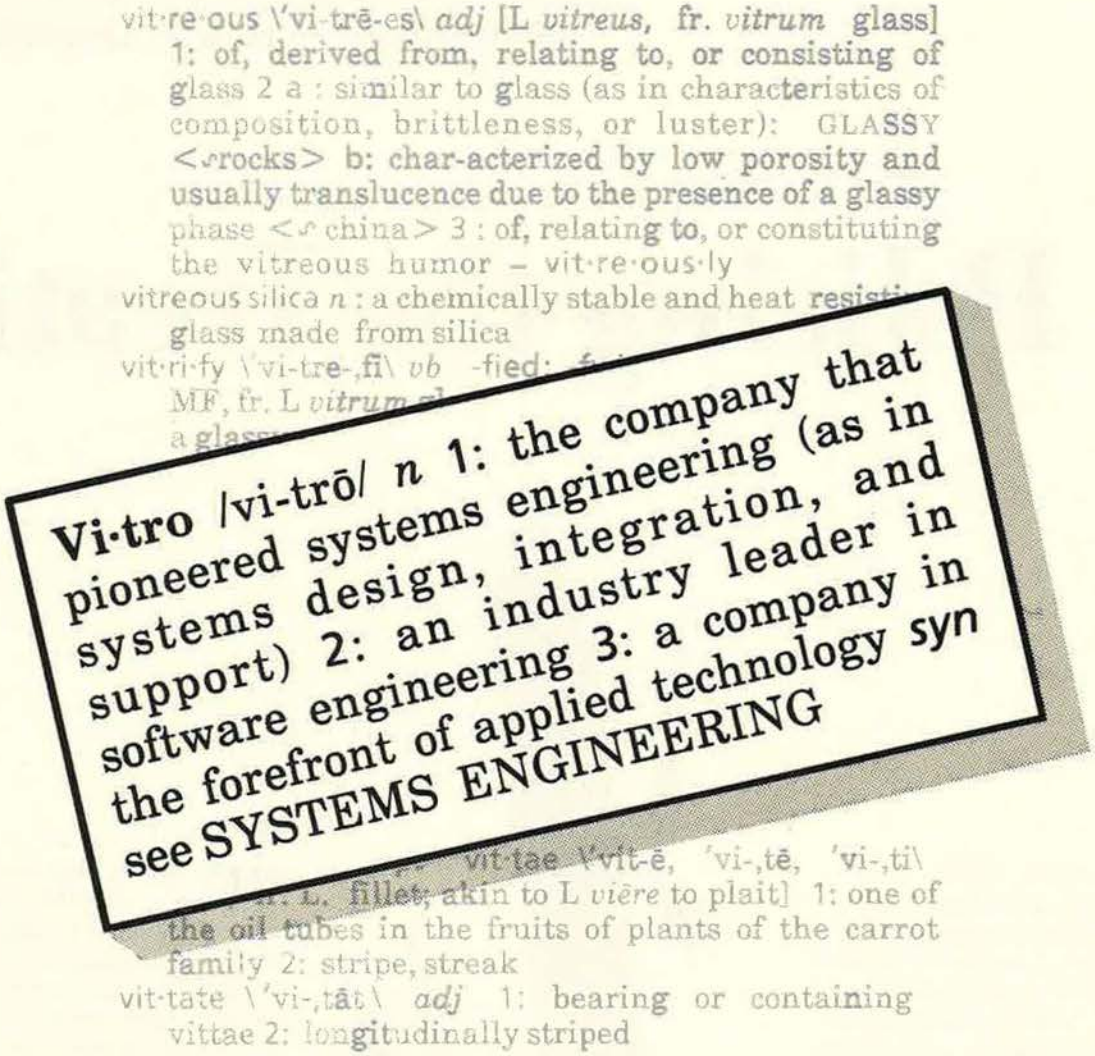
Within this legal structure, the services apply a "risk rule": Women are barred not only from positions in combat units, but also from noncombat units if the risk of combat incurred by the units is deemed sufficiently high. The rule was applied inconsistently for years. Each service used different criteria. For the Army, it was proximity to the battlefield; for the Air Force, exposure to enemy fire and risk of capture; for the Navy, the combat mission of groups of ships.

In 1987, however, the Defense Department undertook a major policy review. The Task Force on Women in the Military recommended that combat missions be explicitly defined and made specific recommendations as to which positions should be opened to women. Recommended units included USAF RED HORSE engineering repair squadrons, Mobile Aerial Port Squadrons, and tactical reconnaissance units.

DoD adopted almost all the recommendations. More than 31,000 positions were opened to women. The Air Force not only opened those positions recommended by the Task Force, but also cleared Military Airlift Command's women pilots of the C-130, C-141, and forthcoming C-17 aircraft to participate in possible future combat airdrops.

Virtually all Air Force jobs—ninety-nine percent of individual occupational specialties—are now open to women. Women can serve in more than ninety-seven percent of all Air Force jobs. That compares with fifty-two percent of all Army positions, fifty-nine percent of all Navy positions, and twenty percent of all Marine positions.

However greatly USAF women's opportunities have expanded, they are still barred from the all-important combat specialties. ■



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Arms control verification—from satellites to scanners and tagging techniques—is a booming field.

Policing the Treaties

By Peter Grier

BYELORUSSIA, USSR, 1995: A lieutenant colonel from NATO's On-Site Inspection Agency approaches a column of Soviet tanks. He hefts his scanner—a portable version of grocery store check-out equipment—and moves down the line of T-80s, checking the bar code mounted on a metal plate at the back of each turret.

A familiar beep tells him when the unique code of each tank has been entered in the memory of his portable computer. At the tenth tank in line, he unscrews the code plate and slaps a blob of quick-setting plastic on the patch of newly-exposed armor.

Within seconds, he peels off the plastic cast and packs it carefully in his bag. Later, the minute surface imperfections it has reproduced will be magnified and compared with a master list kept in Brussels, identifying this particular T-80 as surely as a fingerprint identifies a person. If the "fingerprint" is new, unknown to NATO, it may be evidence that Soviet tank production is violating the Conventional Forces in Europe (CFE) Treaty.

With major arms-control agreements at hand, the Department of Defense is looking for new ways of keeping tabs on Soviet war equipment. The tank-print idea is just one of the verification concepts now being worked on in US government labs. They range from microchip "license plates" on aircraft to portable gamma-ray detectors for inspecting mobile nuclear missiles in the field.

Even in the 1990s, traditional National Technical Means will remain a linchpin of verification. New types of imaging systems, now coming on line, will provide much-improved capabilities in the next-generation reconnaissance spacecraft, but the advent of intrusive, on-site inspections is creating demand for earth-bound verification equipment that most military men thought they'd never see. Commercial cameras and other types of off-the-shelf gear are being quickly adapted by government scientists for use in verification.

"It's like a cottage industry," says Roy Woodruff, director of the treaty verification program at Lawrence Livermore National Laboratories in California.

Technologies With a Future

The press of world events forces "verification engineers" to face deadlines that would surely daunt their weapons-developing counterparts. For example, Sandia National Laboratories at Albuquerque, N. M., had a mere three months to produce a perimeter-monitoring facility for INF Treaty verification after receiving an urgent request for the system.

Verification is an area of technology with a future, and it's drawing new interest from armed forces and contractors alike. Says Lt. Col. John M. Sovich, Technical On-Site Program Chief at Air Force Systems Command's Electronic Systems Division, Hanscom AFB, Mass., "The two areas where there's going to be money are drug interdiction and verification."

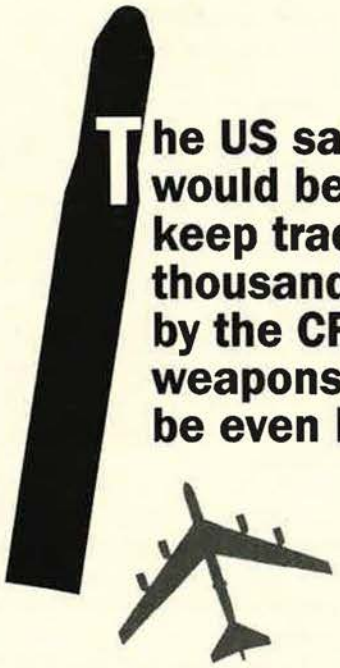
Verification technology today has come a long way since the early 1960s, when the first space platforms for monitoring treaty compliance were built. These were the Vela satellites, launched between 1963 and 1970, that carried radiation and light detection equipment needed to monitor the Limited Nuclear Test-Ban Treaty.

Since then, US eyes and ears in the sky have become the stuff of legend and spy novels, rumored to be capable of reading the license plates of limousines leaving the Kremlin and hearing the car phone conversations of leaders within. These systems include Defense Support Program early warning satellites, Magnum and Chalet electronic eavesdropping "ferret" satellites, and the workhorse KH-11 photoreconnaissance satellite, launched in 1976.

The latest generation of reconnaissance satellites is the AFP-731. Theoretically, contends a recent report published by the Institute of Electrical and Electronics Engineers, the AFP-731 can "resolve" items on the ground seven centimeters long. Experts say detection of troop units requires resolution of six meters. Resolution of sixty centimeters is needed to see a generic vehicle. Resolution of three centimeters would be needed to distinguish a T-72 tank from a T-80.

Cloud cover, however, can block the AFP-731's vision. To bolster its space imaging capability, the US last year is said to have launched a new radar-imaging satellite with a ground resolution of two to three meters.

The complexity of new agreements and new Soviet openness mean that on-site inspections and ground-based systems are fast becoming the main means of acquiring basic data. The US satellite network would be hard pressed to keep track of the tens of thousands of items covered by the CFE Treaty. Chemical weapons restrictions would be even harder to enforce.



The US satellite network would be hard pressed to keep track of the tens of thousands of items covered by the CFE Treaty. Chemical weapons restrictions would be even harder to enforce.

December 8, 1987—the day the superpowers signed the Intermediate-range Nuclear Forces Treaty—marked the start of the "verification revolution." Besides eliminating entire classes of nuclear weapons, the pact established an intrusive verification system. It is a test-bed for larger efforts that would accompany a CFE or Strategic Arms Reduction Talks (START) Treaty.

Under INF provisions, DoD's On-Site Inspection Agency (OSIA) has two main tasks: Provide personnel and gear to mount inspections on Soviet territory, and maintain an around-the-clock watch of the perimeter of the Soviet missile plant at Votkinsk, which assembled the now-banned mobile SS-20 missile. Both jobs forced OSIA to come up with equipment that hadn't previously existed.

That doesn't mean that the troops in the field weren't a big help. Navy Capt. John Williams, an OSIA on-site technical advisor, says USAF's loadmasters gave OSIA the idea for wheel scales that OSIA inspectors carry to weigh missile transporters.

Overcoming Soviet Potholes

Among the fancy tools carried by traveling, short-notice inspectors are ordinary plumb bobs and metric tapes, chosen over the high-tech measuring equipment that some government scientists favored. Inspectors have quickly developed a preference for rugged, simple, and lightweight equipment, the kind of gear that keeps working after traveling over pothole-filled Soviet roads. Explains Williams: "I've seen fifty-five-pound scales take four-foot hops in the back of a bus."

Whenever possible, inspectors use off-the-shelf equipment. Rather than using fancy cameras that can take two photos at once, one for each side, US and Soviet inspectors agreed on a simpler method. When they take pictures, they set a Polaroid camera on a tripod and press the button twice.

The simple approach isn't always possible. Consider, for example, the "portable" radiation detector that OSIA inspectors periodically lug to the Soviet Union. It is only relatively portable, in that it fits in only

four cases. By measuring neutrons, the detector distinguishes the banned intermediate-range, three-warhead SS-20 from the strategic, one-warhead SS-25, which falls outside treaty limits.

The US-operated INF portal-monitoring facility required development of an integrated, permanent system for watching the perimeter of a fixed installation. Sandia Labs produced a model of a Technical On-Site Inspection facility, known as a TOSI, in one month after getting a go-ahead. Three months later, a full-sized test system was ready in the New Mexico desert.

TOSI is a sophisticated security system similar to those that surround any sensitive US factory or military installation. The only difference is that TOSI is designed to keep certain items from exiting, rather than to stop intruders from entering. Looking like a combination toll plaza and railway roundhouse, TOSI is now parked outside the main gate of the Votkinsk Machine Building Plant, former assembly point for Soviet intermediate-range missiles. All rail and road vehicles rolling out its gate must pass TOSI's induction loops, which detect their presence. Infrared break-beam sensors measure length and profile to determine if the vehicle is large enough to contain a prohibited article. TV cameras keep a twenty-four-hour watch on traffic flow.

Controversy at Votkinsk

TOSI includes Cargoscan, a huge X-ray apparatus originally developed by Bechtel Corp. to detect drugs smuggled in container shipments. The purpose of this $30 million machine is to ascertain quickly whether a banned SS-20 missile is being surreptitiously shipped out in a container intended to carry the larger, strategic SS-25, which Votkinsk still assembles. In February, Cargoscan was the subject of the most serious dispute at Votkinsk so far. After a test, the Soviets complained that the machine was recording too much detail. Apparently worried that the US would learn missile design secrets, Soviet officials shipped several SS-25 canisters without permitting what the US felt to be a proper inspection.

The dispute has been resolved by the US agreeing to modify Cargoscan so that it sees the outline of objects but little detail in the middle.

About thirty US inspectors are on duty at Votkinsk at any one time. Four or five are from OSIA; the rest are Hughes contractor personnel. They operate from a central control room where a main computer processes and displays information from all the sensors. "It's hard to overstate the amount of work and the complexity that's gone into this processing system," says Army Maj. Charles Haver, Deputy OSIA Site Commander at Votkinsk.

Sandia's original plan for on-site monitoring called for stringing a net of fiber-optic cable around the plant perimeter. If broken, the cable would alert the control room that an attempt might be under way to sneak something out. But the INF Treaty doesn't provide for such a net; perimeter policing is done by foot patrols. Much of the time, this is done on skis, as snow falls at Votkinsk almost every day in the winter.

"When you're skiing around a missile plant with two Soviets at 4:00 a.m.," observes Colonel Sovich, "it makes you think about the progress that the two nations have made."

Lessons learned from INF perimeter inspection will be valuable in setting verification of START and CFE treaties. The INF pact, though, covers only a few sites and eliminates entirely a class of weapons. How does one police a treaty under which thousands of the weapons, still permitted, are spread across the vastness of the Soviet Union?

Next-generation verification is required. Sure to be used, once it is perfected, is "tagging." Verification tags are license plates for weaponry. They enable inspectors to tell at a glance if a particular tank, missile, or plane was legally registered under a treaty. A good tag will have to be hard to duplicate; it must be something more than merely a stamped, multicolored piece of metal. US researchers are hard at work attempting to invent a tamper-proof, easy-to-install, cheap tagging scheme.

The plastic cast approach is under consideration at Argonne National Laboratories in Illinois. It relies on the intrinsic roughness of a patch of weapon surface as a unique identifier. A cast of an area as small as a square centimeter, examined under an electron microscope, can identify tiny ridges and valleys that would be matched with stored records. The metal plate imprinted with a bar code could protect the reference area from weather and wear. The treaty inspector would carry a bar code reader and would quickly scan weapons as if checking serial numbers.

Glittering Weapons

Another tag idea, dreamed up by Sandia scientists, calls for affixing an identification number to a weapon, then covering the number with a clear epoxy mixed with aluminized Mylar glitter particles. When dry, the epoxy would contain a random glitter pattern impossible to duplicate. A video camera would be carried to the field and used to analyze the tag. For extra insurance, a series of lights would be used to illuminate the tag at different angles, creating patterns that would have to be counterfeited if inspectors were to be fooled.

A higher-tech tag technique would rely on small, unpowered integrated circuits. These circuits would be "interrogated" by an instrument that would provide them with a burst of electricity. The microchip would then emit an encrypted code, identifying itself. One advantage is that weapons could be interrogated from a distance—perhaps even by satellites.

"There's a similar thing under trial for a bridge in San Diego," says Mr. Woodruff of Livermore, where the idea is being developed. "It's a little tag that goes on a car. When it passes a reader on the bridge it says, 'This is who I am, and this is where you bill me for the toll.'"

No tagging scheme is perfect. The surface-imprint technique, for example, may be hard even for a computer to analyze. For CFE and START, it would be only a part of larger systems. For example, a conventional weapons pact might allow for exit/entry point (EEP) manned monitoring stations near key rail points, airports, and other transportation nodes. Comings and goings may be watched with seismic sensors near military installations and

tuned to detect the movement of heavy equipment.

Destruction of treaty-banned conventional weapons could be a key CFE issue, but keeping tabs on every last tank and heavy gun controlled by treaty might not be that important. Violations that do not exceed twenty to thirty percent of permitted levels might be militarily acceptable, concludes Stanley Sloan, a senior security specialist with the Congressional Research Service. Considering the variety and numbers of items to be controlled, he asserts, no conceivable monitoring system could enforce total compliance.

Computerized data storage, sorting, and retrieval might be as powerful a CFE verification tool as tags. "The effectiveness of the compliance system," reports Mr. Sloan, "will depend in large part on the ability of the Western allies to integrate the information that they obtain."

For START purposes, tags and INF-inspired portal monitoring of facilities and short-notice inspections will form the bedrock of verification. To further aid in nuclear-weapon discrimination, US government labs are hard at work perfecting radiation detectors. Current detectors, allowed near enough, could be used to distinguish between nuclear and nonnuclear cruise missiles.

Uncomfortably Perceptive

Powerful X-ray machines could do the same thing. As the INF Cargoscan dispute showed, however, such machines might reveal too much for comfort on either side. At Argonne Labs, researchers are experimenting with the transmission of narrow beams of gamma rays through weapons to receiver arrays. "We get what we feel is the same amount of information as with an X ray but in a way we feel is not as intrusive," says one Argonne technician.

Radiation detectors used by OSIA are a passive type that measures emissions of neutrons. An active instrument that fires a beam of neutrons at a warhead could yield more information. The International Atomic Energy Agency (IAEA) uses this approach to examine stores of uranium and plutonium at civilian powerplants, to make sure no radioactive material is diverted for clandestine weapons production. Both US and USSR officials have so far balked at this method as too intrusive.

Argonne Labs, however, is continuing work on the technology. In addition, the laboratory is devising a rocket propellant detector for the Defense Nuclear Agency. This type of sniffer would allow inspectors to determine if rocket motors were hidden in large, off-limits spaces.

Sniffers could be crucial to verification of yet another arms pact—the world chemical weapons ban now being negotiated at the Conference on Disarmament in Geneva. A neutron-scattering technique is one method under consideration. In theory at least, it could produce a sniffer able to differentiate between a 155-mm shell packed with high explosive and one loaded with poison gas.

Verification of a chemical treaty could be particularly tough, because a chemical weapons plant looks very much like an industrial chemical facility. A network of sensors on crucial valves and utilities could at least ensure that former poison factories remain shut down.

Protecting remote sensors from surreptitious tampering is critical to any verification scheme. One simple antitampering measure: Anodize the surface of a sensor's aluminum housing to a color difficult to duplicate if scratched. One tamper-resistant seal technique developed for IAEA equipment relies on short lengths of fiber-optic cable that break if the device is opened. The cable has a unique light signature; any replacement could easily be detected as a fake.

The output of these remote sensors would have to be authenticated as well. One idea promoted by Sandia calls for attaching an encrypted electronic "word" to the signal beamed back by TV cameras or other instruments.

Such modifications don't come cheap. Upgrading an off-the-shelf video camera to verification-quality levels, for example, costs much more than the camera itself. That points up the basic problem with many elaborate verification schemes: They simply cost too much. Says one administration official who is deeply involved in verification matters, "We are truly plagued by the way we operate in the US. We do like wonderful equipment." ■

Apparently worried that the US would learn missile design secrets, Soviet officials shipped several SS-25 canisters without permitting what the US felt to be a proper inspection.

Peter Grier is a Washington-based defense correspondent for the Christian Science Monitor. *His most recent article for* Air Force *Magazine was "R&M Is Serious Stuff," which appeared in the November 1989 issue.*

After eight years of haggling, the superpowers will meet to try to put the finishing touches on the strategic arms treaty proposal.

The State of START

By Stewart Powell

THE landmark strategic arms accord taken up by US President Bush and USSR President Gorbachev at their Washington summit promises to mark a major turn in the nuclear standoff that has kept the peace—and rattled the world's nerves—for forty years.

In the runup to their May–June meeting, the superpower leaders grappled with some final, significant provisions of the Strategic Arms Reduction Talks (START) Treaty due for signing this year. The accord, when it takes effect, will for the first time impose numerical limits on nuclear warheads. It will constrain deployment of fast-flying, long-range, ballistic missiles and set the stage for even deeper cuts.

The 450-page draft treaty, the result of eight years of line-by-line haggling, promises to shape superpower arsenals well into the next century.

The draft treaty encourages a move away from today's tense situation in which a country might find itself with only minutes to launch or lose its premier silo-based weapons in a nuclear crisis. The agreement penalizes reliance on fueled-and-ready ballistic missiles, especially land-based, multiwarhead systems, such as the Soviet SS-18, and rewards greater reliance on recallable bombers and slower-flying air-launched cruise missiles (ALCMs).

START leaves signatories free to deploy 6,000 "countable warheads" —a diplomatic term that, exploited fully, would let each side maintain more than 8,000 actual warheads, so long as the bulk of the weapons shifts to the bombers and ALCMs that are being given preferential treatment under START.

Negotiated under two US presidents and four Soviet leaders, START would commit Moscow and Washington to accepting the most intrusive verification measures in diplomatic history. As many as 1,200 inspectors per side will peer into the adversary's sanctuaries to monitor existing weapons and production of new ones.

The negotiations, begun in 1982, have ebbed, flowed, and bounced back from a lengthy Soviet walkout. President Reagan and General Secretary Gorbachev sketched outlines of the accord at the 1986 Reykjavik

summit after sidestepping a paralyzing dispute about whether the 1972 Antiballistic Missile Treaty banned testing of space-based defensive systems. On taking office in January 1989, President Bush moved quickly to put his imprint on the accord. He halted talks for six months to conduct a review of its language, then added an overlay of new verification measures, finally reaffirming the text as his own. The superpower leaders agreed at their summit off Malta last December to press for final agreement in 1990.

What looked like steady progress on treaty language slowed in the spring, however, as repercussions from the Lithuanian independence crisis spilled over into Soviet-American relations. The Bush Administration still hoped to have the treaty wrapped up by year's end, in time for submission to the Senate early in 1991 for what are expected to be exhaustive ratification proceedings. For the first time, Senate review of an arms agreement will coincide with scrutiny by Soviet authorities. Elected Soviet legislators plan to conduct a public review of the agreement.

The Treaty Provisions

Today each superpower deploys some 11,000 to 12,000 warheads atop weapons capable of reaching the other's soil. START gives the US and USSR seven years to trim each force to 6,000 "countable" warheads deployed on 1,600 strategic nuclear delivery vehicles—ICBMs, SLBMs, and long-range bombers. Either nation could decide to deploy all but 1,100 of the warheads aboard land-based or submarine-based ballistic missiles, but doing so would cause it to forgo additional numbers of warheads that it might otherwise be able to deploy.

From the Soviet Union, the United States wins a fifty percent cut in the number of blockbuster, silo-based SS-18s. The Soviet Union may retain only 154 of its force of 308 SS-18s, each of which comes armed with ten warheads. The Kremlin's concession, important in itself, also translates into a substantial cut in the lifting power, or throw-weight, of its land-based missile force. This is seen as a major gain for the US, which has long fretted about the USSR's theoretical ability to pack two dozen or more reentry vehicles atop each monster SS-18 missile.

The United States gains Soviet agreement to START without having to agree to Soviet-sought restrictions on space testing of defensive components developed under the Strategic Defense Initiative (SDI), a program on which $21 billion already has been authorized. The Americans also won Soviet agreement to dismantle the Krasnoyarsk phased-array radar facility, which US officials regarded as a violation of the ABM Treaty.

START makes no radical change in the strategic force posture of either superpower.

From the United States, the Soviets in the draft START agreement won at least temporary acceptance of Soviet deployments of mobile, long-range missiles, a category of weaponry in which the USSR enjoys a substantial lead. The Soviet SS-24 missile, a ten-warhead weapon, now is operational aboard railcars crisscrossing vast stretches of Soviet territory. Also deployed are truck-mounted, single-warhead SS-25s. The first mobile US ICBM won't be available until 1992 at the earliest, when the initial flight of LGM-118A Peacekeeper ICBMs aboard railcars is to go on alert.

In a bid to lay the groundwork for future negotiations to redress this imbalance, Secretary of State James A. Baker III floated an eleventh-hour proposal to Soviet Foreign Minister Eduard Shevardnadze at a presummit meeting. The proposal called for the two sides, in START, to ban mobile, multiwarhead ICBMs. The proposed trade-off—existing Soviet SS-24 missiles for planned US deployment of mobile Peacekeepers—long had been sought by Sen. Sam Nunn, the Georgia Democrat who chairs the Armed Services panel. Such a deal, says Senator Nunn, offers "the best opportunity we have had in forty years to try to bring about a stable [nuclear deterrence] regime."

The Soviets, however, gave no definitive response, raising the likelihood that resolution of the complex issue would be taken up in subsequent Soviet-American negotiations on strategic weapons.

While American negotiators thwarted Soviet efforts to include naval cruise missiles formally in the START negotiations, Soviet insistence on taking them into account forced "politically binding" declarations on the number of nuclear-armed cruise missiles to be deployed. The issue is unresolved.

The Shape of Treaty-Limited Arsenals

For all the trade-offs, however, much remains unchanged.

The Bush Administration, under provisions of the draft treaty, is free to press ahead with US strategic triad modernization, including plans to shift fifty silo-based Peacekeepers at F. E. Warren AFB, Wyo., to railroad cars, deploy multiwarhead D5 SLBMs (UGM-133As) aboard *Ohio*-class Trident SSBNs, and seek congressional approval for additional radar-evading B-2 bombers and the stealthy Advanced Cruise Missile.

The Soviet Union has hardly been idle. On land, it has fielded the highly accurate "Mod 5" version of the SS-18. It has deployed eighteen of the SS-24 missiles aboard six trains, as well as more than 200 single-warhead, road-mobile SS-25s. Modifications of these mobile missiles also are on the drawing boards.

The Soviet bomber force is being upgraded. However, there is no consensus within the intelligence community about whether the Kremlin intends to build the full force of 150 Tu-160 "Blackjack" bombers that had been originally envisioned. Ten Blackjacks are now in operation, each capable of carrying up to twenty-four gravity bombs or air-to-surface missiles. Also on line are seventy-five new-production "Bear-H" bombers equipped with six AS-15 air-launched cruise missiles —nuclear-tipped weapons with a range of 1,860 miles.

At sea, four modern Delta IV-class submarines are operational, each packing sixteen SSN-23 SLBMs with ten warheads. Four "Typhoon"-class subs are on line, and a fifth is undergoing sea trials. Each boat carries twenty of the ten-warhead SS-N-20 missiles.

The plain fact is that START, for all its potentially significant contributions to nuclear stability, makes no radical change in the strategic force posture of either superpower. Walter B. Slocombe, Director of the Carter Pentagon's SALT II Task Force and now a Washington attorney, speaks for many arms-control veterans with this assessment: "In terms of capabilities, what is striking about the post-START forces is how little they require changes in basic doctrine and how little they differ in fundamental characteristics from present forces."

Neither nation really loses much of its force of warheads—the actual nuclear weapons—so long as it shifts much of it away from treaty-constrained systems such as ballistic missiles and on to more generously counted platforms such as bombers.

Each penetrating bomber, such as the B-1B, the B-2, or the Soviet Blackjack, would be deemed, under START's counting rules, to be a single warhead, even though each aircraft could carry sixteen to twenty-four hydrogen bombs or nuclear-tipped, short-range attack missiles. In the weeks leading up to the Washington summit, final counting rules and permissible ranges still were being worked out for application to bomber-borne ALCMs. The discounting concept under consideration called for a bomber capable of carrying twenty cruise missiles to be counted as carrying only ten.

Future Force Structure

In the battle to shape the future US strategic force structure, Washington officials circulated numerous post-START blueprints, including one in which the US would retain as many as 11,700 "actual" warheads by building a full fleet of 132 B-2 bombers. The Pentagon decision to buy only seventy-five B-2s, however, reduces the total by nearly 1,000 warheads. On the Soviet side, calculations show, the post-START strategic force could legally deploy up to 8,600 actual warheads while staying under the negotiated ceiling of 6,000 "countable" warheads.

The debate over the shape of the post-START force is sure to continue for quite a while. There can be no denying, however, that US military officers will try to press to the limits of the START Treaty's provisions. In the words of Gen. John T. Chain, Jr., Commander in Chief of Strategic Air Command: "The START agreement will put new finite constraints on both sides, so our forces need to be optimized within the START constraints."

Elected Soviet legislators plan to conduct a public review of the agreement.

Far and away the most challenging aspect of the accord—for Washington, at least—is developing the means to verify Soviet compliance with the accord. The 1987 Intermediate-range Nuclear Forces (INF) Treaty, by which the US and Soviet Union agreed to withdraw certain theater nuclear forces from Europe, required US surveillance of only 120 sites. By contrast, says CIA Director William Webster, START demands constant monitoring of as many as 2,500 locations.

The possibility that weapons can elude monitoring was underscored in March with the discovery that INF monitors failed to detect twenty-four banned SS-23 missiles and four banned launchers in East Germany. The Senate Select Committee on Intelligence has been so concerned about verification that it has pressed both the Reagan and the Bush Administrations for $12 billion in improvements, by 1994, to satellite surveillance and other "national technical means" of snooping. Maintains Sen. William Cohen, the Maine Republican who serves as Vice Chairman of the intelligence panel: "If we're going to have more arms-control agreements . . . it's going to intensify [the need for] verification. It's not going to diminish."

"Fingerprinting" Missiles

A number of steps are envisioned. Credit-card-sized reflective tags read by scanners might be used to "fingerprint" missiles. Short-notice, on-site inspections are being planned to monitor warhead configurations. Inspectors will be at the perimeters or portals of missile and warhead production facilities. Overhead surveillance will augment on-the-ground monitoring.

Ambassador Richard Burt, the chief US negotiator at the START talks in Geneva, told *Arms Control Today* in a recent interview that reciprocal visits have helped the two sides "work out the bugs" in verification procedures. Though US officials say much remains to be done, Ambassador Burt maintains that "we have gained a lot of experience in working through some very difficult verification issues."

The stakes are exceedingly high. "This is an issue everybody understands," says Ambassador Burt. "It's a simple question of whether the other side cheats in meaningful ways, and, if they do cheat, can we detect it?"

Once the treaty is completed and signed, the Senate opens its ratification deliberations mandated by the Constitution. The President will need to round up sixty-seven "aye" votes in the 100-member chamber, assuming all members vote.

The Senate Foreign Relations Committee leads the review. Also playing pivotal roles will be the Senate Select Committee on Intelligence, which will examine verification issues, and Senate Armed Services Committee, which will examine and assess the treaty's military ramifications. (It is worth recalling that, in the 1979 debate on the SALT II Treaty, the Armed Services panel delivered a unanimous report stating that the treaty was "not in the national interest" and should not be ratified, a step that crippled the treaty and helped bring about its demise.)

In all of the hearings, the most crucial testimony likely will be that

of the Joint Chiefs of Staff, which as an assembled body will give its views on whether the composition of US forces under the constraints of START allows for "military sufficiency." In effect, they will be called on to say whether the post-START forces are sufficient to deter an attack on the United States.

If ratification of the INF agreement is any guide—and it surely is—the Senate will take months to deliver a verdict. In fact, the START Treaty is likely to be even more controversial than the INF accord; the weapons covered in that earlier pact were of only marginal importance to US security, whereas the arms covered by START go to the very heart of national survival.

Conservatives such as Sen. Jesse Helms (R–N. C.) already are peppering the administration with queries about alleged Soviet violations of earlier arms accords and asking pointed questions about the implications for adherence to START provisions. The alleged breaches, reports Senator Helms, leave him "deeply concerned about Soviet noncompliance."

Responding to the Right

Administration officials acknowledge that the concerns of the conservatives cannot go unanswered. While some whisper that the treaty could spark a political revolt from the right within the President's own party, the White House thinks such talk is overdone. Dozens of senators have been "in on the takeoff," discussing their concerns with US negotiators, says Ambassador Burt, and are virtually certain to be on hand "for the landing."

Relatively swift ratification appears to be contingent on several developments, however.

For politically exposed senators to back the accord, Bush Administration officials maintain, the United States must be seen to be moving ahead with deployment of the rail-mobile Peacekeeper ICBM as a counter to the mobile Soviet SS-24 weapons. However, this assessment is widely disputed, with many experts maintaining that START, and the concept of reducing nuclear arms generally, enjoys broad support.

Second, East-West relations must continue to improve, without any hiccups. This assessment is virtually undisputed. There is wide agreement that a sharp Soviet U-turn back toward militarism would doom the START agreement. "If there is a serious change in Soviet policy . . .," warns Ambassador Burt, "that will have a real impact." Indeed, Washington analysts have not forgotten that it was the Soviet Union's Christmas 1979 invasion of Afghanistan—a military move unrelated to strategic weapons—that finished off the SALT II Treaty in the Senate.

The danger was underscored by the abrupt slowdown in START progress in the spring, caused in part by the crisis over Lithuania's independence movement.

Finally, political experts agree, the Bush Administration must deal effectively with challenges to the START Treaty from the political right. The White House doused potential trouble earlier this year when the Soviets interfered with US inspectors using a $30 million X-ray cargo scanner to ensure that banned SS-20 missiles were not being spirited out of the Soviet missile production facility at Votkinsk. Secretary Baker quickly fired off a letter of protest.

"The incident," explains one knowledgeable State Department official, "got the arms-control compliance buffs around town all wound up, and it was decided at a high level that we'd better get out in front of it."

Disputes are inevitable, however, over implementation and verification of any major nuclear arms accord, particularly one as complicated and far-reaching as START. The intensity of the disputes will provide a good political barometer for the state of East-West relations generally.

Administration officials hope the accord sets the stage for subsequent talks to resolve issues left up in the air by START negotiators. Elimination of the category of ICBM bearing multiple warheads remains a US goal. The United States wants the two sides to devise a workable system of verification before they begin serious bargaining for treaty limits on sea-launched cruise missiles.

Threat of a Pullout

Also looming is the dispute over space-based antimissile defenses, an issue that the two sides probably will not be able to finesse beyond the relatively short term. The Soviet Union, in fact, has pushed the divisive issue closer to the front burner by threatening to withdraw from START should the US ever conduct tests that contravene the Soviets' broader interpretation of the ABM Treaty.

The prospect of easing East-West tensions and changes in respective arsenals heralds the revision of targeting guidance given by civilian leaders to US strategic planners. Existing guidance is said to call for targeting plans that would enable US forces to destroy seventy to ninety percent of 16,000 Soviet bloc targets. It is an ambitious plan that probably requires an arsenal larger than the one Congress will fund in years ahead.

The process of altering such "national guidance" will take many months, if not years, as experts grapple with a new definition of "effective deterrence" and the budgeting of weapons needed to carry it out. Bruce Blair, a Brookings Institution analyst and author of a study of US-Soviet strategic forces, argues that such redefinition and revision will require US political leaders to end what he calls their "historic abdication" of responsibility for the command and control of nuclear weapons during the cold war. "We need the civilian political leadership to redefine the target requirements," says the former Air Force officer.

General Chain, who is also Director of Joint Strategic Target Planning, told the House Armed Services Committee in March that, unless the nation builds the full fleet of 132 B-2 bombers, START limitations will require scaled-back US targeting of the Soviet bloc by the late 1990s, when existing US bombers no longer will be able to penetrate Soviet defenses. General Chain now says he can live with a smaller fleet of seventy-five B-2s, but will strongly oppose further cuts. ■

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Efforts are afoot to recover eight airplanes, down on the glacier since 1942. They now rest beneath 260 feet of ice and snow.

Squadron in the Ice

By C. V. Glines

In July 1989, a team traveled to Greenland (right) and confirmed the site of the 1942 forced landing of six P-38Fs and two B-17Es. The photo below shows one of the crashed Lightnings.

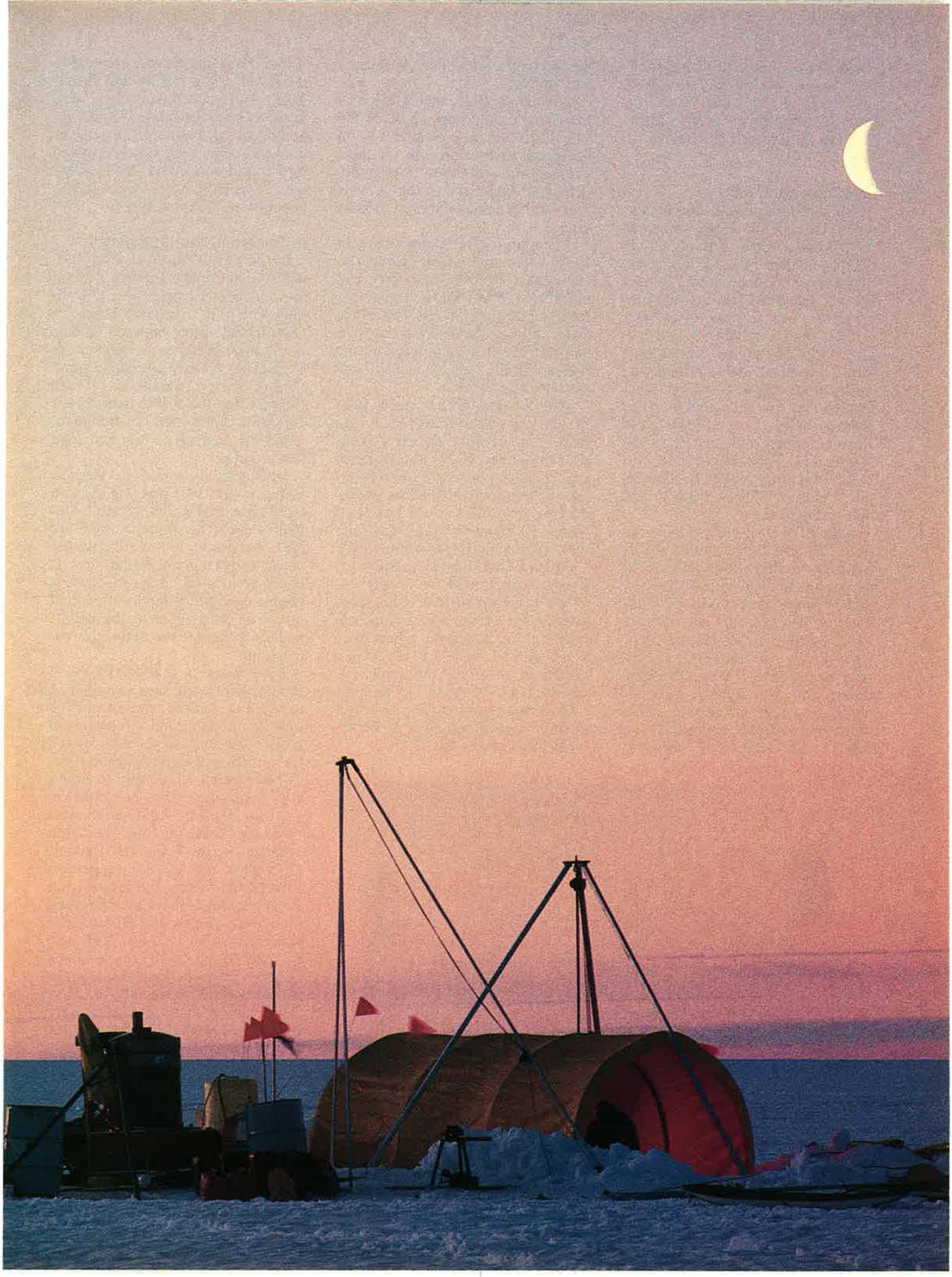
THEY code-named it Operation Bolero. The objective: Move the 97th Bomb Group's B-17s from New England to old England in the summer of 1942 to provide the nucleus of bombers for the Eighth Air Force. The Fortresses also were to provide navigation escort so that a number of short-legged fighter planes could fly the North Atlantic. The aircraft and pilots would be pioneering the ferry route that hundreds of warplanes would follow.

The planes were to proceed from Presque Isle, Me., to Britain via two bases in Greenland, code-named Bluie West One, near the southern tip of Greenland, and Bluie West Eight, north of the Arctic Circle at Sondre Stromfjord (site of Sondrestrom AB today). The next stop was to be Reykjavik, Iceland. From there, the planes were to go to Prestwick, Scotland. The 97th's Group Commander was Lt. Col. Paul W. Tibbets, later to achieve worldwide fame for commanding the first atomic bomb strike on Japan.

Each B-17 had a full crew and was to guide from two to four twin-engine P-38s along the route. A total of forty-nine B-17s was to make the trip and escort eighty P-38s. Also scheduled to take part in the operation were fifty-two C-47s. The bombers carried skeleton crews; the C-47s carried full crews and freight. Original plans called for participation by a number of single-engine P-39s, but this part of the mission was canceled at the last minute. The P-39s and their ground crews went by ship.

The flight was difficult, even in summertime. Weather reports were unreliable. Long weather delays were frequent. Most pilots and navigators were recent flying school graduates and had never been out of sight of land before. Flying the 776 miles from Goose Bay, Labrador, to BW-1 or the 1,002 miles to BW-8 was an experience none would forget. The approach to BW-1 was especially treacherous; the planes had to weave their way up a narrow fjord, usually under a low overcast, with their wingtips in danger of brushing the towering cliffs. Operation Bolero's planners estimated that at least ten percent of the planes would be lost en route.

The first B-17 departed Presque Isle on June 15, 1942, and arrived at



Prestwick on July 1. It was the second American strategic aircraft to reach the UK in World War II. (A lone B-24 had flown over in May.) The last Bolero aircraft landed on July 27.

Landing on the Ice

The operation was completed with no loss of life. However, it was not without incident. On July 15, six P-38Fs and their two B-17E escorts, flying under the code name "Tomcat Flight," left BW-1 and ran into progressively worse weather as they headed east. Unable to get to Iceland, the B-17s led the aircraft back into fierce headwinds and low visibility toward BW-8 but were informed that it was socked in. They then tried to return to BW-1, but weather reports indicated it too was now closed. This was not true. It is believed that the bogus weather reports were broadcast from a German submarine.

Without fuel and alternative airports, Tomcat Flight had no choice but to try to find a level area on the glacier and land all aircraft close together so the crews could be easily spotted from the air and rescued. Lt. J. Bradley McManus, a P-38 pilot critically low on fuel, made the first approach. He put the gear down, touched lightly, and slid along the snow on the mains. But when the nose wheel dropped and dug in, the Lightning suddenly flipped over on its back. McManus was unhurt.

Other P-38 pilots, seeing this mishap, landed with gear up while the B-17s circled. The bombers soon followed, also sliding in on their bellies; none of them was badly damaged. Only one of the twenty-five crewmen received even a minor injury.

Although the navigators thought they were somewhere along the west coast of Greenland, they had actually landed about ten miles from the southeast coast. One of the B-17 radio operators sent out SOS signals. These were heard, and the position of the "lost squadron" was quickly ascertained.

With temperatures hovering near zero degrees Fahrenheit all day and below zero at night, the crews huddled in the two B-17s awaiting rescue. Friendly aircraft quickly located them and took aerial photographs. Supplies were dropped from a C-47 on the third day, and more plummeted from a Navy PBY Catalina on the fifth day. Navy Lt. Fred Crockett and two Army enlisted men arrived with a dog team and led the crews on a seventeen-mile trek to the coast, where they were picked up by a US Coast Guard cutter on the ninth day. Later, Lt. Col. Norman D. Vaughan took a dog team to the site to recover a top-secret Norden bombsight from one of the B-17s.

Lt. J. Bradley McManus (left) was the first pilot of "Tomcat Flight" to land on the ice cap. Twenty yards into the landing, the nose gear dug into the soft snow and the Lightning flipped over. Lieutenant McManus emerged unharmed and posed for this photo with Lt. Carl Rudder.

One more salvage attempt in 1942 retrieved some radios and armament. The eight planes then were dropped from the active USAAF inventory for the rest of the war. Over the years, they were slowly covered by ice and snow, and the incident was forgotten by all except the twenty-five men involved.

In Search of the Lightnings

In the early 1970s, Col. Carl Rudder, one of Tomcat Flight's P-38 pilots and former commander of Dobbins AFB, Ga., met Roy Degan, a commercial airline pilot, by chance in Atlanta. Rudder mentioned his 1942 experience in Greenland, and Degan was captivated by the thought that the P-38s, in excellent condition when they crash-landed, might be recovered, repaired, and flown again.

Degan approached E. Patrick Epps, owner of Epps Aviation, a fixed base operator at Atlanta's DeKalb-Peachtree Airport, and the idea of trying to recover the planes began to germinate. If the aircraft could be located, they reasoned, it might not be too difficult to dig them out, transport them to the coast, and bring them to the States for restoration.

Epps knew it would take much money, effort, and time to mount an expedition, and he tried to put the idea out of his mind. However, in early 1981, a customer who landed for servicing at Epps Aviation mentioned that he would like to find a P-38 somewhere that he could restore and fly. Epps told him the story of the "lost squadron," and the crusade began. Epps and Richard L. Taylor, an Atlanta architect, formed the Greenland Expedition Society in July 1981. Closely associated were Degan and Russell Rajani, also an airline pilot. The men traveled to the crash area to check out the situation. They found nothing, but were convinced from their investigation that the planes were hidden somewhere under the ice near the area they had searched.

Meanwhile, Colonel Vaughan, now residing in Anchorage, Alaska, read a news clipping about the visit to Greenland. He immediately contacted Epps and Taylor to tell them of his trek to recover the Norden sight in 1942 and to offer his services. He joined Epps and Taylor

for a second trip to the area in October 1981. They were unsuccessful. Rajani, who held legal salvage rights, then solicited the financial support of the R. J. Reynolds Co. This effort was also fruitless, and the salvage rights were allowed to expire.

Over the next several years, a number of aviation buffs joined the Greenland Expedition Society as word spread about the potential value of the aircraft. In 1986, Greenland authorities granted three-year salvage rights to Epps and Taylor. Part of the agreement was that the first "aesthetically complete" P-38 would be donated to the Danish Museum of Aviation, no matter what the condition of the rest of the planes. (Denmark has salvage rights under international law; the US retains ownership of US property until such property is sold or otherwise legally disposed of.) The question of legal claim was resolved when a fire at Wright-Patterson AFB, Ohio, destroyed all records of US aircraft procured before November 19, 1961. Once the documentation was lost, the Air Force agreed not to press its claim to any of these eight aircraft.

The second P-38 salvaged is to go to eight investors; a deposit has been placed on a third P-38. One of the B-17s has also been reserved for an investor. No decision has been made about the remaining four aircraft, although the Military Air Force Museum in Leningrad has expressed interest in acquiring the unclaimed Flying Fortress.

Air Force records, including the navigators' logbooks, were researched in an attempt to pinpoint the planes' positions; interviews were conducted with surviving crew members. Epps, Taylor, Vaughan, and others made a trip to the glacier area in 1986. Again, no aircraft was located, but the group refused to be discouraged.

Located at Last

On June 30, 1988, using such sophisticated equipment as low-frequency, side-scanning, subsurface radar and sensitive magnetometers, the team covered a wider area than it had before. It received an accurate sounding for *Big Stoop,* one of the Forts. It was determined to be about 260 feet beneath the surface of the ice cap. Within five days, all eight of the planes had been located. To verify the first find, a metal detector and probe using high-pressure steam bored through the ice and touched one of the planes. Charting the precise location of all the planes was then made easier, and each spot was subsequently recorded in a satellite navigation fix. Because they are located on a glacier that continually shifts, the planes had "moved" about a mile eastward—one of the reasons it had been so difficult to locate them.

In July 1989, a fourteen-man team returned to the site to obtain "tangible evidence" that at least one of the aircraft had been located. This was needed to convince the Danish government to grant an extension of search and salvage rights. To satisfy the terms of the agreement, two borings were made into the accessory section of one of *Big Stoop*'s engines, and metal pieces were retrieved. One was a section of half-inch aluminum tubing; the other was a bolt with a nut attached. Ice brought to the surface was permeated with what appeared to be an ice-oil emulsion. The Boeing Co. verified the samples as coming from a Flying Fortress of World War II vintage. As a result, salvage rights have been extended to September 1991.

The July 1989 expedition set up a work tent over the Flying Fortress* Big Stoop *and used a high-pressure steam probe to obtain metal samples from the plane's engines. After the Boeing Co. verified the samples as coming from a B-17 of World War II vintage, the Danish government extended salvage rights to September 1991.

Greatly encouraged by their "tangible evidence," a larger team led by Epps and Taylor is now planning to make an extended trip to the site this summer. The team is determined to extricate at least one P-38 from its icy prison. Assured by glacier experts and geophysicists that the planes will not be crushed in the process, they will use a thermal generator, called the Super Gopher II, to melt the snow and make vertical shafts for access to each plane. Jackhammers and chain saws will be used to break up the glacier ice.

No one doubts that the removal of the P-38s will be a difficult and expensive task. It is estimated that the cost will run to at least $750,000 for the first extraction and another million dollars for the other seven. Even those figures may be too modest, given the scope of equipment and logistical support needed. A P-38F in good condition could conceivably be sold for $1 million, according to Epps. He isn't sure how much the society could get for a B-17E in reparable condition, but he estimates that it may be worth more than $600,000. ■

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The Korean War, which saw the full emergence of jet aircraft in combat, began forty years ago this month.

JET WAR

By Philip Farris

IN the peaceful years just after World War II, while the United States was deactivating combat units, releasing servicemen and servicewomen from duty, and dismantling arsenals, Air Force leaders were developing aircraft for an air war yet to come—the jet war. The Air Force, under Gen. Hoyt S. Vandenberg, was building a solid nucleus of modern aircraft, even as it shrank in size.

The events of June 25, 1950—forty years ago this month—shattered the brief postwar peace and sparked the militarization of the cold war. Communist North Korean troops stormed across the 38th parallel. Attacking at dawn, the North's spearhead of Soviet-built T-34 tanks and following infantry swept aside the first defenses and flooded south into the Republic of Korea. South Korean forces, taken by surprise, wavered and broke. Communist infantry and marines poured ashore on South Korea's east coast near Kangnung. Kaesong fell at 9:00 a.m., and the seaborne Communist columns pushed their way inland.

The attack set off immediate alarms far south and east of the Korean battlegrounds, in Japan. There, the bases of the US Fifth Air Force were spread out in a defensive arc from Kyushu in the south to Honshu in the north. Fifth Air Force combat squadrons formed the backbone of US air defenses in the Far East.

The Fifth was largest of the Far East Air Forces (FEAF), recognized as the major air element of Gen. Douglas MacArthur's Southwest Pacific Area Theater. FEAF's primary mission was to maintain active air defense of the Far East Command and theater of operations. Fifth Air Force provided the "appropriate mobile air striking force" prescribed in FEAF's mission statement.

The mainstay of the Fifth's defensive capability was the first jet fighter that the United States ever produced in quantity: the Lockheed F-80C Shooting Star. This new aircraft was deployed with the 35th Fighter-Interceptor Wing at Yokota, near Tokyo; with the 68th Fighter-Bomber Wing at Itazuke Air Base on Kyushu; and with the 49th Fighter-Bomber Wing at Misawa on northern Honshu.

Fighter pilots on both sides of the Korean War found that the principles of a maneuvering dogfight applied to the higher speeds of jets. 1st Lt. Russell J. Brown downed a MiG-15 with his F-80C (right) over Sinuiju, Korea, in the first jet-vs.-jet combat in history.


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The United States knew it required more than the F-80 jet fighter for the war effort. The F-80 squadrons were backed by two all-weather fighter units operating prop-driven North American F-82 Twin Mustangs. In fact, FEAF's planners also saw a need for Fifth Air Force to use every prop-driven F-51 North American Mustang that could be found. They understood and valued the F-51's longer range and ability to operate from short, rough airfields.

Also deployed at Yokota were RF-80A reconnaissance planes of the 8th Tactical Reconnaissance Squadron. Two light tactical bomber squadrons of the 3d Bombardment Wing, equipped with Douglas B-26 Invaders, were deployed at Johnson AB, north of Tokyo. Rounding out Fifth Air Force's lineup of units was the 374th Troop Carrier Wing, which operated out of Tachikawa AB with two squadrons of Douglas C-54 transport aircraft.

By September 1952, three jet aces in Korea, members of the 4th FIW, could claim seventeen victories among them. Col. Harrison R. Thyng (left) had shot down five Communist aircraft, Maj. Fred "Boots" Blesse (center) seven, and Capt. Clifford Jolley (right) five. The three would eventually account for twenty-two MiGs.

"A Shoestring Air Force"

In the first days of the war, Lt. Gen. George E. Stratemeyer, FEAF Commander, sent a message to USAF Headquarters asking for personnel to bring all units up to war strength. He also requested 164 F-80s, twenty-one F-82s, sixty-four F-51s, twenty-two B-26s, twenty-three Boeing B-29s, twenty-one C-54s, and fifteen Douglas C-47s. Most of these planes were needed to round out squadrons to war strength and provide a ten percent reserve for combat attrition. Unfortunately, the Air Force in 1950 was what General Vandenberg would later describe as "a shoestring Air Force." Deep reductions in personnel in 1949 and early 1950 brought its strength down to 411,277—less than one fifth the size of the 2,000,000-strong World War II flying force. USAF had to support the first year of operations with World War II equipment stocks.

Even so, there was no shortage of USAF action. By June 26, only hours after the North Korean invasion began, airmen from the Fifth Air Force were flying over the peninsula in every available plane, evacuating Americans via Seoul's Kimpo Airfield and carrying other noncombatants out of the beleaguered country.

The enemy, however, continued to press hard and fast as the droning USAF transports—C-54s, C-47s, and Curtiss C-46s—undertook their life-saving sorties under protective cover of F-80 jets, prop-driven F-51 Mustangs, and F-82 Twin Mustang night fighters.

On June 27, under orders from Washington, Fifth Air Force fighters went to war in earnest, aided by carrier-based Navy and Marine fighter and attack planes, Royal Australian Air Force Meteor jets, South Korean and South African fighter-bombers, and Greek and Thai transport units.

The First Jet Victories

On the same day, Air Force 1st Lt. Robert H. Dewald, flying an F-80 jet, downed a Soviet-made Ilyushin Il-1 attack plane. Lieutenant Dewald's achievement is recorded as the first-ever American aerial victory attributed to a pilot flying a jet aircraft. Flying a cover mission earlier that day, 1st Lt. William G. Hudson and Maj. James W. Little, both flying in prop-driven F-82 fighters, were attacked by two North Korean fighters, and the US pilots fought back. With guns blazing, they flamed two enemy planes. Lieutenant Hudson is credited with downing a Yak-11 fighter. Major Little is credited with destroying an La-7. The Air Force scored three other aerial victories on its first complete day of offensive fighter operations. Lt. Charles Moran, Capt. Raymond Schillereff, and Lt. Robert E. Wayne, flying in an F-82 and F-80s, respectively, brought down a Soviet-made La-7 and two Soviet-made Il-1s.

The following day, June 28, saw another Air Force "first." On the morning of that day, the southward-drifting polar front stood over the airfields on Kyushu, but the Fifth Air Force had to fly. Lt. Bryce Poe II took off alone into the murky overcast from Itazuke in his RF-80A. His task was to reconnoiter and photograph the vanguard of the North Korean force. Weather at Itazuke was foul, but Lieutenant Poe found clear weather in Korea, and he successfully carried out his mission. Lieutenant Poe's flight marked the first reconnaissance sortie of the Korean War and, of greater historical significance, the Air Force's first combat jet reconnaissance sortie.

While the ground war raged up and down the Korean peninsula, FEAF pilots waged unceasing air war against the North Korean enemy—destroying aircraft; attacking supply and troop depots; shattering critical transportation facilities and routes; burning vehicles, locomotives, and railcars; and relentlessly pounding front-line, dug-in positions. American pilots went into this fresh combat bolstered by their battle-tested experience of World War II. For the most part, the Americans who carried the brunt of early fighting were veteran aviators.

A Communist MiG-15 pilot abandons his aircraft after it is hit by gunfire from an F-86 Sabre. The Sabre's gun camera recorded the MiG pilot's ejection. The USAF pilot in this May 1953 dogfight was 2d Lt. Edwin E. "Buzz" Aldrin, Jr., who achieved fame sixteen years later as the second man to walk on the moon.

Early in the war, it was North Korea's Yakovlev fighters that tangled most frequently with the American Mustangs and Shooting Stars. However, as the Chinese Communists moved into the battle along the Yalu River in the war's first winter, the sweptwing, Soviet-made MiG-15 fighter entered the Korean air war. So, too, did an American aircraft that soon would become known as the "MiG Killer": the North American F-86 Sabre.

To be sure, the Air Force's slower F-80 jets already had gone up against the MiGs before the F-86 appeared on the scene in Korea. The first "jet-to-jet" victory in military history, in fact, saw a Soviet-made MiG-15 going down in flames at the hands of an American F-80 pilot. Lt. Russell J. Brown of FEAF's 16th Fighter Squadron sparred with and then brought down the Soviet jet on November 8, 1950.

It was in encounters with the F-86, however, that the Soviet-made MiGs met their true nemesis.

The critical role of the F-86 is made plain in the final tally of Korean War victories. The Air Force's official victory publication lists page after page of Sabre pilot victories over the MiG-15. Of 839 MiG-15s shot down in air-to-air combat during the Korean War, fully 800 were brought down by Sabre pilots. The enemy managed to drop only fifty-eight of the F-86s.

Ace is a title of honor given to an airman officially credited with downing five or more enemy aircraft. Of the forty Americans of all services who became aces in the Korean War, thirty-nine made their mark in F-86s. (The only non-Sabre ace, Navy Lt. Guy P. Bordelon, had five night kills in his F4U-5N.) Though they didn't become aces, many other American pilots scored victories. These individuals are credited with a total of 114 air-to-air victories in Korea. Of these, nearly two-thirds—seventy-two—were racked up by pilots flying the F-86.

A New Type of Air Combat

Jet aces of the Korean conflict were experienced hands, pilots who were able to put the sleek, sweptwing F-86 machine through its paces to give the Americans air superiority and a lopsided kill advantage against the fast and well-built MiG. It was a new type of air combat, never attempted before. The unique problems and features of jet war were dramatized in a personal account of a typical engagement by Col. Harrison R. Thyng, who became one of the Korean War's jet aces *[see "Valor," p. 111, January 1989 issue]*.

In the 1958 book *Five Down and Glory,* Thyng recalled: "The F-86 pilots ride over North Korea to the Yalu River, the sun glinting off silver aircraft, contrails streaming behind, as they challenge the numerically superior enemy to come on up and fight. . . .

"Breaking up into small flights, we stagger our altitude. We have checked our guns and sights by firing a few warm-up rounds as we crossed the bomb line. Oxygen masks are checked and pulled as tight as possible over our faces. We know we may exceed eight Gs in the coming fight, and that is painful with a loose mask.

"We are cruising at a very high Mach. Every eye is strained to catch the first movement of an enemy attempt to cross the Yalu from the Manchurian sanctuary into the graveyard of several hundred MiGs known as MiG Alley.

"Now we see flashes in the distance as the sun reflects off the

The North American F-86 Sabre, the nemesis of Soviet-built MiGs during the Korean War, was known as the "MiG Killer." Of 839 MiG-15s destroyed in air-to-air combat, 800 were F-86 victories. Only fifty-eight Sabres were shot down.

Maj. James W. Jabara, an F-86 pilot, became USAF's second triple jet ace on July 15, 1953, when he shot down his fifteenth MiG. In May 1951, he destroyed two MiGs in a battle that pitted thirty-six Sabres against some fifty MiGs.

beautiful MiG aircraft. The radio crackles: 'Many, many coming across at Suiho above 45,000 feet.'

"We know the enemy sections are now being vectored and the advantage is theirs. Traveling at terrifically high speed and altitude, attackers can readily achieve surprise. The area bound by the horizon at this altitude is so vast that it is practically impossible to keep it fully covered with the human eye.

"Our flights are well spread out, ships line abreast, and each pilot keeps his head swiveling 360 degrees. Suddenly, MiGs appear directly in front of us at our level. At rates of closure of possibly 1,200 miles an hour, we pass through each other's formations.

"Unless the MiG wants to fight, and also turned as he climbed, he will be lost from sight in the distance before the turn is completed. But if he shows an inclination to scrap, you immediately trade head-on passes again. You sucker the MiG into position where the outstanding advantage of your aircraft will give you the chance to outmaneuver him.

"For you, combat has become an individual dogfight. Flight integrity has been lost, but your wingman is still with you, widely separated but close enough for you to know you are covered.

"Suddenly, you go into a steep turn. Your Mach drops off. The MiG turns with you and you let him gradually creep up and outturn you. At the critical moment, you reverse your turn. The hydraulic controls work beautifully. The MiG cannot turn as readily as you and is slung out to the side. When you pop your speed brakes, the MiG flashes by you. Quickly closing the brakes, you slide onto his tail and hammer him with your fifties. Pieces fly off the MiG, but he won't burn or explode at that high altitude. He twists and turns and attempts to dive away, but you will not be denied. Your fifties have hit him in the engine and slowed him up enough so that he cannot get away from you. His canopy suddenly blows and the pilot catapults out, barely missing your airplane. Now your wingman is whooping it up over the radio, and you flash for home very low on fuel."

Making Aviation History

By May 20, 1951, Capt. James Jabara, an F-86 pilot, had destroyed four enemy MiGs and needed but one more to become the first "jet-to-jet ace" in history. Late that afternoon, two Sabre flights closed into "MiG Alley" and found that the adversary was willing to come up and fight. Hearing the news by radio, two other Sabre flights, one of which included Captain Jabara, sped to the area, arrived in fifteen minutes, and took part in the combat. In the battle, thirty-six USAF Sabre pilots battled some fifty MiGs. Jabara plunged into the fight and downed not one but two MiGs, establishing his place in aviation history.

In the pages of this magazine's June 1951 issue, Captain Jabara described the mission: "I tacked on to three MiGs at 35,000 feet, picked out the last one, and bored straight in. My first two bursts ripped up his fuselage and left wing. At about 10,000 feet, the pilot bailed out. It was a good thing he did, because the MiG disintegrated. Then I climbed back to 20,000 feet to get back into the battle. I bounced six more MiGs. I closed in and got off two bursts into one of them, scoring heavily both times. He began to smoke. Then, when my second burst caught him square in the middle, he burst into flames and fell into an uncontrollable spin. All I could see was a whirl of fire. I had to break off then because there was another MiG on my tail."

At war's end, Captain Jabara could claim fifteen MiG kills.

In terms of Korean War victories, Captain Jabara was surpassed only by Capt. Joseph H. McConnell, Jr. In the first five months of 1953, the F-86 pilot from 39th Fighter Squadron bagged sixteen MiG-15s. On one particularly auspicious day—May 18—Captain McConnell dropped three MiGs, thus becoming the first "triple jet ace" in USAF history.

The Korean War was a watershed in military aviation. As the pilots knew only too well, times were changing. The machines were unlike any ever seen, and the era of free-lance air warriors was rapidly passing. Captain McConnell, discussing his status as an ace, made a portentous statement: "It's the teamwork out here that counts. The lone wolf stuff is out. Your life always depends on your wingman and his life on you. I may get credit for a MiG, but it's the team that does it, not myself alone." ■

Philip Farris, a retired Army officer and graduate of West Point, is a free-lance writer specializing in military topics. He served in the Korean War, making two combat jumps with the 187th Airborne Regimental Combat Team. This is his first article for AIR FORCE *Magazine.*

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Viewpoint

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

The Low-Intensity Decade

Scholars, businessmen, and airmen agree that the emphasis will be on "little" wars. Everybody wants a share of the low-intensity mission—and of the budget that goes with it.

As we stumble uncertainly into the last decade of this century, at least a few things appear to be safe bets: A major war with nuclear weapons is unlikely, and lesser wars will occur with the usual frequency. The drug war, which is really not a war but a social crisis, will go on unabated. These were the conclusions—admittedly, summarized here with a bit of literary license on my part—arrived at during this year's Air Power Symposium at the Air War College in Montgomery, Ala.

Prevention of a major nuclear war continues to be our overriding national security objective, and there can be no reasonable argument against that statement. The Chernobyl disaster provided the Soviets with a firsthand, terrifying glimpse of what nuclear weapons can do. Since nukes are expected to turn up in the hands of some very shifty nations, however, the superpowers must maintain an overwhelming capability, not just to keep one another honest, but as a convincing threat against irresponsible behavior elsewhere.

With full agreement by the assembled professors, business executives, and active-duty and retired military on that score, we next turned our attention to the recurring problems of small wars and the drug scourge.

A small war fought without nukes (and, presumably, against lesser opponents) is referred to as a low-intensity conflict or, inevitably, LIC, pronounced "lick." As officially defined, a LIC is "a limited politico-military struggle to achieve political, social, economic, or psychological objectives."

As unofficially defined, LICs will be the means to certain budgetary ends. Periodically, in the national security business, priorities change, and when they do, the dollars naturally follow. The Eisenhower Administration placed the Air Force in the budget ascendancy with its philosophy of "a bigger bang for the buck." The venerable but still useful B-52s are relics of that time and legitimate candidates for an important role in LICs. Even the B-2, originally conceived for a far different purpose, is an entrant in the LIC budget sweepstakes, with its range, accuracy, and conventional payload as credentials.

Regardless of who wins the budget war, there are two basic and essential principles: modernization and quality.

Whatever comes of the various proposed programs, it is certain that defense austerity will provide the setting for interservice wrangling. The Army and the Marines have their sights set on a similar mission, that of proceeding rapidly to small-scale outbreaks. The Navy and the Air Force will collide, as they have every now and then through the years, over the relative capabilities of land-based and carrier airpower and which is best suited to low-intensity conflict. In the absence of such conflict, as is the case at the moment, these arguments become more dogmatic than strategic, but they are the stuff of which budget and interservice battles are made.

There is, of course, no precise answer to how we should shape our forces in the coming decade. We should have learned by now, on the basis of past and bitter experience, that regardless of who wins the budget war, there are two basic and essential principles: modernization and quality. We entered the Korean War deficient in both, and early in that affair, it caused us some heartstopping moments. The Vietnam War, a LIC according to the official definition, began in such a haphazard way that it was not immediately apparent that we were unprepared for it. Years of nuclear delivery practice, for instance, had left our tactical air forces short of a conventional delivery skill.

In today's military quality is at a very high level, perhaps the highest ever. How long it will remain that way if the present somber budget climate endures, as we see assets like the Aggressor squadrons go down the drain, and if the insensitive behavior of Congress toward the current personnel crisis is an indication of treatment to come, is another question. In any case, the Air Force, and all the services, go into the 1990s well-prepared.

In many ways, the long years of the cold war were comfortable ones. The sheer cost to each side of confronting one another over the fortified central European frontier took a large share of available resources. While the threat of European war was real enough, few—and virtually no one in the last twenty years—really believed, deep down, that it would happen.

Now that that menace has been diminished almost to the vanishing point—provided we don't nullify our gains by a mass pullout—we find ourselves facing a variety of less tangible threats. As we concluded in our Air War College seminar, an intense competition for resources and an ever-increasing population signal troublesome times ahead. Terrorism and insurgency will be natural by-products, and easy access to high-technology weapons will make any conflict extremely hazardous.

Then there is the contraband drug trade and its threat to our society. A discouraging commentary on our lack of progress in this struggle is that opium production in the Burma-Thailand Golden Triangle has tripled in recent years, with Americans consuming sixty percent of that output in the form of heroin. ■

Reviews

By Jeffrey P. Rhodes, Aeronautics Editor

Dear Folks, by Van R. Parker. Foreword by Gen. Curtis LeMay. In the foreword, General LeMay refers to the "pick and shovel men" who labored to win the air war against Japan during World War II. The author is one of those who toiled on the front lines: He was a B-29 commander who flew thirty-two combat missions. Although he later flew bombers in Korea and Vietnam, the author confines this story to World War II and uses his letters to his parents as a framework for the narrative. He adds much color and detail by relating some of his wartime experiences as he sees them forty-four years later, rather than clouding them with the emotion of the moment. Unlike the writers of many World War II memoirs, though, the author has also researched many of the larger events of the war, and he includes in the text an analysis of these happenings from his perspective as just one of the many who were actively involved. Global Press, Memphis, Tenn., 1989. 289 pages with photos. $18.95.

The Limits of Airpower: The American Bombing of North Vietnam, by Mark Clodfelter. The author, an associate history professor at the Air Force Academy, takes a controversial look at the three major bombing campaigns of the Vietnam War. The author states that faith in bombing's sheer destructive power led commanders to believe that airpower could have won that war at any time, but that the effectiveness of strategic bombing proved neither uniform nor assured. Professor Clodfelter argues that reliance on airpower as a primary instrument, no matter how concentrated, could not have produced lasting victory in Vietnam. He says that the Rolling Thunder campaign ignored current Communist strategy and pursued broad aims that often conflicted. On the other hand, he notes that the two Linebacker campaigns did achieve results, but only because of the conventional nature of the war at that time and because of President Nixon's limited political aims. Many people won't like what the author says, but his analyses are thought-provoking. The Free Press, New York, N. Y., 1989. 297 pages with maps, notes, bibliography, and index. $22.95.

Treat 'Em Rough! The Birth of American Armor, 1917–20, by Dale E. Wilson. Foreword by Maj. Gen. G. S. Patton III. One of the most overlooked chapters in American military history is the development of armor as a main component of the Army's combined arms team. Using eyewitness accounts from the archives of the Army War College and such sources as Gen. George Patton's papers, the author, an assistant professor of history at West Point, details the design and nonproduction of US tanks during World War I (the cause being production delays and political interference), the training of crews with French-built tanks, the monstrous problem of transport in an age when roads were built for horse-drawn carriages, the evolution of a combat doctrine for armor, and the three great battles—St.-Mihiel, Meuse-Argonne, and St.-Quentin—that revolutionized modern warfare. The postwar period, when armor was nearly allowed to die, is also covered. Presidio Press, Novato, Calif., 1989. 257 pages with maps, photos, notes, appendices, bibliography, and index. $24.95.

United States Military Almanac: A Chronological Compendium of Over 200 Years of American History, by Walt Lang. This unique volume traces US military history from the formation of the Massachusetts Bay colony's militia on October 7, 1636, to the arrival of *Shoo Shoo Baby,* the last surviving B-17 to have seen combat in World War II, at the Air Force Museum on October 13, 1988, and nearly everything from every service in between. In addition to covering all major wartime and peacetime events, this book also contains many offbeat entries. Profusely illustrated, the book also has many interesting charts, such as a complete list of campaign streamers from the Indian Wars and comparative submarine strengths of the US, Germany, and Japan at the start of World War II. A small number of typographical errors and misidentified pictures slightly mar this otherwise useful and interesting work. Military Press/Crown Publishers, New York, N. Y., 1989. 176 pages with photos, maps, charts, and index. $24.99.

WWII: Time-Life Books History of the Second World War, by the editors of Time-Life Books. Foreword by Eric Sevareid. Based on Time-Life's best-selling thirty-nine volume history of World War II, this volume has an entirely new text and dips generously into the photo files of the two magazines. Few of the photos are the World War II "standards" that have illustrated most books, and some, surprisingly, are in color. Many events are illustrated by artists who were on the scene and who painted their impressions. The text is broken down into five major sections—the prewar rise of Hitler, Mussolini, and Imperial Japan; the early defeats suffered by countries in western Europe; the turning of the tide, starting with North Africa; the Allied march to victory; and the aftermath of the war on a global scale. Each section also includes sidebars that profile specific equipment (such as tanks or planes) or particular events (such as the Doolittle Raid). An impressive work. Prentice Hall Press, New York, N. Y., 1989. 496 pages with photos, maps, chronology, and index. $39.95.

Yamamoto: The Man Who Planned Pearl Harbor, by Edwin P. Hoyt. Japanese Adm. Isoroku Yamamoto was the only commander on any side in World War II to be specifically targeted on the direct order of an enemy head of state. Why Yamamoto was regarded as so dangerous that the shootdown order had to come from President Roosevelt himself is explored only briefly. The author concentrates on telling this remarkable man's story. Yamamoto had an unusual understanding of the West, and he made himself unpopular by arguing that if Japan provoked a conflict, it would most certainly lose in the end. Once militarism prevailed, Yamamoto worked dutifully and diligently to provide the one method he saw as a means of victory—a preemptive strike against the US fleet at Pearl Harbor using the carriers and airplanes whose development he had spearheaded. McGraw-Hill Publishing, New York, N. Y., 1990. 281 pages with maps, photos, notes, bibliography, and index. $19.95.

IN VIDEO—"National Air and Space Museum Archival Videodiscs 1, 2, 3, 4, and 5." The National Air and Space Museum, an early videodisc advocate, has almost half of its 1,000,000-plus photo collection on these five 33⅓-rpm-record-sized discs. A videodisc player is a prerequisite, but watching the 100,000-image discs is much like rummaging through the nation's photographic attic—and it's hard to stop once you start looking. Disc 1 covers the most-often-requested photos of US and foreign aircraft. Disc 2 covers major aerospace personalities, as well as aircraft not on the first disc, balloons, airships, airlines, air meets, trophies, museums, models, and stamps. Disc 3 covers pre- and post-World War II, as well as the war itself. Disc 4 (50,000 images only) completes both World War II and the pre-1954 USAF collection. Disc 5 covers the history of the space program. Disc 6, covering lunar imagery, will be out shortly. Various dates, black-and-white and color. Distributed by the Smithsonian Institution, Washington, D. C. $57.25 each.

AFA/AEF Report

By Daniel M. Sheehan, Assistant Managing Editor

Association Jointness

Mirroring the jointness that was an outstanding characteristic of Operation Just Cause, the year-end deployment that ousted Panamanian strongman Manuel Noriega, AFA's **Tallahassee (Fla.) Chapter** got together with its Army counterpart to get a first-hand account of that successful operation. Meeting with the Big Bend Chapter of the Association of the US Army (AUSA), Tallahassee Chapter members listened to Capt. Patrick M. McGerty and Sfc. Robin Harrison, participants in Just Cause, describe the realities of low-intensity conflict. The two soldiers are members of the elite Army Rangers (specifically, the 1st Ranger Battalion, 75th Infantry, Fort Stewart, Ga.), who, during the invasion, took part in the largest night combat airdrop since D-Day. Members of a USAF Combat Control Team (a unit that by definition works closely with the Army) from Hurlburt Field also addressed the gathering. 1st Lt. John Schuldheiss and MSgt. John Lebold of the 1723d Combat Control Squadron gave vivid accounts of the planning and execution that went into securing Rio Hato Airfield, a key assignment that eased the subsequent airlift of US reinforcements.

Tallahassee Chapter President Terrance H. Fregly welcomed such AUSA dignitaries as Regional President Dr. Hal C. Van Meter of Buena Vista, Ga., Florida State President Col. Russell H. Davis, Jr., USA (Ret.), and Big Bend Chapter President Walter G. Frauenheim, Jr. Mr. Fregley noted the good turnout by members of AFA, AUSA, and the Tallahassee community and expressed hope that similar future events could aid the two associations in their efforts to keep the civilian community informed about military accomplishments and needs.

Chapter News

The **Jerry Waterman (Fla.) Chapter**, a large and busy one operating out of Tampa, reports a full slate of activities. Training was the topic as a Chapter luncheon meeting heard a talk by Maj. Gen. Robert S. Delligatti, Vice Commander of Air Training Command. The General, a much-decorated command pilot and Vietnam veteran, gave an informative talk about the command that provides tomorrow's USAF with the skills essential to its success. The Chapter welcomed back an old friend when Maj. Gen. Lester P. "Paul" Brown returned for a visit. The General, now Commander of of TAC's 24th Air Division at Griffiss AFB, N. Y., had been in the Tampa area when he commanded the 63d Tactical Flying Training Squadron at MacDill AFB. The Chapter also welcomed a new Community Partner, the Marriott Westshore Hotel, and reports its continued support for such worthy causes as the Special Olympics, the Arnold Air Society and its Angel Flight, the Young Astronauts Program, and the Partners in Education (PIE) Program. The PIE Program, under Chairman Darius Bakunas, has succeeded in getting all of the science and math teachers in Hillsborough County involved in it.

AFA's three newest councils met in San Antonio to hear a talk by AFA National President Jack C. Price and discuss the ramifications of smaller defense budgets. Shown here is the Air National Guard Council: (left to right) TSgt. David Mark, Col. Frank C. Khare, Chairman Maj. Gen. Raymond A. Matera, USAF (Ret.), Brig. Gen. Adolph P. Hearon, and Capt. Charles A. Nelson.

Connecticut State AFA made a special effort to brighten the day of hospitalized veterans at the West Haven VA Hospital. State President Al Hudson, accompanied by Miss Connecticut of 1989, Marlena Marshall, toured the wards, distributed cards handmade by local schoolchildren, and tried to let the patients know that they were remembered with appreciation. Mr. Hudson termed the visit "a very rewarding experience."

The **Albuquerque (N. M.) Chapter** held its annual awards and fund-raising dinner at the Kirtland AFB Officers Club. The Chapter targeted AFROTC and AFJROTC for special attention in the form of scholarships. University of New Mexico AFROTC cadets Amy K. Anderson and Michael J. Moore each received scholarships worth $250, while AFJROTC programs at three local high schools, Valley, Del Norte, and Espanola, received $100 each to support their activities. Chapter President Bob Johnson presented his predecessors, retired USAF colonels Don Frank, Bill Gardner, and chapter-founder Walter Fackenthall, with past-president pins.

Also recognizing its duty to invest in the future of young people, the **Langley (Va.) Chapter** made a generous contribution to the Langley Children's Literacy Council. The $1,000 donation will help put books into the hands of toddlers and even younger children to help foster reading as a lifelong enthusiasm. National Director Steve Mallon of Hampton, Va., has been one of the prime movers in this worthwhile effort.

Out in Big Sky country, the **Bozeman (Mont.) Chapter** held its quarterly meeting. Cadets from AFROTC Det. 450, led by Cadet Corps Commander

Kevin J. Malloy and Commandant of Cadets Ron Hollibaugh, briefed Chapter members on AFROTC activities and requirements. Chapter President John Wallace and State President Ron Glock gave informative overviews of AFA activities.

Also out west, the **Lance Sijan (Colo.) Chapter** has a thriving guest-speaker program. Recent guest speakers include Rep. Hank Brown (R-Colo.), whose talk emphasized the economic implications of recent budget drawdowns for military enterprises in the Colorado Springs area, and Maj. Gen. Ian Patrick of the Canadian Armed Forces, whose address concentrated on NORAD's changing role, with particular stress on NORAD's potential and actual contributions to drug-interdiction efforts.

Drug interdiction was also the topic that earned journalistic laurels for Nena Wiley, Vice President of Communications for the **Frank Luke (Ariz.) Chapter**. Ms. Wiley received both a Journalism Award for Excellence and the Earl D. Osborn Award from the Aviation/Space Writers Association for her article "Airborne Drug Hunters," which appeared in *Air Progress* Magazine last year.

Don Schwartz, Nevada State AFA Vice President and Chairman of the Community Partner Program for the

Coming Events

June 1–3, **Alabama State Convention,** Huntsville, Ala.; June 2, **Connecticut State Convention,** West Haven, Conn.; June 2, **Massachusetts State Convention,** Worcester, Mass.; June 2, **South Dakota State Convention,** Rapid City, S. D.; June 8–9, **Alaska State Convention,** Fairbanks, Alaska; June 16, **Oregon State Convention,** Portland, Ore.; June 22–23, **Arkansas State Convention,** Hot Springs, Ark.; June 22–23, **Missouri State Convention,** Whiteman AFB, Mo.; June 23, **Georgia State Convention,** Brunswick, Ga.; July 6–7, **Ohio State Convention,** Dayton, Ohio; July 6–7, **Oklahoma State Convention,** Tinker AFB, Okla.; July 6–8, **Arizona State Convention,** Litchfield Park, Ariz.; July 13–15, **Pennsylvania State Convention,** Philadelphia, Pa.; July 13–15, **Texas State Convention,** Fort Worth, Tex.; July 13–15, **Virginia State Convention,** Hampton, Va.; July 20–21, **Michigan State Convention,** Wurtsmith AFB, Mich.; July 21, **North Carolina State Convention,** Fayetteville, N. C.; July 26–28, **California State Convention,** Los Angeles, Calif.; July 27–29, **Florida State Convention,** Tampa, Fla.; July 27–29, **New Mexico State Convention,** Alamogordo, N. M.; August 4, **Indiana State Convention,** Indianapolis, Ind.; August 10–11, **North Dakota State Convention,** Fargo, N. D.; August 17–18, **Wisconsin State Convention,** Milwaukee, Wis.; August 18, **Mid-America Ball,** St. Louis, Mo.; August 18–19, **Illinois State Convention,** St. Louis, Mo.; August 24–25, **Utah State Convention,** Hill AFB, Utah; August 25, **Minnesota State Convention,** Minneapolis, Minn.; August 24–26, **Nevada State Convention,** Las Vegas, Nev.; September 7–8, **Colorado State Convention,** Colorado Springs, Colo.; September 17–20, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.; October 13, **North Central Regional Workshop,** Bloomington, Minn.; November 17–18, **Southeast Regional Workshop,** Shaw AFB, Sumter, S. C.

Also at the San Antonio meeting, along with the Reserve Council (for a list of members of all the councils, see next month's issue), was the Veterans/Retirees Council. Left to right, Maj. Gen. Paul D. Straw, USAF (Ret.); Maj. Gen. (Chaplain) Richard W. Carr, USAF (Ret.); Robert Puglisi; CMSgt. Robert W. Waldrup, USAF (Ret.); CMSAF Don Harlow, USAF (Ret.); Col. Robert W. Gregory, USAF (Ret.); Col. James E. "Red" Smith, USAF (Ret.); and Chairman Col. Sherman W. Wilkins, USAF (Ret.).

NASA astronaut Capt. Manley S. "Sonny" Carter, USN, a mission specialist on last November's STS-33 space shuttle* Discovery *mission, receives an AEF Ira Eaker Fellowship from Carl Vinson (Ga.) Chapter President Tom Reed (right) and former Chapter President Jack Steed (left).

Dale O. Smith (Nev.) Chapter, recently welcomed Jim Brady, General Manager of Jimsair Aviation Services at Reno-Cannon IAP, as the Chapter's fifteenth Community Partner. The Chapter is in the midst of an aggressive effort to get the Reno community involved with AFA.

Foundation Functions

At the **Cape Canaveral (Fla.) Chapter's** annual Astronaut Tribute Night, recently retired shuttle veteran Dr. James D. "Ox" van Hoften was installed as a Jimmy Doolittle Fellow of the Aerospace Education Foundation. Director of the Kennedy Space Center Lt. Gen. Forrest McCartney, USAF (Ret.), conducted the installation, and Col. Robert Bourne, Commander of the 6555th Aerospace Test Group, served as master of ceremonies. Dr. van Hoften flew as a mission specialist on both *Challenger* and *Discovery* and since his retirement has been a professor at the University of Texas.

Another recently installed Jimmy Doolittle Fellow is Gen. H. T. Johnson, Commander in Chief of Military Airlift Command and CINC of US Transportation Command. The **Altus (Okla.) Chapter** cosponsored the General's installation along with Altus-area businesses during ceremonies at the Altus AFB Officers Open Mess. Chapter President Bennie Drake presented the award.

The deadline for nominations for the 1990 Christa McAuliffe Memorial Award is fast approaching. AEF's annual award, given last year to Dr. Ben Millspaugh of Colorado, honors the nation's outstanding math or science teacher. This year's nominations are due by July 15. Contact Laura Ingle at AEF for further details.

Chennault Stamp

Another founding father of the Air Force will be honored by the US Postal Service by having his picture placed on a commemorative stamp. A stamp honoring Lt. Gen. Claire Lee Chennault, who led his "Flying Tigers" over the Hump and into history, will be issued at a First Day of Issue Ceremony held in Monroe, La., on September 6, 1990. The Postal Service plans to hold additional ceremonies marking the issue of the forty-cent stamp in conjunction with the annual convention of the 14th Air Force Association.

Have AFA News?

Contributions to "AFA/AEF Report" should be sent to Dave Noerr, AFA National Headquarters, 1501 Lee Highway, Arlington, VA 22209-1198. ■

March weather has a reputation for volatility in many parts of the world, so it is particularly apt that AEF's March 1990 calendar features the 55th Weather Reconnaissance Squadron's TSgt. Barbara Cole. Here, her commanding officer Lt. Col. Bill Richards and Sacramento (Calif.) Chapter President Douglas Baldwin judge the accuracy of the John Witt portrait.

Gen. H. T. Johnson receives his Jimmy Doolittle Fellowship from Altus (Okla.) Chapter President Bennie Drake during ceremonies at Altus AFB. The General, a forward air controller during the Vietnam War and holder of the Silver Star and many other decorations, is CINC of Military Airlift Command and US Transportation Command.

Bulletin Board

Seeking contact with survivors of the attack on Pearl Harbor who were in Hawaii on **December 7, 1941. Contact:** Betsy Camacho, Public Affairs, Bellows AFS, P. O. Box 1010, Waimanalo, HI 96795.

Seeking contact with **combat air traffic controllers** from World War II, Korea, the Berlin Airlift, and Vietnam for a history of air traffic control in combat environments. **Contact:** Margaret J. Nigra, Hq. AFCC, Scott AFB, IL 62225-6001.

The 329th Combat Crew Training Squadron (formerly 4017th CCTS) at Castle AFB, Calif., is seeking patches and photographs related to **strategic tanker operations** for a permanent historical display. **Contact:** Maj. Walter E. Ifill, USAF, 329th CCTS/CTK, Castle AFB, CA 95342-5000.

Seeking an **illustrated book of military patches,** especially Air Force and Naval aviation units. Will also trade patches. **Contact:** Mike Trumpfheller, 5422 Adobe Falls #7, San Diego, CA 92120.

Seeking contact with the American pilot who took a photo of **Bon Schofield,** who was in an infantry battalion in the 14th Army of the Royal Welsh Fusiliers in Burma. Schofield was shot in the leg on February 24, 1945, and was evacuated from Myitkyina to Shwebo by Americans. An American took a picture of him lying on a stretcher with his leg in a Thomas splint when he was taken off the plane. **Contact:** Elmer Otto Michener, 21 Kasouka Rd., Camberwell, Victoria 3124, Australia.

Seeking information on a **B-24 Liberator, B-24D-CO-20, serial number 41-24143.** It had a piece of nose art that read "Dippy Dave and his 8 Dippy Diddlers." **Contact:** Jason Kritikos, 1314 Barkley Rd., Port Vue, PA 15133.

Seeking to compile a list of **World War II aircraft nicknames.** Please include the exact spelling and punctuation of the nickname, the aircraft type and serial number, and the assigned organization (squadron, group, wing/division, and air

force). **Contact:** Harold W. Sherman, Yankee Air Force Library, P. O. Box 599, Belleville, MI 48111.

Seeking loan of maps, drawings, or photographs of **airfields in southeast Asia** that were used by helicopters. **Contact:** William H. Greenhalgh, 654 Haggerty Rd., Wetumpka, AL 36092.

Seeking contact with **Capt. Roger Krell** of the 19th TASS. His O1-G, *Little Puff*, was recently purchased in Australia. Also seeking information on the **Fairchild C-123 Provider** for a book on that aircraft. **Contact:** Al Adcock, 121 Bales Dr., Marianna, FL 32446.

Seeking information on and insignia of **Air Force helicopter units** past and present. **Contact:** Cadet Col. John Trumpfheller, 5422 Adobe Falls #7, San Diego, CA 92120.

Seeking contact with anyone who knew **SSgt. Paul Joseph Caruso,** who was a ball turret gunner on B-17s with the 571st Bomb Squadron, 390th Bomb Group, during World War II. **Contact:** Bill Caruso, 504 Bonerwood Dr., Nashville, TN 37211.

Seeking contact with **Col. Walker "Bud" Mahurin** and a copy of his book, ***Honest John,*** which was published by Putnam Bros. Books in 1962. **Contact:** CMSgt. Joseph N. Larocca, USAF (Ret.), R. R. 2, S. Jackson Ave., Newburgh, NY 12550.

Seeking the whereabouts of **Lt. Fred Bell,** who was in Pilot Class 43-D and was stationed at March Field, Calif., in the summer of 1943. **Contact:** Bill Beecher, 3209 Clifford Dr., Metairie, LA 70002.

Seeking the whereabouts of the following pilots who served with the **32d Fighter Squadron** in Curacao and Aruba in 1943–44: Albert S. Pouliot, Virgil H. Roan, Edward C. Troutman, and Arnold B. Davis. **Contact:** Donald L. Baker, 824 Bridlewood Rd., Copley, OH 44321.

Collector seeks USAF **patches,** stickers, posters. **Contact:** Sener Getinkaya, Sütlüce Mah, I. Mandira Sok., #15, 10100 Balikesir, Turkey.

Seeking contact with the following crew members of a C-47A from the **50th Troop Carrier Squadron** who were on board on June 5, 1944: 2d Lt. Loy C. Grimes, 2d Lt. Hugo S. Burleson, TSgt. Joe P. Greer, and Sgt. Wilford L. Snodgrass. **Contact:** Richard Chilton, Rte. 1, Box 552, Genoa City, WI 53128.

Seeking contact with those who were stationed at **Sioux City AAFB** with the 2d Air Force in 1944 and worked in either the photo lab or camera repair. **Contact:** George E. Estee, 3 Birch Dr., Dover, NH 03820.

Seeking contact with **Col. Taylor B. Zinn,** USAF (Ret.), whose last known station was the Pentagon. Also seeking **SMSgt. James King,** USAF (Ret.), whose last known station was as a boom operator on KC-135s with the 306th ARS, McCoy AFB, Fla. **Contact:** Col. Pete Peterson, USAF (Ret.), 2911 Timberlake Dr., Orlando, FL 32806.

Seeking whereabouts of my godfather, **A. Schumer,** who was in USAF, stationed close to Nuneaton, Warwickshire, England, in September 1944. **Contact:** Pamela R. (Palmer) Egan, 16514 Melba Jean, Southgate, MI 48195.

Seeking contact with **Americans who served in Cornwall,** England, during World War II, possibly to arrange a tour of the area in commemoration of the fiftieth anniversary of D-Day. **Contact:** Georgina Holman, City Hall, Lemon Quay, Truro, Cornwall TR1 2HG, England.

Seeking information on pilots who were at Cazes AB, Casablanca, Morocco, between 1942 and 1945, especially **Joseph J. Burrowes, Gilbert F. Lauritzen, and Sammy V. C. Snyder. Contact:** Carl B. Larson, 1460 Mandalay Beach Rd., Oxnard, CA 93035.

Seeking contact with members of the **936th Troop Carrier Group** of the 9th Air Force, World War II. **Contact:** Jane Johnson, 2701 Liveoak, Waco, TX 76708.

Researcher/writer would like to contact **pilots and aircrews of Special Operations Group's "air force,"** the 20th and 90th SOS and 1st Flight Detachment who flew southeast Asia missions between 1965 and 1972. Also seeking **Capt. Robert Gleason,** USAF, who worked for Chief, SOG, Col. John K. Singlaub. **Contact:** John B. Dwyer, 430 Westbrook, Dayton, OH 45415.

Seeking the whereabouts of **CWO Steele Crauswell,** whose last known address, in 1960, was Warner-Robins AFB, Ga. **Contact:** Maj. James R. Williams, USAF (Ret.), 323 N. "W" St., Lompoc, CA 93436.

Seeking a picture of a **B-24 named *Man-o-War.*** **Contact:** John J. Kardos, 6 Swatling Rd., Latham, NY 12110.

Seeking the whereabouts of **James G. McDonnell,** who was navigator/radar operator of Ray Pownall's crew at Ramey AFB, Puerto Rico, in the early 1950s and was in the 55th Strategic Reconnaissance Wing at Forbes AFB, Kan., in the late 1950s and early 1960s. **Contact:** Andy Meyer, 8516 Racine Trail, Austin, TX 78717-5305.

Seeking the whereabouts of **Walter Pine** and **Jack Messmore,** both of whom attended Communications School at Scott AFB, Ill., in 1951. **Contact:** Marion Lockleer, 13308 92d Ave. NE, Kirkland, WA 98033.

Seeking the whereabouts of **Maj. Gerald R. Johnston, MSgt. Calvin Floyd Williams,** and **MSgt. John Charles Bentrup,** who were in the 8th Fighter Squadron, 49th Fighter Group, which served in Japan and Korea between 1950 and 1951. **Contact:** Capt. Charles W. Vaughn, 5303 Josie Ave., Lakewood, CA 90713.

Seeking the whereabouts of **Sgt. Richard "Dick" Hasen,** who was in a photo recon squadron based in Kunzing, China, in June 1944. **Contact:** Arthur Fred Leibe, Jr., 2111 Metairie Heights Ave., Metairie, LA 70001.

Seeking information or the whereabouts of **Wally Fairance,** who was based in Warmwell, Dorset, England, during 1944–45 and knew Jeanetta Isabel "Jen" Bartlett. **Contact:** Sarah Lee-Snape, 29 Holme Close, Weymouth, Dorset DT3 5RW, England.

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

For a book, seeking the stories of **GI brides** who moved to the US between 1945 and 1946. **Contact:** Richard Collier, c/o Curtis Brown, Ltd., 10 Astor Pl., New York, N. Y. 10003.

Collector seeks donations of **military patches** and contact with other collectors. **Contact:** SSgt. Daniel J. Truhan, PSC 2, Box 15036, APO San Francisco, 96367-5000.

Seeking information concerning the firing order (1–28) on the **Pratt & Whitney Wasp Major Series engine. Contact:** Leo Kelleher, P. O. Box 403, Preemption, IL 61276.

Seeking the whereabouts of those who served with **Det. A, 1st Tactical Air Force** (Prov.), flying C-47s from Nancy, France, and Mannheim, Germany, from June to July 1944. **Contact:** Robert J. Hahlen, 2009 19th St., Monroe, WI 53566-3036.

Seeking whereabouts of members of **University of Arizona, Det. 20, AFROTC Class of 1985.** Also seeking **patches. Contact:** Capt. E. J. "Eddie" Adelman, PSC Box 2046, APO New York, 09238-5000.

Seeking information on a **T-39 Sabreliner,** tail number 24477, which was assigned to Ramstein AB, West Germany, in 1970. **Contact:** Paul Stevens, 14907 Parron Ave., Gardena, CA 90249.

Seeking information on which **Air Police units** were based at RAF Lakenheath and RAF Mildenhall, UK, between 1952 and 1954. **Contact:** Beryl Foreman, 59 Scotland Rd., Cambridge CB4 IQW, England.

Seeking the whereabouts of **Lt. Col. Charles E. Root,** USAF (Ret.), whose last known address eight years ago was in New York. **Contact:** Elmo I. Ellis, 6345 Aberdeen Dr. NE, Atlanta, GA 30328.

Seeking the whereabouts of **Sgt. James "Jim" Neblett,** who was stationed in Udorn, Thailand, in 1967 and was medically evacuated before the birth of his daughter, Rungnipa Thuaimuen, in April 1968. **Contact:** Joseph C. Jones, 1659 Brittain Ave., Deland, FL 32720.

Seeking the whereabouts of **Ron Brown,** who served in Thailand from approximately 1970 to December 1973. He was based at Takhli, Udorn Thani, and Ubon. **Contact:** Chris Mortimer, 1 The Croft, Pinner, Middlesex HA5 5EX, England.

Seeking information on the origins and evolutions of **wargaming** within the US Air Force, including analytical, operational, educational, and other applications. **Contact:** Matthew B. Caffrey, Jr., 2221 Semmes Dr., Montgomery, AL 36106.

Seeking the whereabouts of **Norman B. Ellis,** who was in Pilot Class 43-E, Terrell, Tex. His last known address was in the Washington, D. C., area, when he was flying for Allegheny Airlines. **Contact:** John H. Conder, 3213 15th St., Menominee, MI 49858.

Author seeks contact with members of the **332d Fighter Group** who flew the P-51 Mustang from Italy in the spring and summer of 1944. **Contact:** Michael O'Hagan, RAF (Ret.), 493 Lampson St., Victoria, BC V9A 5Z4, Canada.

Collector seeks to trade **USAF patches. Contact:** CMSgt. Bob Pfenninger, PSC Box 6457, APO San Francisco 96366.

Seeking a **Sperry S-1 Bombsight** for the Cradle of Aviation Museum. **Contact:** Robert J. Sitterly, 2258 Charing Cross Rd., Baldwin, NY 11510.

Seeking **USAF patches** for the Castle Air Museum patch collection. **Contact:** Frank Flynn, Castle Air Museum Foundation, Inc., P. O. Box 488, Atwater, CA 95301.

Seeking information on the whereabouts of members of the **96th Squadron,** 440th Troop Carrier Group, World War II. **Contact:** Capt. Harold B. Prince, USAF (Ret.), 1169 Oldfield Rd., Decatur, GA 30030.

Unit Reunions

AACS Alumni Assn
The Airways and Air Communications Service Association will hold a reunion October 4–7, 1990, in Reno, Nev. **Contact:** Ray Arnold, 7524 Bluestone, Reno, NV 89511. Phone: (702) 853-9537.

AAF/USAF Crash Rescue Boat Ass'n
AAF and USAF Crash Rescue Boat personnel will hold a reunion October 5–7, 1990. **Contact:** John E. Hagan, 6749 Sandwater Trail, Pinellas Park, FL 34665.

Air Commandos
The Air Commando Association will hold a reunion October 5–7, 1990, in Fort Walton Beach, Fla. **Contact:** Reunion Committee, Air Commando Association, Box 7, Mary Esther, FL 32569.

Berlin Airlift
A Berlin Airlift reunion will take place during September 1990 in Las Vegas, Nev. **Contact:** Mark Burton, P. O. Box 234, Wayne, PA 19087.

Brady Aviation School
Students and personnel who attended or served at Brady Aviation School, Tex., will hold a reunion October 12–14, 1990, at Curtis Field (Hangar 1) in Brady, Tex. **Contact:** Col. Alonzo W. Groves. USAF (Ret.), 900 S. Bridge St., Brady, TX 76825. Phone: (915) 597-0330.

Chosin Few
Veterans of the Battle of the Chosin Reservoir, North Korea (1950), will hold a reunion November 26–29, 1990, in Las Vegas, Nev. **Contact:** Jim McKee, P. O. Box 1917, Palm Desert, CA 92261.

CNS Division Tech School
Personnel and students who were affiliated with the Army Air Forces Central Technical Training Command, CNS Division Technical School, also known as the Tomah Radio School, during the 1940s will hold a reunion August 4, 1990, in Tomah, Wis. **Contact:** Laura Bishop, Veterans Affairs Medical Center, Tomah, WI 54660. Phone: (608) 372-1727.

Pueblo Army Air Base
Personnel who were stationed at the Pueblo Army Air Base, Colo., between 1942 and 1946 will hold a reunion September 14–16, 1990. **Contact:** William Feder, 31301 Aldred Rd., Pueblo, CO 81006. Phone: (719) 948-9219 (days).

SAW Battalions
Members of the 574th and 565th Signal Aircraft Warning Battalions (5th and 13th Air Forces) will hold a reunion July 20–23, 1990, in Moline, Ill. **Contact:** Angel M. Zaragoza, 1581 W. 9th St., San Bernardino, CA 92411.

Southern Airways School Alumni
Permanent party military personnel and former contractor employees of Southern Airways School, Bainbridge AFB, Ga. (1950s), will hold a reunion in Bainbridge, Ga., during the Labor Day weekend. **Contact:** Max E. Horn, 2114 High Rd., Tallahassee, FL 32303. Phone: (904) 385-4419.

Wild Weasels
The Wild Weasels will hold a twenty-fifth-year reunion September 7–9, 1990, at the Union Plaza Hotel in Las Vegas, Nev. **Contact:** Bill Hickey, P. O. Box 566, Shalimar, FL 32579. Phone: (904) 651-5620.

Women in the Air Force
Women in the Air Force will hold a reunion July 27–30, 1990, at Days Inn Motel in Tacoma, Wash. **Contact:** Lillian Phillips, P. O. Box 45453, Tacoma, WA 98445.

1st Strategic Air Depot
Members of the 1st Strategic Air Depot, stationed at Honington-Troston, England, between 1942 and 1946, will hold a reunion October 4–7, 1990, in Norfolk, Va. **Contact:** Earl A. Dosey, 7336 Mikesell Dr., Indianapolis, IN 46260.

3d Air Depot Group
The 3d Air Depot Group will hold a reunion September 21–23, 1990, in San Antonio, Tex. The group was stationed in Agra, India, during World War II. **Contact:** C. Keith Coffman, 221 Maplewood Estates, Scott Depot, WV 25560. Phone: (304) 757-6025.

5th Air Force
Veterans of the 5th Air Force will hold a reunion October 15–19, 1990, at the Riviera Hotel in Las Vegas, Nev. **Contacts:** Max Vinson, 3201 W. Oakey Blvd., Las Vegas, NV 89102. Phone: (702) 876-1590. Jules Teck, 1601 Cabana Dr., Lake Havasu City, AZ 86403-1033. Phone: (602) 855-1776.

7th Bomb Group
Members of the 7th Bomb Group (World War II) will hold a reunion October 3–6, 1990, in Tucson, Ariz. **Contact:** Harry L. Russell, 220 Placita Pera, Green Valley, AZ 85614. Phone: (602) 625-8184.

13th Bomb Squadron
Members of the 13th Bomb Squadron (Korea) will mark the fortieth anniversary of the beginning of the Korean War with a reunion October 3–7, 1990, in Tucson, Ariz. **Contact:** William F. Ricketts, Jr., 11650 E. Calle Aurora, Tucson, AZ 85748-8319. Phone: (602) 885-1438.

Seeking the whereabouts of the following members of **Pilot Class 50-E:** Tom M. Arnold, Robert L. "Bo" Hickman, Salvatore W. Kemp, and Thomas J. Macmillan. **Contact:** Glenn Mitchell, 1226 Gen. Geo. Patton Rd., Nashville, TN 37221.

Seeking contact with individuals who served in both the **Eighth and Fifteenth Air Forces** during World War II. **Contact:** Kenneth P. Werrell, Department of History, Radford University, Radford, VA 24142.

Seeking contact with members of **Pilot Class 47-C,** the "Guinea Pigs," who took advanced training at Barksdale AFB, La., or Williams AFB, Ariz. **Contact:** Maj. Bill Forrester, USAF (Ret.), 304 Lynch St., Edgefield, SC 29824.

Seeking contact with relatives and friends of the B-24 crew members of the **492d Bomb Group,** 857th Bomb Squadron, who were lost on October 9, 1944: Frank Cser, Presely E. Ferris, Joseph W. Zwinge, Frank A. Villelli, Clarence S. Watson, and Charles T. Lowblad. **Contact:** B. Blunt, 17 Marina Dr., Marple, Stockport SK6 6JF, England.

Seeking contact with American **Vietnam veterans who are living in Israel. Contact:** Eric Lee, Kibbutz Ein Dor, D. N. Yezreel 19335, Israel.

Seeking information, photos, etc. from aircrews and maintenance crews of **Cessna O-2 aircraft** in Vietnam, especially the 9th SOS, 14th SOW, 14th ACW, and 7th Air Force. **Contact:** Lt. Col. Don Nieser, AFRES, 6221 Commodore Lane, Oklahoma City, OK 73162.

Seeking the whereabouts of **Maj. Gen. Chester C. Cox, USAF,** whose last known duty was at SAC in Duluth, Minn. **Contact:** Don Hartley, 118 31st Ave., San Mateo, CA 94403.

For a book, seeking information on **"Mac the FAC," Maj. William W. McAllister, USAF,** who was killed in action April 22, 1965, while flying an L-19 out of Phu Cat. **Contact:** Mike Daciek, 22 Abernathy Ct., Highlands Ranch, CO 80126. *[Note: For more information on "Mac the FAC," see "Valor: One Man Show at Bong Son," November 1989 issue, p. 116.]*

Collector wishes to buy, sell, or trade **patches.** Also seeking current-issue USAF HGU-55P flight helmet. **Contact:** Curtis J. Lenz, 32 June St., Nashua, NH 03060-5345.

Seeking the **ATC wings and hat emblem** used by commercial pilots during World War II. Also seeking any other commercial pilot wings and hat emblems. **Contact:** Frank Waldorf, P. O. Box 25544, Tamarac, FL 33320.

18th Troop Carrier Squadron
The 18th Troop Carrier Squadron (World War II) will hold a reunion September 13–16, 1990, in St. Paul, Minn. **Contact:** Robert S. Walker, Jr., 286 E. Queens Dr., Williamsburg, VA 23185. Phone: (804) 229-5473.

21st/22d Troop Carrier Squadrons
The 21st and 22d Troop Carrier Squadrons (World War II) will hold a reunion June 13–15, 1990, in Colorado Springs, Colo. **Contact:** Floyd Smith, P. O. Box 1605, Eagle River, AK 99577. Phone: (907) 694-9414.

25th FIS
Fighter pilots of the 25th Fighter Interceptor Squadron, 51st Fighter Interceptor Group and Wing, will hold a reunion in mid-1990 at Nellis AFB, Nev. This unit served at Suwon AB, Korea, and at Naha AB, Okinawa, Japan, in 1954. **Contact:** Dr. Robert N. Cleaves, 1224 Roberto Lane, Los Angeles, CA 90077. Phone: (213) 472-2593.

27th Troop Carrier Squadron
The 27th Troop Carrier Squadron (World War II) will hold a reunion October 11–14, 1990, at the Hilton Hotel in Cocoa Beach, Fla. **Contact:** Lester J. "Rip" Van Winkle, 126 Riojas Dr., Kerrville, TX 78028. Phone: (512) 995-2558.

33d Air Depot Group
The 33d Air Depot Group will hold a reunion October 5–7, 1990, in Warner Robins, Ga. **Contacts:** Herbert L. Cooper, 643 Reynosa Ct., Berea, OH 44017. Phone: (216) 234-9007. Robert W. Gocholl, 10280 Pendery Dr., Cincinnati, OH 45242. Phone: (513) 891-7742.

36th Fighter Group
Members of the 36th Fighter Group will hold a reunion October 11–14, 1990, in Albuquerque, N. M. **Contact:** John Lightwine, P. O. Box 1103, Corrales, NM 87048. Phone: (505) 898-5023.

Class 42-B
Members of Class 42-B will hold a reunion and memorial dedication June 21–24, 1990, at Wright-Patterson AFB, Ohio. **Contacts:** R. E. "Roger" Monroe, 19056 Singing Wood Circle, Trabuco Canyon, CA 92679. Phone: (714) 589-0200. Ed Radtke, 214 Marinda, Fairfax, CA 94930. Phone: (415) 454-4978.

71st Tactical Recon Group
Members of the 71st Tactical Reconnaissance Group, including the 17th Reconnaissance Squadron, the 82d and 110th Tactical Reconnaissance Squadrons, and the 25th Liaison Squadron, will hold a reunion October 18–21, 1990, in Houston, Tex. **Contact:** Jap C. Lott, 6302 Gulf Freeway, Houston, TX 77023. Phone: (713) 641-1351.

79th Airdrome Squadron
The 79th Airdrome Squadron, 5th Air Force (World War II), will hold a reunion June 14–16, 1990, at the Ramada Inn Hotel in Pittsburgh, Pa. **Contact:** Fred Hitchcock, 29 Blueberry Hill Lane, Sudbury, MA 01776. Phone: (508) 443-6679.

90th Bomb Group
Members of the 90th Bomb Group "Jolly Rogers" will hold a reunion October 3–6, 1990, at the Holiday Inn North in Indianapolis, Ind. **Contact:** Paul L. White, 6055 Manning Rd., Indianapolis, IN 46208. Phone: (317) 299-2237.

98th Bomb Group
Members of the 98th Bomb Group (B-24 person-

Unit Reunions

nel) are planning to hold a reunion August 1, 1990, in Pueblo, Colo. **Contact:** International B-24 Memorial Museum, 31301 Aldred Rd., Pueblo, CO 81006. Phone: (719) 948-9219 (days) or (719) 948-4032 (evenings).

Readers wishing to submit reunion notices to "Unit Reunions" should mail their notices well in advance of the event to "Unit Reunions," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA. 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

111th Tactical Recon Squadron
The 111th Tactical Reconnaissance Squadron (World War II) will hold a reunion October 17–21, 1990, at the Hampton Inn in Dallas, Tex. **Contact:** Garland "Dee" Hendricks, 7201 Claybrook Dr., Dallas, TX 75231. Phone: (214) 348-2779.

306th Bomb Wing
Vietnam veterans of the 306th Bomb Wing (McCoy AFB, Fla.) will hold a travel get-together October 26–November 8, 1990. The trip will include Thailand (U-Tapao AB) and Hong Kong. **Contact:** Lt. Col. Joseph J. W. Demes, USAF (Ret.), 1585 Mercury St., Merritt Island, FL 32953. Phone: (407) 452-4417.

310th Bomb Wing
Members of the 310th Bomb Wing will hold a reunion September 20–22, 1990, at the Bourbon Orleans Hotel in New Orleans, La. **Contact:** J. B. Cobb, 166 W. Oakridge Park, Metairie, LA 70005. Phone: (504) 835-2690 (days) or (504) 834-7034 (evenings).

339th Fighter Group
The 339th Fighter Group, 8th Air Force (World War II), will hold a reunion November 7–11, 1990, in Orlando, Fla. **Contact:** Chet Malarz, 2405 Kings Point Dr., Atlanta, GA 30338.

368th Fighter Group
The 368th Fighter Group (all personnel) will hold a reunion October 7–9, 1990, in Newport, R. I. **Contact:** George Sutcliffe, P. O. Box 580, Greenville, RI 02828. Phone: (401) 949-3500 or (401) 949-4027.

386th Bomb Group
The 386th Bomb Group will hold a reunion October 4–11, 1990, in London, Cambridge, and Dunmow, England. **Contact:** Barnett B. "Skip" Young, 5658 Eichen Circle, Fort Myers, FL 33919. Phone: (813) 482-5059.

405th Fighter-Bomber Group
Members of the 405th Fighter-Bomber Group (Langley AFB, Va.) who served between 1952 and 1958 will hold a reunion September 27–30, 1990, at the Sheraton Inn in Hampton, Va. **Contact:** Roger Warren, 7550 Palmer Rd., Reynoldsburg, OH 43068. Phone: (614) 866-7756.

409th Bomb Group
The 409th Bomb Group will hold a reunion November 15–17, 1990, in Charleston, S. C. **Contact:** Hasell Barton, 14 Queen St., Charleston, SC 29401. Phone: (803) 577-3596.

410th Bomb Group
Members of the 410th Bomb Group (World War II) will hold a reunion October 6–8, 1990, in Myrtle Beach, S. C. **Contact:** Mike Pezza, 17 Rowley St., East Providence, RI 02914.

436th Fighter Squadron
Members of the 436th Fighter Squadron, 479th Fighter Group, 8th Air Force (World War II), will hold a reunion October 10–14, 1990, in New Orleans, La. **Contact:** James E. Frolking, 18675 Parkland Dr., Cleveland, OH 44122. Phone: (216) 752-1829.

450th Bomb Group
The 450th Bomb Group "Cottontails" will hold a reunion September 13–16, 1990, in Orlando, Fla. **Contact:** Robert H. Gernand, 1054 San Remo Rd., St. Augustine, FL 32086. Phone: (904) 797-7348.

455th Bomb Squadron
Members of the 455th Bomb Squadron, 323d Bomb Group "Whitetailed Marauders," 9th Air Force (World War II), will hold a reunion September 24–27, 1990, in Mount Pocono, Pa. **Contact:** Erhard Reich, 347 Matthew St., Bristol, CT 06010. Phone: (203) 583-2449.

463d Bomb Group
The 463d Bomb Group, 5th Bomb Wing, 15th Air Force, will hold a reunion November 6–11, 1990, in Colorado Springs, Colo. **Contact:** Michael Geller, 7246 S. Birch St., Littleton, CO 80122.

467th Bomb Group
The 467th Bomb Group and ancillary and associate units will hold a reunion October 4–7, 1990, at the Red Lion Hotel in Omaha, Neb. **Contact:** Floyd J. Pugh, 2004 S. Kentucky, Sedalia, MO 65301. Phone: (816) 827-2261.

491st Bomb Group
Members of the 491st Bomb Group will hold a reunion October 17–20, 1990, in Dayton, Ohio. **Contact:** F. C. "Hap" Chandler, P. O. Box 88148, Dunwoody, GA 30356-8148. Phone: (404) 394-3056.

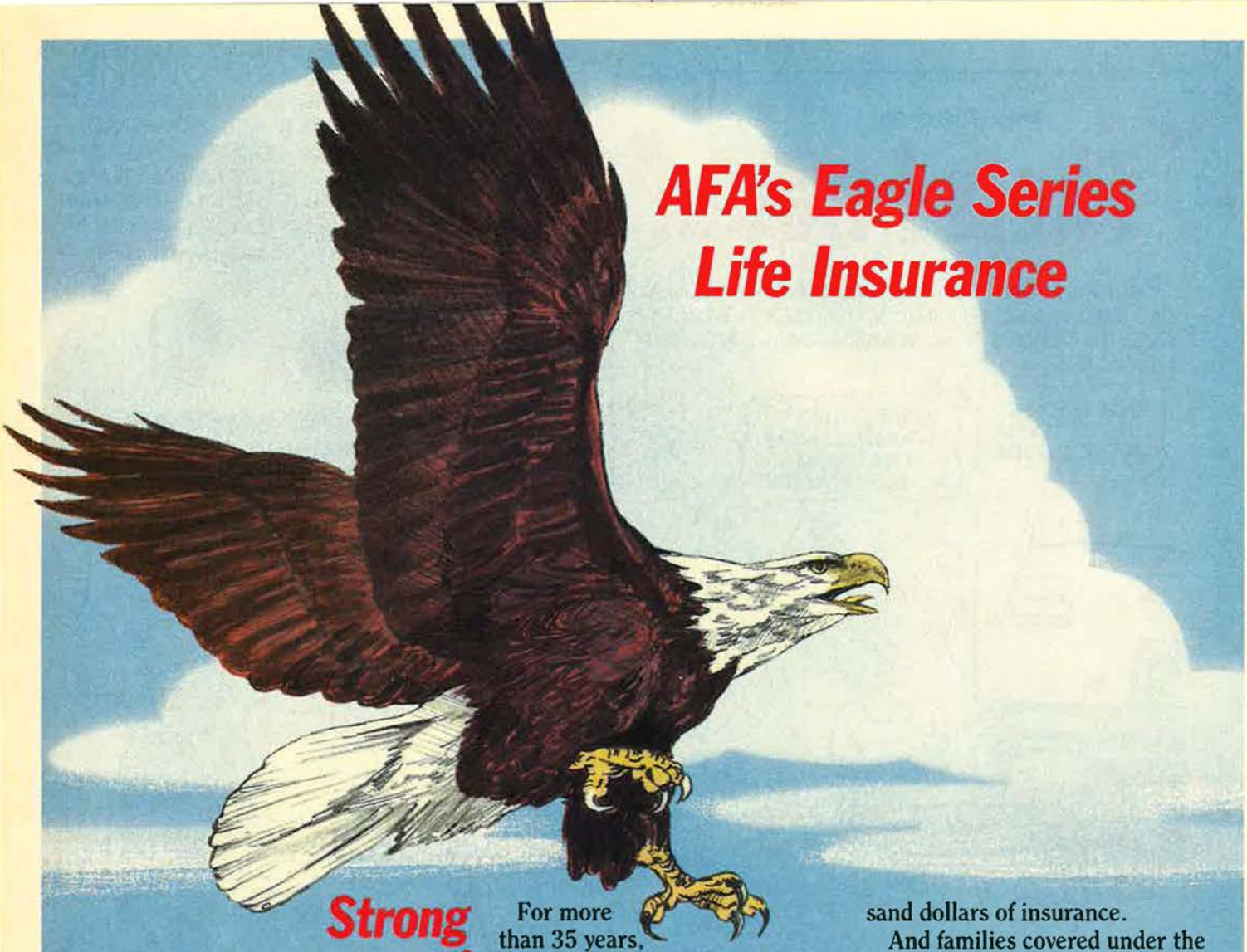
504th Bomb Group
Members of the 504th Bomb Group, 313th Bomb Wing, 20th Air Force (World War II), will hold a reunion September 5–9, 1990, in Portsmouth, N. H. **Contact:** Art Tomes, 2409 Oakwood Dr., Burnsville, MN 55337. Phone: (612) 435-5406.

868th Bomb Squadron
The 868th Bomb Squadron "Snoopers" will hold a reunion October 25–27, 1990, at the Antlers Hotel in Colorado Springs, Colo. **Contact:** Leon Smith, 532 Dentro Dr., Santa Barbara, CA 93111. Phone: (805) 964-2652.

40th Bomb Wing
I would like to hear from veterans who served in the 40th Bomb Wing, which included the 25th, 44th, and 45th Bomb Squadrons, the 40th Air Rescue Squadron, and support units, who would be interested in holding a reunion in 1991 or 1992. These units served at Smokey Hill, Schilling, and Forbes AFBs, Kan. **Contact:** Morris C. Garrison, Jr., P. O. Box 311, Caldwell, TX 77836. Phone: (409) 567-3976.

Class 56-D
For the purpose of organizing a thirty-fifth anniversary reunion, I would like to hear from members of Class 56-D. **Contact:** Raymond M. Leonard, Jr., 1904 Bay Blvd., Atlantic Beach, NY 11509. (516) 239-4195.

437th Organizational Maintenance Squadron
For the purpose of organizing a reunion, I am trying to contact former members, both enlisted and officers, of the 437th Organizational Maintenance Squadron, 437th MAW, who served between 1967 and 1971 at Charleston AFB, S. C. **Contact:** Bill D. Jones, 1605 Harrod Lane, Greensboro, NC 27410.



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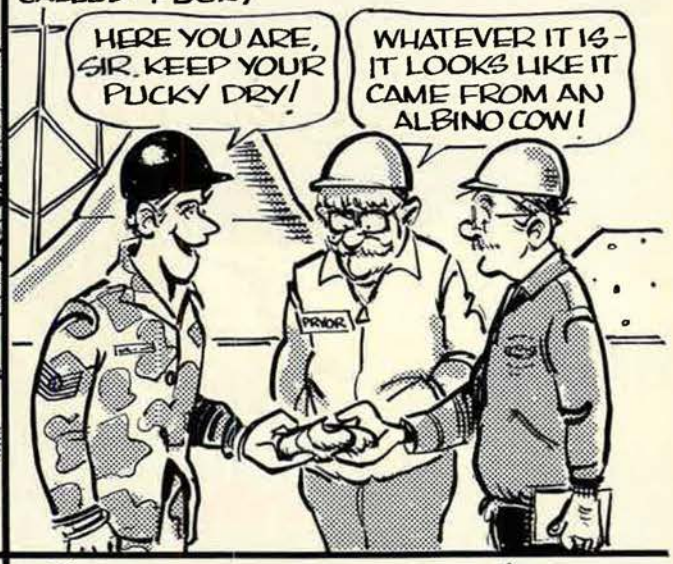

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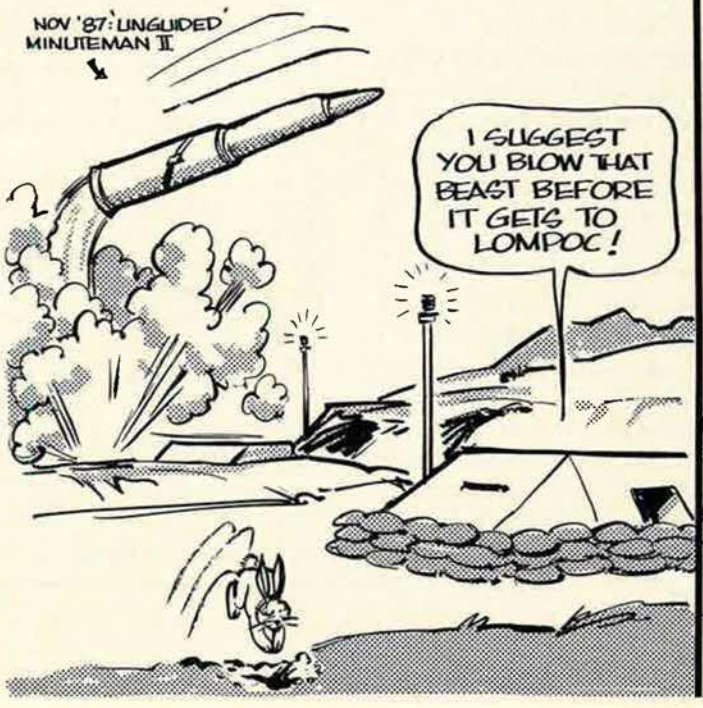

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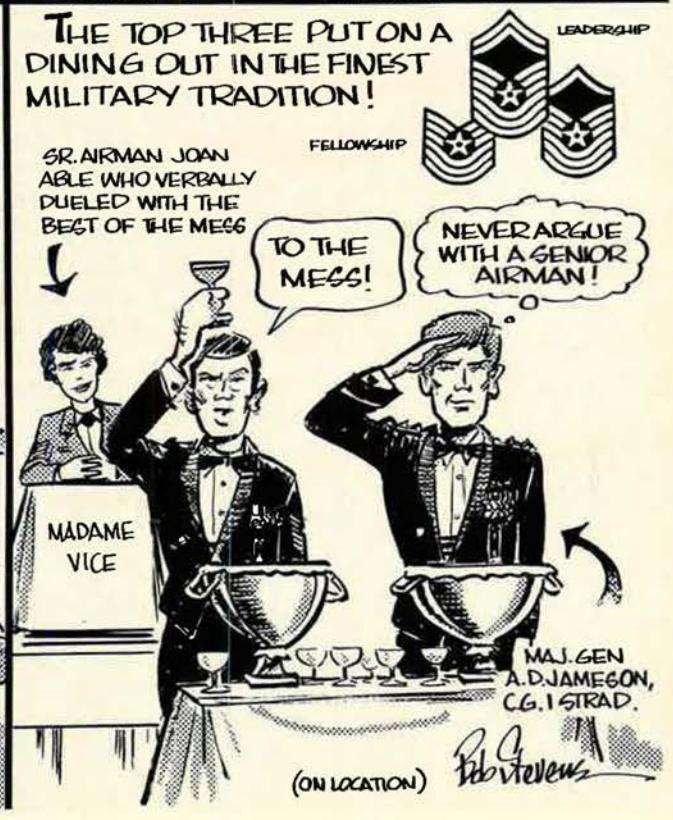

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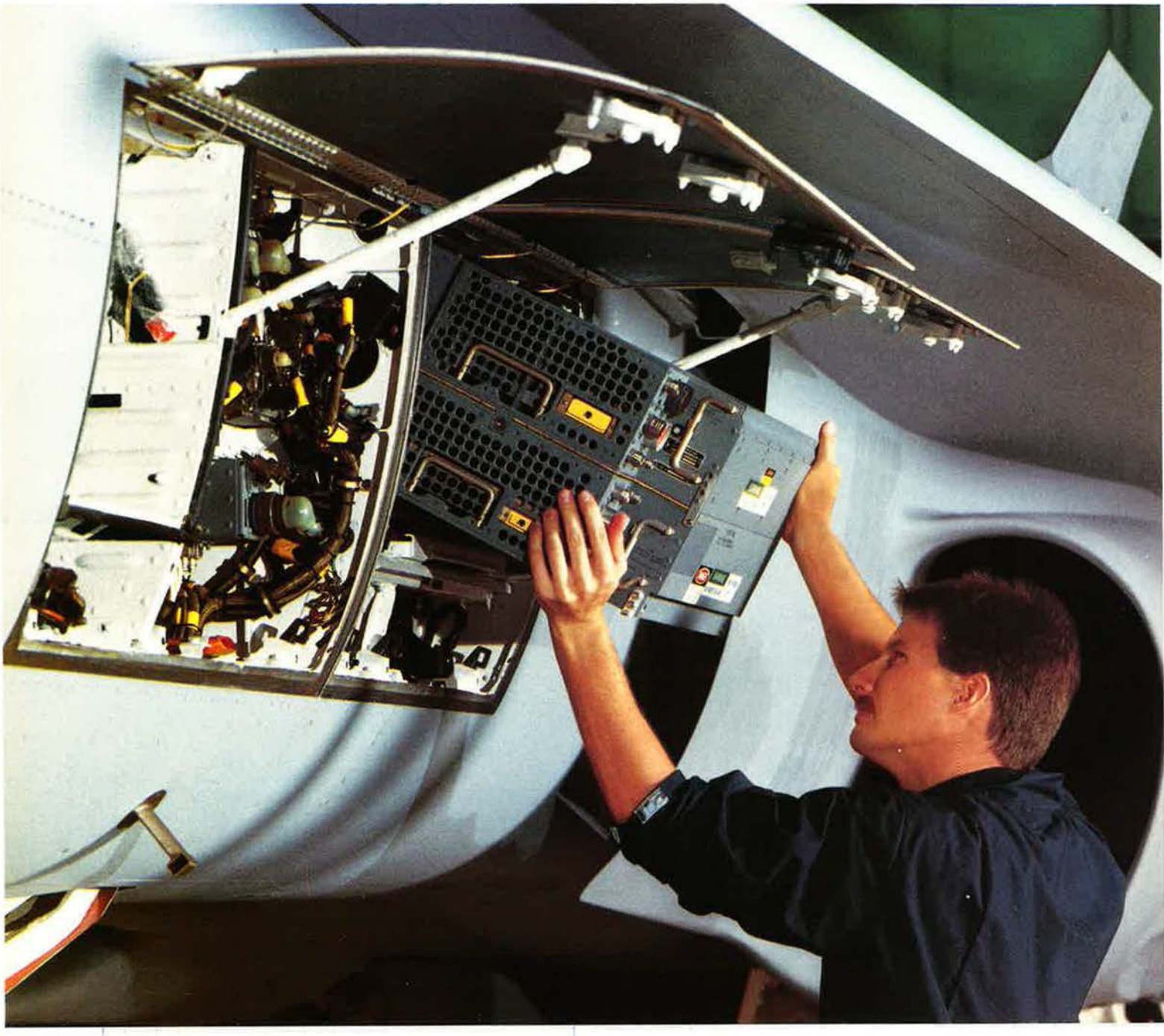
When the fight's on, and a pilot finds himself in a high threat environment, the AN/ALQ-126B can mean the difference for survival. This Lockheed Sanders electronic countermeasures system is a combat-tested veteran, now protecting U.S. and allied fighter and attack aircraft.

Sanders is the world's largest producer of on-board ECM systems. The 126B is battle-proven and in serial production, with more than 1,000 units delivered to the U.S. Navy, Marines and a number of allied air forces.

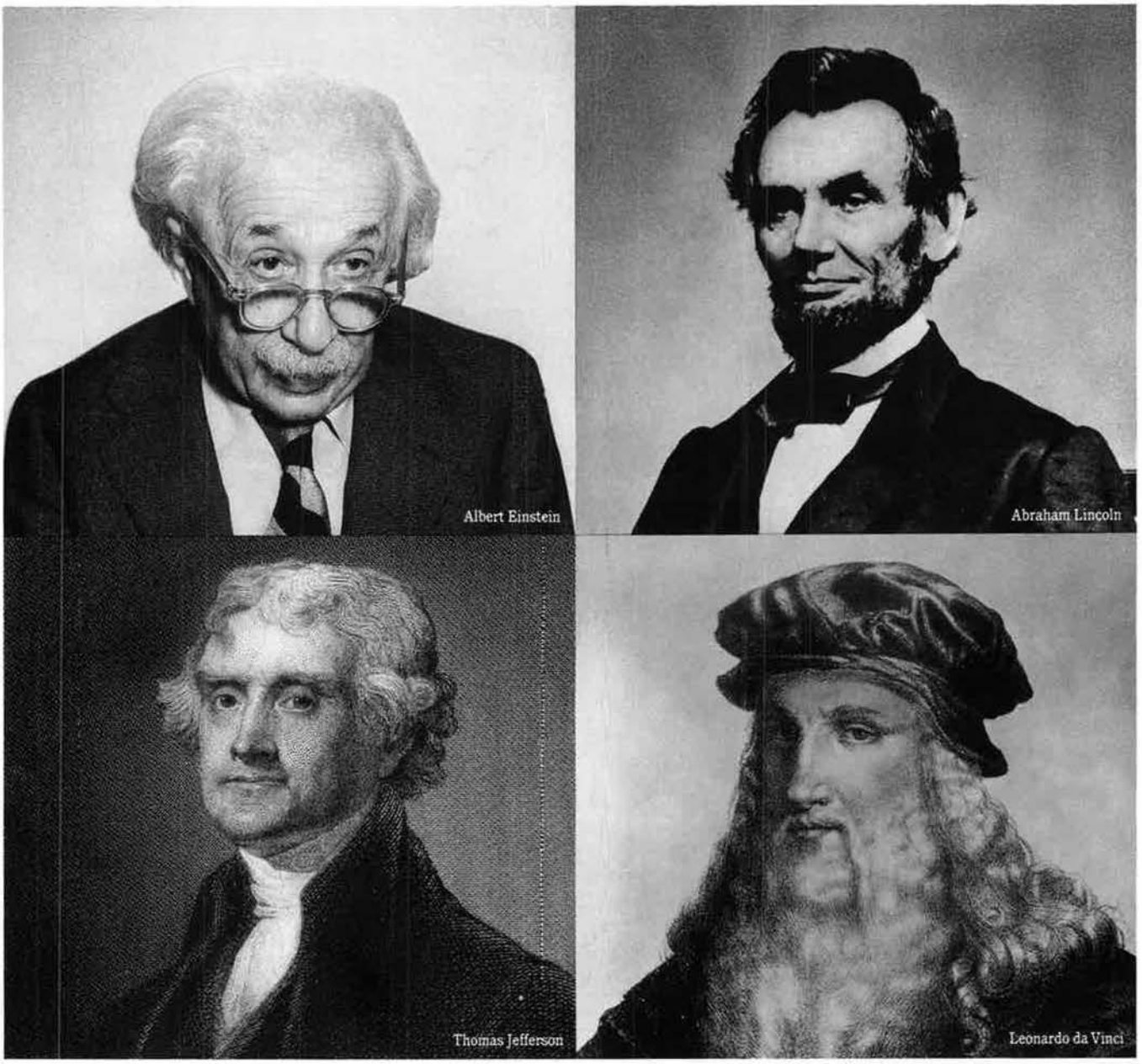
Combined with either the AN/ALQ-162 or an off-board decoy system, the 126B assures a full range of protection from radar-guided threats. The system is fully integrated and deployed aboard all Navy tactical aircraft, including the latest F/A-18s. And, the 126B is compatible with current Air Force fighters, including the F-16. The technology is modern and an extensive logistics infrastructure is in place. Performance, reliability, and maintainability all meet or exceed design parameters. Above all, the 126B is affordable.

Sanders is currently integrating advanced gallium-arsenide circuitry into the 126B so it will outpace the evolving threat, making sure tactical aircraft can meet the challenge—present and future.

Lockheed Sanders



Great minds don't think alike.



McDonnell Douglas Electronic Systems Company. Where great minds integrate.

Great minds don't think alike, but they do have common characteristics. They're creative. They're motivated by problems that confound others. And they pursue their solutions with imagination. At McDonnell Douglas Electronic Systems Company (MDESC), people with great minds work together. The result: an integrated group of thinkers dedicated to solving the toughest problems you present. Our people not only bring their own knowledge and experience in electronics, but they also call on tremendous expertise from their teammates in space, aviation and missiles.

Integrating great minds and great products is not new to us. We've been doing it as part of the McDonnell Douglas Company for more than 40 years. What is new is the MDESC name. With it comes a new focus on today's changing electronics needs. By putting our best minds to work with your best minds, we're developing innovative electronic systems solutions of the highest quality and at the fairest price. Contact us at: McDonnell Douglas Electronic Systems Company, 8201 Greensboro Drive, Suite 500, McLean, VA 22102; 703-883-3900.

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