MARCH 1995/$3

AIR FORCE MAGAZINE

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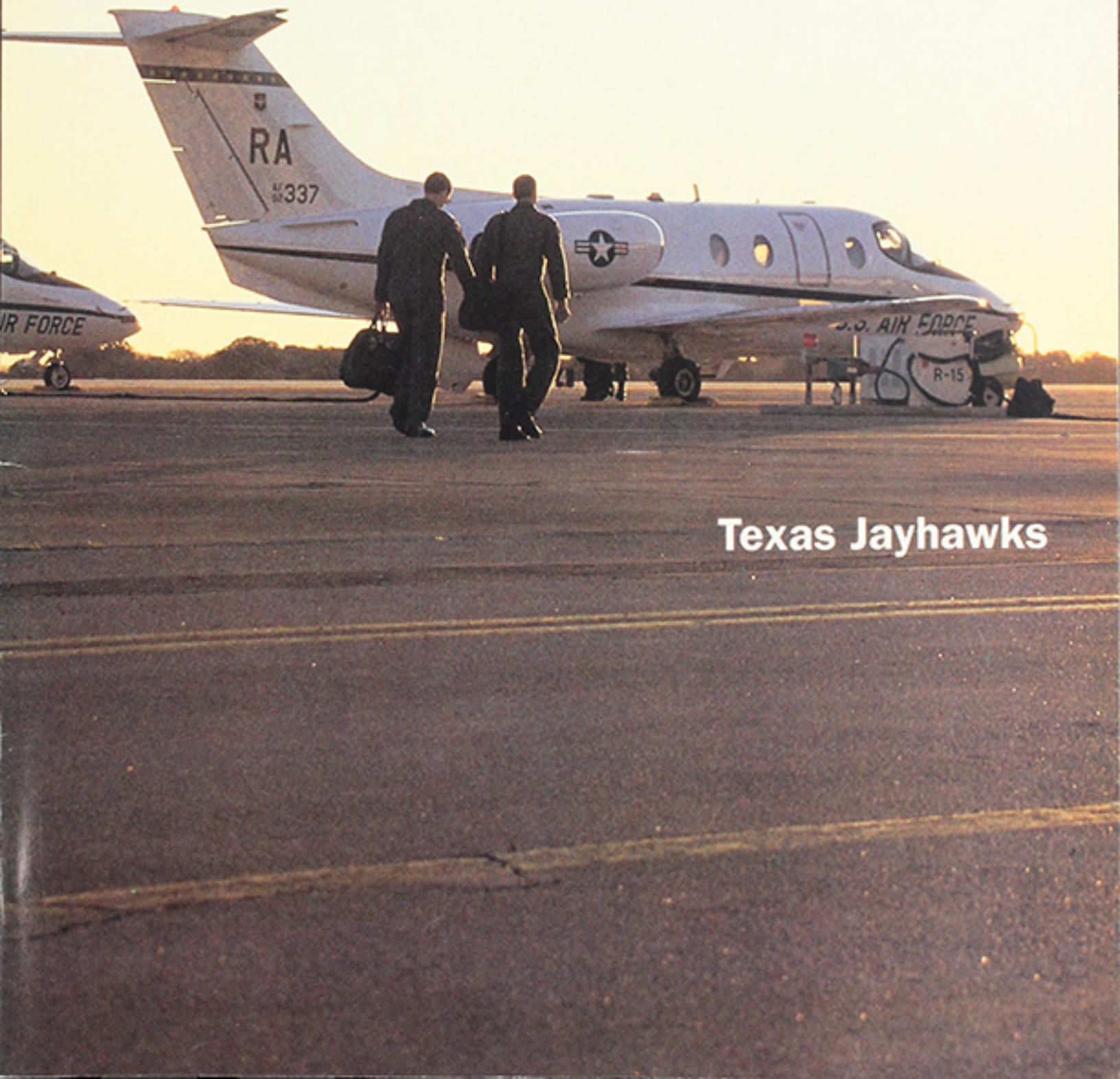

Texas Jayhawks

Walt Bylciw, Vice President, F119 Programs, Pratt & Whitney

"Basically, This Is What Is Meant By Good Ol' American Know How."

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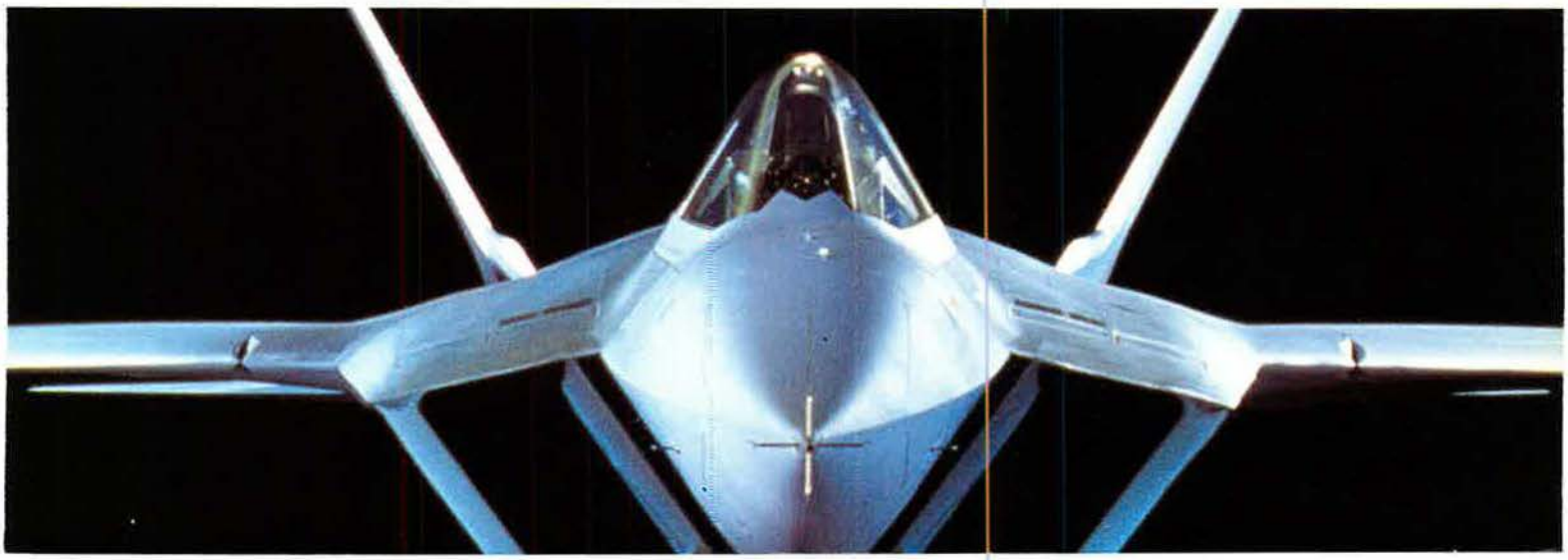

March 1995, Vol. 78, No. 3

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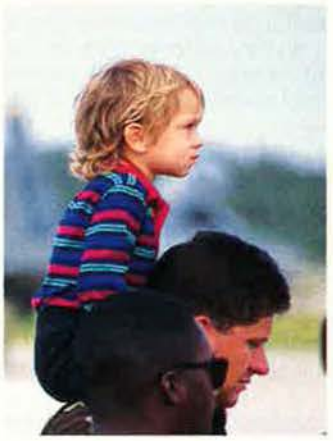
About the cover: Instructors and students at the 99th Flying Training Squadron, Randolph AFB, Tex., head for the T-1A Jayhawk classroom. See "Texas Jayhawks," p. 42. Photo by Paul Kennedy.



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Editorial

By John T. Correll, Editor in Chief

A Message From Seven Secretaries

On March 18, 1945, the US Eighth Air Force put up 1,250 bombers for a concentrated strike on Berlin. By today's standards, that number seems incredible. During the war years, however, the United States produced 34,400 heavy bombers and 55,500 medium bombers. The big mission against Berlin was an impressive effort but well within the limits of the aircraft inventory.

It was a different time. Bombers were not as capable (or as expensive) as they have since become. The average accuracy in "daylight precision bombing" in World War II was 3,300 feet, or more than half a mile. Modern bombers can penetrate unseen and strike within a few feet of the target, but as their precision has improved, costs have risen and numbers have shrunk.

The day is coming soon when the Air Force's total fleet of operational bombers will be no more than 100 aircraft. In primary aircraft authorized, or aircraft available for combat, that would conceivably shake out to sixteen B-2s, forty B-1s, and forty B-52s. Only the B-2s will have the attribute of stealth, and the numbers do not leave much margin for mishap or the unexpected.

This plan is driven by cost considerations, not by calculations of actual military needs. One requirements study after another has pointed to the need for a more substantial bomber force. The Air Force's Bomber Roadmap project in 1992 and the Pentagon's Bottom-Up Review in 1993, for example, prescribed 184 operational bombers. The Senate Armed Services Committee similarly found the projected 100-bomber force to be "inadequate" for responding—as prescribed by the national defense strategy—to two near-simultaneous regional conflicts.

Alternatively, there is a persuasive body of data saying that a small bomber fleet is sufficient only if it includes more stealthy B-2s. That suggestion gained a definite boost on January 4, when seven former Secretaries of Defense wrote to the President asking him to consider the purchase of more B-2s. Signing the letter were Melvin Laird, James Schlesinger, Donald Rumsfeld, Harold Brown, Caspar Weinberger, Frank Carlucci, and Dick Cheney.

The B-2, the former Secretaries wrote, "remains the most cost-effective means of rapidly projecting force over great distances. Its range will enable it to reach any point on Earth within hours after launch while being deployed at only three secure bases around the world. Its payload and array of munitions will permit it to destroy numerous time-sensitive targets in a single sortie. And perhaps most importantly, its low-observable characteristics will allow it to reach intended targets without fear of interception."

The President gets some timely advice about the value of the long-range bomber force.

The B-2 program as originally planned would have purchased 132 aircraft. The total was cut to seventy-five for budget reasons, then cut again to twenty. Any perceived attempt to lift that cap on the program met with thunder and lightning from B-2 foes in Congress. In 1993, Rep. Ronald V. Dellums (D-Calif.), chairman of the House Armed Services Committee, accused Gen. John M. Loh, commander of Air Combat Command, of conspiring to extend B-2 production, a move that the powerful Mr. Dellums opposed emphatically and blocked in dramatic fashion.

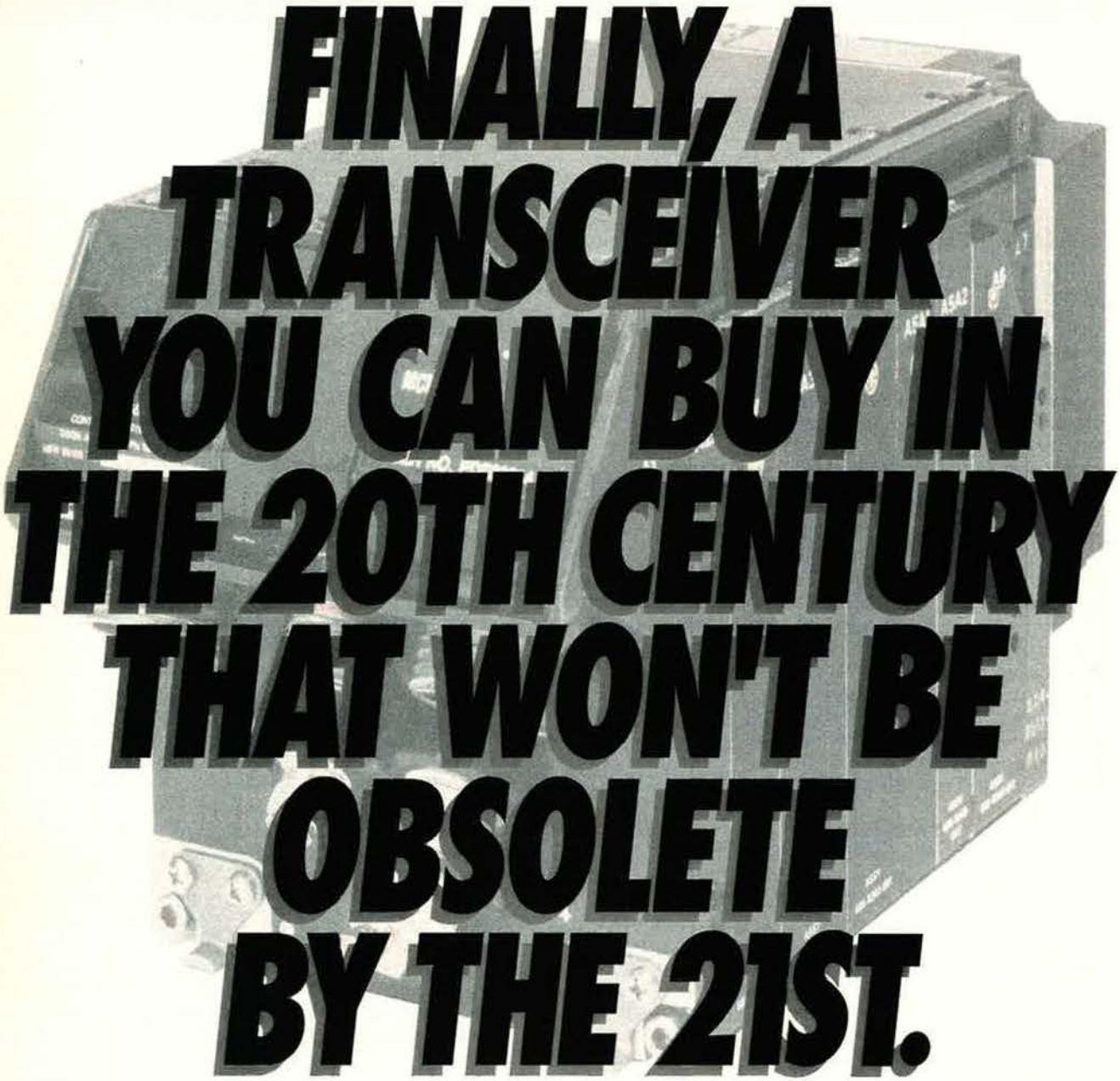
This year, the committee has a new name, a new chairman, and a new attitude. It's the House National Security Committee now, and its chairman, Rep. Floyd D. Spence (R-S. C.), says that stopping the B-2 program at twenty aircraft "was a political decision and does not make a lot of sense from a strategic or operational perspective." The issue is open again, but it is as controversial as ever.

There is little if any precedent for the extraordinary statement by the seven former Secretaries of Defense, and it must have been a bitter pill for the Navy. A major point of contention in the current roles and missions debate is how the global power projection job should be divided between long-range Air Force aircraft and Navy carriers. As the statement recognized, the B-2's stealth features allow it to fly through formidable modern air defenses to strike strategically critical targets. During the Persian Gulf War, flights over downtown Baghdad were left to the stealthy F-117A and to unmanned cruise missiles. Air defenses will not get any easier in the years ahead, and none of the aircraft flying off the Navy's carriers is going to be stealthy for some time to come.

Cost comparisons were inevitable as well. According to figures repeated in the press, the nation could buy twenty more B-2s for less money (about $12 billion) than three large-deck aircraft carriers would cost ($15 billion). That ratio would be expected to widen further if operations and support costs were counted.

A question that needs asking, though, is whether it is truly necessary to raid one part of the emaciated national security program to cover legitimate military needs in another part. The share of gross domestic product that will be devoted to national security is already dropping toward 2.9 percent. There is a rising awareness that the defense program is underfunded.

As the readjustment proceeds, the advice of seven former Secretaries of Defense merits attention. "It is already apparent that the end of the Cold War was neither the end of history nor the end of danger," they wrote. "We hope it also will not be the end of the B-2." ■



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Letters

An Absurd Premise

The Air Force must reject the absurd premise that it is prepared to fight two simultaneous "cold start" major regional conflicts (MRCs) similar in magnitude to the Persian Gulf War *["Bomber Forces for 'Cold Start' Conflict," December 1994, p. 30].* This formally adopted Department of Defense planning scenario is both misguided and harmful.

Let's be realistic about what the Air Force will face. The Gulf War was possible because of the unique alignment of many factors (*e.g.*, favorable terrain, clear aggressor, political feasibility, major US economic interests at stake, nearly unanimous international support). It will probably be decades before all of these factors line up in the same fashion again. The chances of *two* conflicts similar to Operation Desert Storm occurring simultaneously, without warning—well, the odds of winning the lottery are better.

Unfortunately, it is damaging to focus one's efforts on the most remote of possibilities. For one, Air Force priorities are distorted when we labor under the two-MRC scenario. This premise encourages the Air Force to spend its resources on large-scale acquisition projects. These resources would be better used for training, operations, and personnel to maintain a more effective, albeit smaller, fighting force.

Second and more important, the two-MRC scenario distorts our national priorities. While the defense industry would certainly favor spending to prepare for the two-MRC scenario, this does not promote our national interest. Given our slipping education system, our stifling societal violence, and the national debt, America's prosperity and freedom are not served by pandering to the two-MRC scenario.

The world remains dangerous and uncertain. While we should consider and study worst-case scenarios, we cannot shape our force-structure planning based on such extremely remote possibilities as the two-MRC scenario. This planning scenario hurts Air Force planning and works to misdirect America's resources from the truly dire threats to our national security.

Maj. Charles A. Ringo,
AFRES
Portland, Ore.

Relative Vulnerability

"Bomber Forces for 'Cold Start' Conflict" purports to make a case for buying more B-2s based on the assertion that the B-2 is invulnerable and that the B-52 and B-1 must use expensive standoff munitions. Nowhere does author Maj. Gen. Jasper Welch, USAF (Ret.), discuss the vulnerability of the B-2 to SAMs or interceptors relative to the vulnerability of the B-52 or B-1. This argument must be made, or there is no case.

General Welch does discuss several prescriptions that are extremely important to future contingencies: build bases, stock them with consumables, exert every effort to obtain good intelligence for accurate targeting on any potential enemy, and have those off-board sensors in place when the bombers arrive.

Modification costs are low relative to buying more B-2s. The key question: Which bomber do you depend on until 2020 when the additional B-2s will be available? Mothballing B-52s and B-1s is betting the farm on a single characteristic: stealth.

If stealth were so essential, we would not buy any F/A-18E/Fs, retire the F-15E and the F-16, and rush pell-mell into buying a new stealth aircraft. Obviously, this is ridiculous, and so is threatening the bomber force in the same manner.

Lt. Gen. James E. Light, Jr.,
USAF (Ret.)
Rockwell International
El Segundo, Calif.

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 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

In Eurofighter's Defense

We Brits have lived all our lives trying to produce good airplanes and contribute to our own defense, while being sniped at by a powerful and far more affluent lot of friends across the Atlantic. We are used to it. You want the world to buy American airplanes (nothing wrong in that) and just hate it on those rare occasions when someone in Europe offers competition.

What has triggered this outburst is "The Luftwaffe Spreads its Wings" *[January 1995, p. 62].* Author Maj. Brian Collins may think he is helping the US industry by rubbishing the Eurofighter, but in fact he is merely misleading his readers.

Does he think the combined staffs of four major air forces, in a decade of study, would overlook the need to consider global scenarios? The RAF hasn't forgotten the Falklands campaign, and I seem to recall that RAF aircraft were involved over Iraq. On the matter of range and loiter time, he says, "The Eurofighter does not measure up." Knowing that the aircraft has a range of 2,000 nautical miles without using its air refueling capability, I think this is a strange assessment.

As for "an existing fighter with proven performance might be a better buy," most fighter pilots would say that in air warfare there's not much point in coming in a good second. After implying that Eurofighter is being continued only to keep German factories in work, Major Collins ends with the belief that "system price per aircraft" will be "$70 million to $100 million." Nobody can discuss costs with precision, but the official view is that the Eurofighter will fly rings around every other warplane it might meet except the F-22, which at twice the cost will perform slightly better, though with less versatility. . . .

Bill Gunston
Haslemere, England

SOMETIMES IT TAKES A COMPETITION TO PROVE YOU HAVE NO COMPETITION.

Once again, the multirole F-16 did what it does best - dominate the competition. This time, it was William Tell, the definitive USAF air superiority competition. The F-16 teams captured every major event - Overall, Operations, GCI, Maintenance, and Loading.

WILLIAM TELL '94 FINAL RESULTS					
PLACE	OVERALL	GCI	MAINTENANCE	LOADING	OPERATIONS
1st	**F-16**	**F-16**	**F-16**	**F-16**	**F-16**
2nd	CF-18	**F-16**	**F-16**	**F-16**	CF-18
3rd	**F-16**	CF-18	F-15	F-15	F-15
4th	F-15	F-15	F-15	F-15	**F-16**
5th	F-15	F-15	F-15	CF-18	F-15
6th	F-15	F-15	CF-18	F-15	F-15
7th	F-15	F-15	F-15	F-15	F-15
8th	F-15	F-15	F-15	F-15	F-15

Demonstrating its multirole talent, the F-16 also consistently dominates Gunsmoke, the premier worldwide air-to-ground competition, sweeping all events. The F-16 is the only aircraft ever to win both weapons competitions.

The F-16 is also undefeated where it counts most - in the real world. It has a 69-0 record in aerial combat and the world's only three combat AMRAAM kills. With this capability and a $20 million price tag, what's left to tell?

Lockheed

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Letters

A Truly Bad Program

Mike Miller's concern about two-level maintenance in Europe is justified *["A Recipe for Disaster," October 1994 "Letters," p. 6]*. Not since the height of the Cold War has so much disinformation been put forth in an attempt to sell a truly bad program.

The two-level maintenance idea originated at the RAND Corp. in the early 1980s. Two-level maintenance was then pushed strongly by Donald Rice (former RAND executive) when he became Secretary of the Air Force. It was sold under the pretense of saving huge amounts of money by eliminating unit-level maintainers in the avionics and propulsion career fields.

Senior Air Force officials were also told to expect savings from the return of unit test equipment, stands, and other equipment because the work would all be centralized at a major depot. Another argument often used by advocates of two-level maintenance was the reduction in the mobility footprint of deploying forces to an overseas war zone.

The truth is that the move toward two-level maintenance hasn't saved a dime. The anticipated savings conjured up twelve years ago have been offset by expensive packaging and handling, high transportation costs via priority air (*e.g.*, Federal Express), and outlandish surcharges tacked onto aircraft components repaired at the depots. This has made the two-level maintenance program considerably more expensive than the tried-and-true three-level system.

From personal studies and input from other unit sources, I have found that two-level is costing approximately $1 million to $3 million more per base than unit repairing, even after counting the wages and facilities of the GIs who had been doing the work. Concerning cargo footprint, exchanging three C-141 loads of automated test equipment for 300 resupply flights in a "desert express" role doesn't make a lot of sense. . . .

Even after three years of "testing" the two-level concept (on new F-16s), the parts-flow times were still twice what it took to repair and return a typical part at the wing level. Even with constant oversight and intervention by zealous project officers, flow times were eight days Stateside, ten days for European bases, and more than fifteen days for Pacific Air Forces. This is hardly a force-multiplier. This program has resulted in fewer parts in supply kits and on the shelves to support our aircraft. . . .

I find it interesting that people like Mr. Miller, young troops in our field units, and some old pros at the depots ask, "Why are we doing two-level maintenance?" Meanwhile some of our senior leaders cannot see the dangerous fallacy of two-level maintenance. In today's quality-conscious culture aren't we suppose to be listening to the customers? . . .

Col. Richard D. Zwieg,
USAF
Tucson, Ariz.

Remember the Tankers

"Airlift at High Tempo" *[January 1995, p. 56]* certainly highlights the critical nature of airlift, given our new national strategy of CONUS-based forces with the capacity to reach out and make global impact. Yet it fails to mention the other essential partner in and member of the air mobility mission—tankers. The issue is not that author James Kitfield simply forgot to write about tankers in AMC. Rather, it appears that he misunderstands the air mobility concept.

No one doubts that Tanker Airlift Control Elements and airlifters work hard. Everyone in AMC does. However, when one speaks of airlift, one must also speak of tankers. The AMC team works hard to produce and provide the two key components of air mobility—airlift and air refueling. What Mr. Kitfield says about our airlifters is true—they are overworked, underpaid, and in dire need of a new aircraft, and they do a super job with what they have. What he fails to mention is that they often do not do the job alone.

Tankers allow AMC to get the goods to the customer faster than any other organic military capability available. Airlifters and tankers, working in conjunction with one another, allowed the immediate and direct delivery of tanks and armored personnel carriers to our US troops in Somalia after the ambush in Mogadishu (missions were flown directly from the East Coast to Somalia by C-5s with three separate air refuelings). While tankers are obviously not needed for every airlift mission, they allow AMC to accelerate the delivery of cargo and personnel when necessary.

Although air refueling airlifters in action is important, one should also note that tankers are capable of performing either one of AMC's missions—airlift or air refueling. In fact, AMC regularly employs (schedules and runs) tankers (KC-10s and KC-135s) on a variety of airlift missions, including the Pacific Express (AMC's

overnight service to the Pacific) and various European and southwest Asia resupply missions. The point is, tankers are also airlifters.

In summary, when one speaks of AMC "Airlift at High Tempo," one must speak of an AMC team comprising both airlifters and tankers and all those who support them. . . .

Maj. Scott E. Wuesthoff, USAF
O'Fallon, Ill.

■ AIR FORCE *Magazine gives the tanker force extensive coverage in the context of its air mobility mission. "Tankers at the Rendezvous"* [June 1993, p. 54] *dealt exclusively with tankers.*—THE EDITORS

The *Enola Gay* Fiasco

I join with the many others who have written to express outrage at the *Enola Gay* fiasco at the Smithsonian Institution and to applaud your continuing efforts to set the record straight *["The Three Doctors and the* Enola Gay," *November 1994 "Washington Watch," p. 8].*

My *New World Dictionary* defines "fiasco" as "an ambitious project that ends up as a ridiculous failure." That certainly describes the mess created by Drs. Martin O. Harwit, Michael J. Neufeld, and Thomas D. Crouch. It is good to know that the eighth revision of the script approached reality. The disgusting and frightening aspect of this matter is that the pseudo-intellectuals who perpetrated the fraud are still in positions of authority. Those three positions should be prime candidates for reductions in government overhead and waste.

I bailed out of a burning B-17 Flying Fortress over Germany and spent more than twenty months as a POW. I suspect that the three doctors would interpret the experience thusly: Under the guise of abandoning a crippled aircraft, he parachuted into Germany to attack the beleaguered citizens who were so bravely defending their homeland.

Col. Herbert F. Egender, USAF (Ret.)
Green Valley, Ariz.

John T. Correll's excellent "Airplanes in the Mist" *[December 1994 "Editorial," p. 2]* really hit home with me. I have been angry, irritated, and frustrated by the National Air and Space Museum's plans for the *Enola Gay* exhibit since I first learned of it.

In 1945, I was a POW in Japan. Early in June we were told, "When the first American soldier sets foot on the sacred soil of Japan, all prisoners of war will be executed." If it had not been for President Truman's decision, the *Enola Gay*, and *Bockscar,* I certainly would not be here today.

In April 1942, I was captured by the Japanese forces near Mariveles on Bataan Peninsula. I barely survived the Death March and three months as a "captive" (not eligible for Geneva Convention privileges) in the O'Donnell Concentration Camp near Clark Field.

In July, we were moved to the Cabanatuan Prison Camp where we were formed into ten-man "escape squads." If any member of the squad escaped or attempted to escape all members would be executed. One man tried. He and all of his squad were beaten severely, then executed. For the rest of us, this brought back unpleasant memories of the Death March and the men beaten, shot, bayonetted, beheaded, or run over by tanks or trucks along that route.

So we believed them in July 1945. The Japanese did not consider themselves defeated, nor were they ready to give up. They obeyed their Emperor. They were a unified people. Even the women and children had sticks with sharp, fire-hardened points to repel invaders. If their Emperor told them to defend the beaches or kill the prisoners, they would have done so without question. Had there been an invasion, the number of casualties on both sides would have been astronomical. Those two bombs saved many lives.

Like some in today's Japan, Drs. Harwit, Neufeld, and Crouch are trying to rewrite history. They will never change their belief that we were the bad guys. I say get rid of all of them, cut off their funding, or move the *Enola Gay* to the US Air Force Museum in Dayton, Ohio, where it will receive the treatment and respect it deserves.

Col. Robert J. Jones, USAF (Ret.)
Roseville, Calif.

Unhappy Hooligans

It required a vivid imagination and a magnifying glass to determine who really won William Tell 1994 *["On Top at William Tell," January 1995, p. 40].* As the adjutant general of North Dakota, I am understandably proud of the fact that our 119th Fighter Group was once again victorious in the World Series of air-to-air competition. Flying less-than-new F-16A aircraft, these magnificent warriors brought home the Top Team honors and won several other categories. The F-16s are shiny beyond their years, but this is a tribute to the outstanding people who work for the North Dakota Air National Guard.

We believe strongly in the Total Force concept and congratulate the other winners at William Tell 1994. Anyone who was there knows that our Allied Air Force is in very good hands.

Please don't allow bias against our aircraft to get in the way of objectivity. The "Happy Hooligans" deserve your apology.

Brig. Gen. Keith D. Bjerke
Adjutant General, N. D.
National Guard
Bismarck, N. D.

Why the Air National Guard?

In light of current defense budget cutbacks and downsizing of military units *["What's Left of the Air Force Program?" December 1994, p. 24],* has anybody thought of eliminating the Air National Guard and placing ANG's old units in the Air Force Reserve?

A move like this could eliminate mission duplication and redundant units and place all air reserve units under a single command and management structure.

After all, why is there a National Guard? To provide state governors with a ready militia to be called up in cases of civil disturbance and natural disaster. It makes sense to have an Army National Guard. But can anyone remember the last time a governor called up or activated a fighter wing?

In these days of tight defense dollars, an Air Guard unit makes no more sense than a Navy or Marine Guard unit. Let's move those fighters, tankers, and cargo aircraft over to the Air Force Reserve.

SMSgt. Noel A. Sivertson, USAF (Ret.)
Denver, Colo.

Down Under on the B-17

Something in the January 1995 issue caused me to take a second look at the B-17 we are restoring at the Yankee Air Museum in Belleville, Mich.

In "At the Aeronautical Frontier" *[p. 22],* it seems that the photo of a B-17 wing is either printed upside down or the wing itself was inverted for testing.

The two turbochargers visible in the photo are normally on the bottom of the engine nacelles. The large raindrop-shaped fairing covers a fuel drain, and the small "goosebump" along the leading edge is the underwing jack point.

Your photo caught my attention and helped me learn this.

Mary Ann Bittner
Belleville, Mich.

The Chart Page

By Tamar A. Mehuron, Associate Editor

Vietnam Vets and the Workplace

Vietnam-Theater Vets vs. Nonvets in the Labor Force

(thousands)	In Civilian Population	In Civilian Labor Force	Labor Force Participation Rate	Number Employed	Employment Rate	Number Unemployed	Unemployment Rate
Vietnam-theater veterans	3,408	3,138	92.1%	3,011	88.4%	127	4.0%
Nonveterans	24,681	22,731	92.1%	21,655	87.7%	1,076	4.7%

A common misconception about Vietnam War veterans is that they have fared poorly in the work force. A recent Bureau of Labor Statistics study conflicts with that view. One aspect of the study focused on sample employment figures for the nearly eight million Americans who served during the Vietnam era (August 1964–May 1975). The charts focus on the seven million vets who were between thirty-five and fifty-four years old in September 1993, the cutoff date for the survey. As shown, Vietnam-theater vets had a slightly higher employment rate of 88.4 percent vs. their nonveteran peers, whose rate was 87.7 percent. The two groups' unemployment rates had a similar disparity, with the Vietnam vets' rate at 4.0 percent compared to 4.7 percent of nonveterans.

Many vets are employed by federal, state, or local governments. Nearly twenty-two percent of Vietnam vets work in government, compared to 11.4 percent of nonveterans.

Vietnam-Theater Vets vs. Other Veterans

Compares employment and unemployment rates for those who served in the southeast Asia theater and those who served outside southeast Asia

(thousands)	In Civilian Population	In Civilian Labor Force	Labor Force Participation Rate	Number Employed	Employment Rate	Number Unemployed	Unemployment Rate
Vietnam-theater veterans	3,408	3,138	92.1%	3,011	88.4%	127	4.0%
Non-Vietnam-theater veterans	3,657	3,429	93.8%	3,261	89.2%	168	4.9%

Labor force participation rate = percent of the civilian population in the civilian labor force (either employed or unemployed). The remainder may be retired, disabled, etc.
Employment rate = percent of the civilian population that is employed • **Unemployment rate** = unemployed as a percent of the civilian labor force

Source: Based on US Department of Labor, Bureau of Labor Statistics, "Employment Situation of Vietnam-Era Veterans," October 21, 1994.

Capitol Hill

By Brian Green, Congressional Editor

The Problem Is Money

Chairman Spence says the defense budget shortage may be close to $100 billion and decisions made by "a different Congress" will get another look.

SIMPLE lack of money is the key problem facing US military forces today, according to Rep. Floyd D. Spence (R–S. C.), the new chairman of the House National Security Committee. He said the military has so many needs that only an infusion of cash can resolve them.

How bad is the shortage? "I sense it is closer to $100 billion than $50 billion," the chairman said, referring to five-year projections. He indicated that he and Rep. C. W. "Bill" Young (R-Fla.), chairman of the House Appropriations Committee's National Security Subcommittee, would seek to add $80 billion to $125 billion to Clinton Administration plans.

The South Carolina Republican warned that the military is suffering from major deficiencies across the board—in readiness, modernization, quality of life, and force structure. Setting priorities to fix these weaknesses would be "difficult," he said, because "all of them are important."

In an interview with AIR FORCE Magazine, the new chairman maintained that the force is underfunded. Even if this force were well funded, he said, it would be inadequate to the task defined by the 1993 Bottom-Up Review of defense needs—the ability to win two nearly simultaneous regional wars.

He noted, "I think it is now universally understood that the Bottom-Up Review force structure is not up to the task required by the Bottom-Up Review strategy."

Though reluctant to commit himself to specific correctives ("I don't want to shoot from the hip"), he did state that "we will clearly focus on readiness, quality of life, and modernization problems."

Mr. Spence blamed readiness problems on the fact that the nation has much "smaller force[s], and we use them all over the place." He said he believes that frequent deployment in support of peacekeeping and contingency operations is inappropriate. "Our people aren't cut out for peacekeeping," he said. "I like to think that our military people are warriors."

He blasted President Clinton for making "an end run around Congress" in sending troops to Haiti. He was also critical of mission creep as experienced in the humanitarian aid mission to Somalia, which turned into a search for a warlord.

Mr. Spence noted that these operations consume funding for spare parts, maintenance, and training. He agreed with USAF leaders that Air Force readiness remains high, but he is concerned that forward-deployed forces are losing training opportunities because of the demands of contingency operations. To the extent they remain operationally ready, he suggested, they do so in part by shifting assets from other units. "US forces are being run too hard, and the result is a slow deterioration of readiness," he argued. "We have got to be more selective on where and how we deploy."

One part of the readiness problem—the erosion of military pay—is easy to understand, said the chairman. "Military people tell us [the pay raise] is one of the biggest quality-of-life and readiness issues." For the past two years, Congress approved pay higher than that requested by the Administration. "We should never break faith with US service members," he said.

The tug of war over the pay raise, Mr. Spence argued, has left a bad aftertaste with the troops. Unrest caused by the drawdown, the flap over homosexuals in the military, and a perception that service members are held in low esteem by the public also contribute to a sense of unease. The chairman said that in his visits to the field, he sensed a view among the troops that " 'they're taking away our benefits, they're RIFing us out, they're jerking us around; people must not think too highly of us the way they use us.' "

Even so, he said, morale is "surprisingly good," considering these factors and the heavy pace of operations.

Mr. Spence made plain his commitment to modernizing US forces. "Modernization is the whole life of the military in the future," he explained. In that light, he vowed to revisit recent actions on the B-2 bomber, F-22 fighter, and RAH-66 Comanche helicopter programs. The move to stop B-2 production at twenty aircraft "was a political decision and does not make a lot of sense from a strategic or operational perspective," he argued. "There is a lot of support over here for the B-2. That was a bad decision, . . . but it was made by a different Congress."

Buying more B-2s "is an admittedly expensive proposition," he said, adding, "A lot will depend on how much more Republicans are able to add to the Clinton Five-Year Defense Plan."

The chairman suggested that a reexamination of defense funding might result in a zero real growth budget plan combined with reductions to nondefense spending buried in the defense budget. He pointed to potential savings in defense conversion and environmental restoration accounts and in minor programs, such as museums, medical research, and World Cup soccer.

While he is still studying the proposed Fiscal 1996 defense budget, Mr. Spence believes that he might be able to save $2 billion to $3 billion by cutting these nondefense accounts. Mr. Spence is also hopeful that acquisition reform legislation passed last fall will result in substantial savings and wants to pursue further reforms this session.

Finding the money, he conceded, will be a "tough exercise." But he is convinced that the American people want a modern, capable, ready military, and he is unfazed by military officers and defense officials who offer little aid to his cause. "Obviously they can't take a position contrary to what the commander in chief says," he suggested. ■

FYI — When the USAF needed an airborne SINCGARS radio replacement for platforms like F-16s, A-10s, & C-130s, they selected the ARC-222, a VHF AM/FM radio set from MAGNAVOX.

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Aerospace World

By Suzann Chapman, Associate Editor

Joint Chiefs Seek TDY Relief

Gen. Ronald R. Fogleman, the Air Force Chief of Staff, told members of the 4404th Composite Wing (Provisional) during a visit to the Persian Gulf region that the Air Force is changing the way it will respond to future worldwide taskings.

General Fogleman, visiting Air Force troops in late December, stated that the Chairman of the Joint Chiefs of Staff, Gen. John M. Shalikashvili, and the service chiefs are examining innovative ways to meet taskings "to reduce the level of TDYs for our people."

High operations tempo and record high numbers of TDYs in recent years have become a politically sensitive issue, with some in Congress and the Pentagon claiming that virtually nonstop operations are creating morale and maintenance problems within the force.

General Fogleman emphasized that he did not mean that Air Force operational taskings will diminish but that the way the service responds to taskings will change somewhat. "It should change in a positive fashion . . . to produce less TDY per year per individual," he said.

Joint Chiefs Ask Congress to Ante Up

Addressing another issue with troops during his Gulf visit, General Fogleman also said that he and the other service chiefs met in late December with the deputy secretary of defense to discuss readiness.

While the service chiefs know that as the military has become smaller the operations and personnel tempos have picked up, the General said, "we are not funded for contingencies and crises. It becomes critical . . . that Congress provide us supplemental money."

Without this money, the Air Force consumes its spare parts and allotted flying hours and cannot make up day-to-day training needed to maintain readiness. General Fogleman added that no Air Force "hollow force" looms on the horizon: "We have been able to put together a balanced program that protects readiness, takes care of our people, and ensures our long-term readiness."

USAF photo by SrA. Bret Buckert

Capt. Raymond Strasburger flew an A-10 in January to Moody AFB, Ga., for the 347th Wing. Brig. Gen. Timothy A. Kinnan, 347th Wing commander, greeted the pilot and said, "We're now one of only three composite wings in the entire Air Force." The wing now has F-16s, C-130s, and A-10s.

Reserve Supplies Orphanages

An Air Force Reserve C-130 became the first American humanitarian aircraft to fly into Albania when its crew delivered supplies to orphanages in Tirana, just before Christmas.

A crew from the 94th Airlift Wing, Dobbins ARB, Ga., delivered 8,000 pounds of clothing, furniture, schoolbooks, beds, a refrigerator, and Plexiglas for fixing broken windows as part of a "Hope for the World" mission. According to Air Force officials, the flight was only the third humanitarian effort from an outside country to help the orphanages in Albania.

Hope for the World, an organization that runs orphanages and vocational schools, requested the mission under the Denton Amendment, which allows DoD to transport humanitarian relief supplies, on a space-available basis, without charge to the donor or receiver.

Chief to Drop Uniform Board

General Fogleman told members of the 5th Combat Communications Group, Robins AFB, Ga., in mid-December that he is going to disband the uniform board after the redesign of the uniform is finalized early this year.

"In the thirty-one years I've been in the Air Force, I've seen things invented and reinvented many times, and I don't think there is anything else they can do to the uniform," he said.

The Chief of Staff said that one of the main problems in changing the uniforms is that about half the people will not like the changes no matter what they are.

AAFES Offers Retrofits

Beginning this month, the Army and Air Force Exchange Service (AAFES) will offer a retrofit program for Air Force officers who want to convert their new wool-blend service coat rather than purchase the modified coat when it becomes available in September. The cost for the retro-

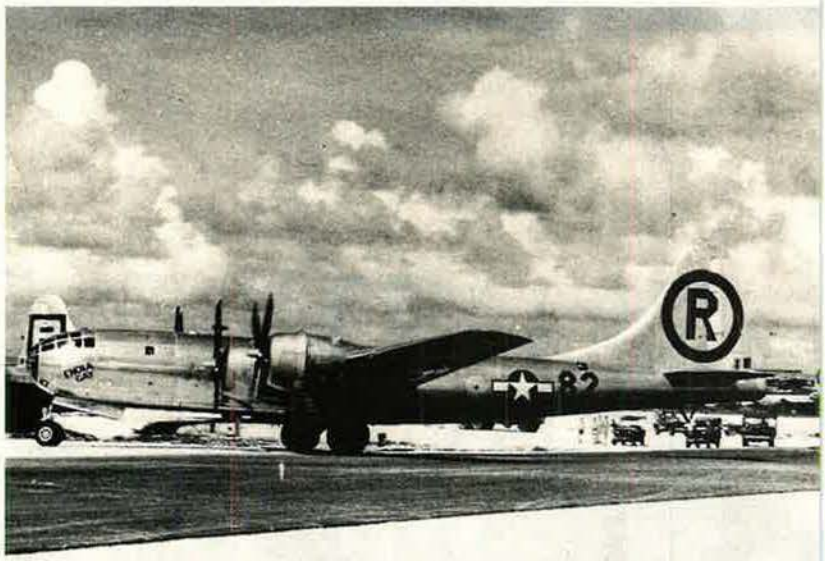

Photo via Robert F. Dorr

Political Exhibit Crashes at the Smithsonian

It was obvious that something had to give when eighty-one members of Congress called January 25 for the resignation or removal of Dr. Martin O. Harwit, director of the National Air and Space Museum. What gave was the plan of Dr. Harwit and his curators to use the *Enola Gay,* the B-29 that dropped the atomic bomb on Hiroshima, as a prop in a politically charged exhibition, "The Last Act: The Atomic Bomb and the End of World War II."

On January 30, with Congress breathing hard down his neck, I. Michael Heyman, secretary of the Smithsonian Institution (of which the museum is a part), announced that the controversial program would be scrapped. Instead, the museum will display the forward fuselage of the *Enola Gay* simply, along with a videotape about the crew that flew it on the historic mission in 1945.

The public controversy began with an article, "War Stories at Air and Space," in AIR FORCE Magazine in April 1994. Over the next year, that built to national and international news coverage. Initially, Smithsonian officials disparaged AIR FORCE Magazine accusations of bias, imbalance, and lack of historical context. Those denials lost credibility, however, when the magazine published internal museum admissions that the criticism was valid.

The Air Force Association and other veterans' groups provided detailed commentary as the exhibition script proceeded through five full revisions. From November on, senior Smithsonian officials took a direct hand in modifying the exhibit and gave assurances that no unilateral actions would be taken by the museum staff, in whom veterans' groups had lost confidence.

What finally brought the roof crashing in was a letter—subsequently repudiated by Secretary Heyman—from Dr. Harwit to the commander of the American Legion on January 9, declaring the museum's intentions to mark down from 250,000 to 63,000 the number of American casualties that would have been expected from an invasion of Japan. Dr. Harwit explained that the basis for this change was a new examination by Stanford University Prof. Barton Bernstein of the diary of Adm. William D. Leahy, wartime chief of staff to President Truman, leading to "a different interpretation of what [Truman] might have had in mind."

The ensuing outrage led to the cancellation of the exhibit, although Dr. Harwit remains on the job. Secretary Heyman has said that he will oversee the new *Enola Gay* display personally. Media coverage has been generally critical of the Smithsonian, and congressional hearings are expected in both the House and the Senate.

This turn of events has caused consternation in Japan. "The government cannot intervene, but this is regrettable [in terms of] the Japanese people's feelings," said Prime Minister Tomiichi Murayama, according to Kyodo News Service. Also unpopular in Japan is a point that figured centrally in the whole debate about the exhibition—that the atomic bomb shortened the war and saved lives by making an invasion of the Japanese islands unnecessary. "I have never directly heard that opinion myself, but it would be regrettable if such an opinion exists," Foreign Minister Yohei Kono told Reuter News Service.

—John T. Correll

fit, which involves sewing an epaulet to the shoulders and removing the sleeve rank braid, is $39.94 to $42.94, depending on the number of rank insignia braids.

AAFES officials say the retrofit is complex; the manufacturer will convert the coats at its factory, requiring about six to eight weeks turnaround time.

General Fogleman approved new washable polyester trousers for men and women for daily wear without the service coat. AAFES officials said military clothing sales stores should have the slacks in late spring.

B-2s Show Reliability

The 509th Bomb Wing, Whiteman AFB, Mo., completed 114 of 120 planned B-2 sorties since the first stealth bomber arrived there in December 1993. With 380 flying hours on all four assigned B-2s, that makes the reliability rate ninety-five percent.

Since beginning its B-2 operations, the Whiteman wing has trained six instructor pilots; the wing now has eight instructor pilots and four pilots who have completed basic qualification training. The wing also has six trained and certified weapons load crews.

In September, the 509th completed the first bomb drop at the Air Force's Utah Test and Training Range when *Spirit of California* delivered two inert Mk. 84 2,000-pound bombs on target and on time, according to Col. William M. Fraser III, 509th Operations Group commander.

Wing Commander Brig. Gen. Ronald C. Marcotte said, "I'm extremely pleased with the Whiteman team and excited about the future of the B-2. Our goal is to make the B-2 and Whiteman AFB the crown jewel of national defense. I think we're well on our way."

U-2s Photograph Flood Damage

Two U-2 aircraft from the 9th Reconnaissance Wing, Beale AFB, Calif., provided aerial surveys to help California disaster relief officials assess the extent of flood damage from last month's torrential rains.

Responding to a request from the California Department of Conservation, the wing's U-2 crews used the advanced synthetic aperture radar system to obtain radar imagery of the ground through the rain and cloud cover. On a second mission, they used the aircraft's panoramic camera to survey broad areas quickly.

The imagery provided critical data

to help assess the extent of damage and measure flood plains to help planners avert further problems. The 9th RW flew similar missions during the Mississippi River floods in 1993.

Victories For the Total Force

The Air National Guard's 110th Fighter Group, Battle Creek, Mich., has shown the merit of the Total Force concept with two active-duty deployments within twelve months.

Currently serving a two-month tour at Aviano AB, Italy, to support NATO's Operation Deny Flight in the sky above Bosnia-Hercegovina, the 110th FG also completed a six-week deployment to Thailand six months ago.

"This deployment validates what we've been saying in the Guard. . . . We can handle these kinds of active-duty missions—we've shown we can do it," said Maj. Gen. Gordon Stump, Michigan adjutant general.

Lockheed photo by Denny Lombard

The first reactivated SR-71A flew from Edwards AFB, Calif., to Air Force Plant 42 in Palmdale, Calif., in January. Congress has given the Defense Airborne Reconnaissance Office $100 million to reactivate three SR-71s. Air Combat Command will fly them after Lockheed Advanced Development Co. completes refurbishment.

Easier Drops Save Money

Four Air Force Special Operations Command airmen developed the Tri-Wall Aerial Delivery System (TRIADS) to distribute relief supplies over Bosnia-Hercegovina more effectively. TRIADS, the Air Force said, saved not only lives but millions of dollars as well.

Capt. Matthew B. Ash, SMSgt. Haldor C. Regi, MSgt. Michael G. Duffie, and MSgt. Mark N. Heflin developed TRIADS, which uses a cardboard tri-wall box that disintegrates in midair and scatters its contents over a larger target area. Previously, the Air Force used a crate attached to a parachute. The crate, filled with almost a ton of meals, ready to eat, or other supplies, landed at fifty to sixty miles per hour, often causing damage on the ground.

The four airmen each received $6,000 for developing TRIADS, which allows the light meal packets to fall individually to earth and costs about $44 per drop. The crate had cost about $750. According to Air Force officials, the Air Force and Army have adopted TRIADS to deliver food around the world.

Lockheed photo by John Rossino

Lockheed Aeronautical Systems Co. delivered twelve new C-130H Hercules to the North Carolina ANG's 145th Airlift Group. The new C-130s replaced earlier B models the Guard had flown for twenty-three years. Lockheed says it has sold more than 2,100 military and civilian C-130s to sixty-four countries.

Personnel Records On-Line

Air Force enlisted members worldwide now have access to their promotion data through local military personnel flights, according to Air Force Military Personnel Center officials.

Each military personnel flight has direct on-line computer access to the AFMPC database. TSgt. Dan Mendez, NCO in charge of AFMPC's promotion management section, said that direct access should cut the former three to four week process to less than a week. He added, "This will especially help senior NCOs because they will know what the promotion boards are going to see or have seen sooner."

Rome Lab Recognized

Rome Laboratory engineers at Griffiss AFB, N. Y., received three Federal Laboratory Consortium Awards for Excellence in Technology Transfer in 1995.

Dr. Richard Linderman and Ralph Kohler from the Lab's Directorate of Surveillance and Photonics helped transfer technology involving three-dimensional stacking of thinned computer memory chips, which increase memory density, consume less power, and offer greater speed than existing technology.

The Rome engineers worked jointly with Irvine Sensors Corp., Costa Mesa, Calif., to develop the Short Stack Memory Component.

Lee Uvanni, a computer engineer in the Lab's directorate of Intelligence and Reconnaissance, applied Auto-

In December, Maj. Mark Miller (left) became the first active-duty flyer to reach 3,000 hours in an F-16. Lt. Col. Bill Rew, commander of the F-16 Division, US Air Force Weapons School, Nellis AFB, Nev., greeted Major Miller after the record flight. Major Miller flew 120 combat hours during Operation Desert Storm.

matic Target Recognition (ATR) technology to classification of lung tumors. Originally used by intelligence analysts to locate such targets as planes and tanks quickly in aerial photos, the ATR technology has successfully identified malignant lung tumors with 100 percent accuracy and benign tumors with thirty to fifty percent accuracy.

Ms. Uvanni worked with Booz-Allen & Hamilton, McLean, Va., and Cornell Medical University of New York, N. Y., to develop the new application for ATR technology. It could ultimately provide more accurate diagnoses and reduce costs associated with lung disease.

An eight-member team from Rome Lab's directorate of Intelligence and Reconnaissance received an award for speech enhancement technology. Team members were 1st Lt. Douglas G. Smith, John J. Grieco, John G. Parker, Jr., Laurie H. Fenstermacher, Bridget E. Withers, Edward J. Cupples, Sharon M. Walter, and Stephen E. Smith.

The team's work improved voice communications by removing noise and interference without degrading the quality of the voice signal. Working with Martin Marietta Labs of Baltimore, Md., and Ernest Aschkenasy, Inc., of New York, N. Y., Rome Laboratory already has transferred speech enhancement technology to USAF organizations, the National Security Agency, the National Transportation Safety Board, and the FBI.

VA Reduces Processing Time

The Department of Veterans Affairs reports large reductions in the average time it takes to process a veteran's benefit claim. VA Secretary Jesse Brown said that the VA has lowered its overall backlog of claims from 575,000 in 1993 to 470,000 in 1994.

The average time for the VA to process an original disability compensation claim was 212 days; now it is 173 days. VA goals for the end of Fiscal Year 1998 include a further reduction for an original claim to 106 days.

The VA attributes the reduced time to the introduction of personal computers, local area networks, computer applications to support claims processing in its fifty-eight regional offices, and development of new business practices in those regional offices.

International Unit Takes Flight

To provide familiarization training on the F-16C for foreign pilots, the Air Force created the 311th Fighter Squadron, Luke AFB, Ariz. The first class of four Turkish and two Japanese pilots arrived at Luke in mid-January, after attending English language class at Lackland AFB, Tex.

Known as the "international squadron," the 311th receives its funding under the DoD Foreign Military Sales program. Countries that purchase the F-16C and participate in the training program reimburse the United States.

Air Force Cop Earns Army Medals

SSgt. John McCormick, 436th Security Police Squadron, Dover AFB, Del., received Army Commendation and Expeditionary Service medals for his service during Operation Uphold Democracy in Haiti.

The ten-year Security Police veteran, who served as a security controller and flight sergeant in charge of protecting the international airport at Port-au-Prince, established a fully operational base defense operations center and assisted in several life-threatening situations. Sergeant McCormick helped deliver a baby when a man dragged a woman in labor to the airport gate.

President Clinton presented the medals at a December White House ceremony recognizing various service members for their contributions in Haiti.

Chaplains Train for Hostile Deployments

More than ninety Air Force chaplains and enlisted support members survived the 1994 Air Combat Command Combat Ministry Course held at Holloman AFB, N. M., in December. The course included an exercise attack by an HH-60 Pave Hawk helicopter.

The objective is to train chaplains to provide ministry to troops during combat, said Maj. (Chaplain) Jeff Swanson, course project officer and a Marine combat veteran of Vietnam. Major Swanson said that during the first couple of attacks, the chaplains and support staff "were like sheep being led to slaughter. They didn't have any concept of how to defend themselves or how to react."

Maj. (Chaplain) Stephen Frick, chief of the readiness division for ACC's chaplain's office, said the course will make students better prepared and more confident when he calls on them for deployments.

Brain Surgery "Breakthrough"

Wilford Hall Medical Center, Lackland AFB, Tex., has the first DoD stereotactic radiosurgery unit—providing brain surgery without a knife. The unit is one of fewer than fifty in the United States.

According to Maj. (Dr.) Bradley Prestidge, chief of radiation oncology at Wilford Hall, this medical technology is noninvasive, requiring no penetration of the patient's skull. Instead of a knife, a very narrow beam of radiation is focused on a specific location in the brain.

Radiosurgery requires the services

of a multidisciplinary team, including a neurosurgeon, a neurologist, a radiation oncologist, and a medical physicist. The process takes almost an entire day, but then the patient usually goes home.

"The procedure is performed on an outpatient basis, reducing the amount of trauma and expense," said Lt. Col. (Dr.) Michael Griffith, chief of neurosurgery. "Stereotactic radiosurgery gives us an alternative in some cases when standard surgical methods are not appropriate."

Last year the Air Force sent more than 200 people to civilian hospitals to receive this treatment. Major Prestidge said that this procedure "has made it possible to do in one day what it used to take weeks to accomplish using conventional radiation therapy."

Lt. Gen. James E. "Bear" Chambers took his final active-duty flight in an F-16 from Spangdahlem AB, Germany, with his son, Capt. James Chambers, flying another F-16 on his wingtip. The General retired January 1 from his last assignment with USAFE after a thirty-five-year career.

Airlifters Review Multiunit Lessons

In December, active-duty and Reserve members of the sixty-ship C-130 formation that launched September 18 as the initial invasion force into Haiti for Operation Uphold Democracy met at Dyess AFB, Tex., to review their operation.

Participants said that it took some time to adjust to US Atlantic Command, which was new to this type of contingency. As usual, communication became a key factor.

According to Col. Richard P. Theokas, chief of Operations Training Division, Air Force Reserve, participants suggested procedural changes and redefinition of lines of communication to warfighting commanders in chief. He added that those in charge are not always the best people to plan an operation. "You want to use the captains and majors who are responsible for scheduling missions, who know what their forces are capable of doing."

Other participants said that many of the lessons learned are not new but have gone undocumented. Many thought that practicing the lessons during exercises will enhance future capability, citing the increasing complexity when planning and flying a large formation.

"One of my goals is to find ways to schedule exercises that plan these large ship formations not just with one unit but using multiple sources of aircraft," said Lt. Col. Dan Hickox, director of Plans for Air Combat Command's 7th Wing, Dyess AFB, Tex.

Lockheed photo by Rita King

Lockheed Aeronautical Systems Co. recently moved the forward fuselage assembly for the first C-130J Hercules transport to its next assembly station, where it will undergo final assembly next month. Lockheed will deliver two C-130Js to USAF and three to the British Royal Air Force in 1996.

Cope Tiger '95 Trains Three Nations

The annual Cope Tiger fighter aircraft exercise, normally conducted by the United States and Thailand or Singapore air forces, included all three for the first time this year. The exercise took place at Korat RTAFB, Thailand, in January.

The 54th Fighter Squadron, Elmendorf AFB, Alaska, flew its F-15s in the ten-day exercise. One of the first US pilots to fly, 1st Lt. Brian Heagy, with just two months' flying time in the F-15, said, "This is the first time I've flown outside the United States and against non-US pilots. It was exciting. It was cool flying next to an F-5."

Denver Military Eases Closing Hardships

Military leadership in the Denver area forged a team effort to ensure that no permanent civilian employees at Lowry AFB, Colo., would lose their jobs involuntarily. It worked.

According to Air Force Reserve officials, it took more than two years of aggressive planning, compassion, and great dedication to achieve the

Texas Instruments announced successful completion of the first Joint Standoff Weapon (JSOW) guided free-flight test, using a US Navy F/A-18C on December 13. JSOW is a low-cost, standoff weapon developed with Naval Air Systems Command to provide an affordable, multipurpose standoff attack capability.

goal of zero involuntary separations, an almost unheard-of feat in Air Force drawdown history.

The team, composed of Lowry's Training Center, Air Reserve Personnel Center, and Buckley ANGB, set its goal in early 1992, a few months after Lowry's fate became law.

The base's closure affected the more than 1,800 civilians working there and also hundreds employed by ARPC, Buckley, and other Denver-based Air Force units that had to help make room for those displaced at Lowry.

The Lowry civilian personnel office mixed normal attrition with such management actions as temporary hiring and promotions, mock RIFs, and the Defense Department Priority Placement Program. It also used Separation Pay Incentives in the later months of the process.

More than seventy-five people were reassigned at their present grades. Almost 100 took jobs at lower grades, at which they will continue to be paid their former salaries for two years. Many people took jobs in different career fields.

JAST Economizes With Paperless Contracts

The Joint Advanced Strike Technology Program Office used a paperless process to award twenty-four contracts in late December for concept definition and design research.

As part of the highly streamlined contracting process, companies submitted proposals on electronic media. Then the program office evaluated the proposals and made the awards electronically. According to DoD officials, these methods saved both the government and industry time and effort.

The JAST program focuses on research related to definition of an affordable family of next-generation strike weapon systems for the Navy, Air Force, and Marine Corps. It is also open to dialogue with allies on defense cooperation on fighter aircraft.

Needed: Major Positions

The Air Force has asked for more positions for majors in Fiscal 1996 and 1997 to allow USAF to promote 1,100 captains and to bring the promotion phase point back within Defense Officer Personnel Management Act (DOPMA) guidelines of nine to eleven years, according to Air Force officials. Currently, it takes about twelve years of service to pin on major.

The proposal would not increase the total number of commissioned officers authorized nor impede reductions planned for the officer force. However, it still requires congressional approval.

Even without grade relief, the Air Force expects promotion opportunities to remain at about eighty percent, but it would take probably until 2001 to see the phase point fall back to the DOPMA guideline of eleven years, the official said.

Tent City Lasts and Lasts

Rotating Prime BEEF (Base Engineer Emergency Force) teams rebuilt the tent city at Incirlik AB, Turkey, in February. Although the tent manufacturers recommended a six-month life expectancy, troops on temporary duty to Operation Provide Comfort have used the six-man tents for nearly four years.

Replacing the 200 tents was the work of a twenty-five-man core team from the 18th Civil Engineering Group at Kadena AB, Japan, plus forty people from various bases throughout Europe and the US.

The process involved a ten-man crew setting up forms for concrete pads. Once the pads were ready, everyone not engaged in other engineering "hot" projects joined in—putting up twenty tents a day.

Rome to Host First "Military Olympics"

Military members from eighty-two nations will compete in the first-ever "Military Olympics" in September in Rome. Officially titled the World CISM Games—CISM is an acronym for Conseil International du Sport Militaire—the competition will bring together qualified military athletes in seventeen sports, including boxing, track and field, cycling, and modern pentathlon, over a two-week period. This also marks the first time that all CISM events have taken place at once.

Lasers Destroy Model Scud-Type Missiles

Phillips Laboratory personnel used the Mid-Infrared Advanced Chemical Laser to hit half- and full-scale replicas of Scud-type missile fuel tanks in tests in December at White Sands Missile Range, N. M. The groundbased tests helped determine the power of the laser and size of the light needed to destroy the targets.

The ultimate goal is to place a weapon-class laser on board a wide-body aircraft and use the laser to destroy attacking theater ballistic missiles shortly after their launch. Phillips Lab technicians conducted the tests with the Army, which operates the laser facility, and the Navy, which operates the laser itself.

ESC Places Contracts On-Line

Electronic Systems Center, Hanscom AFB, Mass., merged onto the information superhighway by listing portions of contracts on an electronic bulletin board in late December. This first-time Air Force listing includes current contracts but eventually could

include past contracts as well, said an ESC official.

People who want information about the contracts can search the board by name, number, or keyword. If they need more information, they can file a Freedom of Information Act request on-line.

POW/MIA Mission Gains Cooperation

When James Wold, deputy assistant secretary of defense for POW/MIA Affairs, went to Vietnam in November, he found the American POW/MIA office listed in the Hanoi yellow pages and advertised on local television. He also found Americans and Vietnamese working side by side to locate and excavate aircraft crash sites.

Mr. Wold cites these and other examples, such as archives that the Vietnamese have opened to US researchers, as evidence of growing cooperation between the US and Vietnam to help resolve cases of missing American service members.

According to Mr. Wold, 2,214 service members are unaccounted-for in southeast Asia. About 505 are missing in Laos. Thirty-eight cases, involving seventy-seven members, are unresolved in Cambodia.

Full-Accounting Team Faces Hardships

Army Brig. Gen. Charles Viale, commander of Joint Task Force–Full Accounting, feels insulted when critics claim the US government isn't doing enough to find Americans missing from the Vietnam War. "I've got the most dedicated, hard-working people in Vietnam, Laos, and Cambodia. They work in some of the . . . harshest conditions I have ever seen," he said.

The US ambassador to Laos, Victor L. Tomseth, echoed that sentiment: "During the rainy season, for instance, they've endured poor sanitary conditions, disease, bugs, snakes, scorpions." To reach some of the excavation sites, the team members hack their way through thick jungle and slip and slide on steep mountainsides.

General Viale said that task force members are American service people who are "motivated not just because this is important to the families but motivated by the brotherhood of the services."

Yokota C-130s Aid POW/MIA Effort

C-130 crews from the 36th Airlift Squadron, Yokota AB, Japan, fly Joint Task Force–Full Accounting members into southeast Asia on their mission to resolve cases of Americans still missing from the Vietnam War after more than twenty years.

The Yokota aircrews also ferry supplies and provide emergency medical evacuations for task force members.

Although there is no enemy fire, the flights are still hazardous, said Capt. Lance Matsushima, a 36th AS navigator. Local navigational equipment "often makes it necessary to rely on visual landmarks, radar, or our internal navigational system. Their airports can't facilitate our arrivals or departures because the navigational aids are either not operational or not as up-to-date as our systems," he said.

Capt. Kevin Giammo and 1st Lt. Tom Hill, 1st Space Operations Squadron, Falcon AFB, Colo., reviewed Precise Lightweight GPS (Global Positioning System) Receiver functions during a competition designed to give GPS satellite operators the "whole picture" of how it affects air, land, and sea forces.

Old Zinc Brings Money

DoD has started selling its stockpiled zinc to the US Mint. During Fiscal 1994, DoD sold 4,125 tons of its highest-grade zinc for more than $3.3 million. The Defense National Stockpile Center still has 327,207 tons of zinc, according to Robert O'Brien, the stockpile's deputy administrator.

Under a 1994 agreement, DoD sells 99.99 percent pure zinc to the US Mint for use in pennies. A Mint spokesman said that the cost of copper became too high, so the US began minting pennies with 97.5 percent zinc and 2.5 percent copper in 1982.

DoD plans to sell another 8,557 tons to the Mint during Fiscal 1995.

News Notes

■ DoD announced that 1994 was its safest year in recent memory. DoD aircraft accident rates dropped from 1.94 to 1.63 accidents per 100,000 flying hours. The cost of major aircraft accidents dropped from $1.6 billion to $1.2 billion. Aviation fatali-

ties dropped significantly from 119 to sixty-eight. The number of aircraft destroyed fell from 110 to an all-time low of eighty-four. Accidental military deaths dropped from 666 to 526, another all-time low, although this was partially because of downsizing. The fatality rate decreased from .39 to .36 accidental deaths per thousand service members.

■ In December, DoD released its final report on "Building US Capabilities in Flat Panel Displays," following a year-long study by an interagency group. The military services will need flat panel displays—visual screens that are millimeters deep, very light, rugged, and portable—for the battlefield of the future, according to a DoD press release. The report concludes that the US can enhance its flat panel display capabilities by increasing funding for manufacturing R&D, by speeding up the use of advanced display technology in military and other government systems, and by developing measures to promote more open markets for US display producers.

■ Family, friends, and former members of the Glenn Miller Army Air Forces Orchestra gathered for a memorial ceremony in mid-December, exactly fifty years since Major Miller disappeared over the English channel, to honor the father of the modern Air Force band.

■ Joseph McInturff, a civilian with the Air Force Military Personnel Center, Randolph AFB, Tex., won the 1994 Gen. Robert J. Dixon Award for his work on the team that restructured the Air Force career field system. The award recognizes an officer, senior NCO, or civilian who has made the most significant contribution to Air Force personnel administration in solving a tough problem.

USAF photo by A1C Pamela Little

Maj. Mike Bastine, 14th Air Force space operations officer, talked with ANG Capt. Tom Miller, 150th Fighter Group, during a "cockpit symposium" at Vandenberg AFB, Calif., in January. The Flying Tigers organized the event to help pilots and space operators understand combat space support requirements and capabilities.

■ US military members stationed overseas may use the earned income tax credit, a special credit for low-income taxpayers. The new benefit will apply to 1995 and beyond. The credit reduces the amount of federal income tax owed, if any, and helps offset some of the increases in living expenses and Social Security taxes.

■ CHAMPUS-eligible people now have the status of their fiscal year outpatient deductible and catastrophic cost cap tracked automatically through new centralized systems. Beginning with health-care services received on or after October 1, 1994, the Central Deductible and Catastrophic Cap File tracks how much each person or family pays in cost-shares and the annual outpatient deductible in a fiscal year, according to Air Force officials. The new system allows CHAMPUS contractors to share information, instead of requiring individuals to provide records to each contractor.

■ The 37th Airlift Squadron, Ramstein AB, Germany, began flying two to three daily Operation Provide Promise humanitarian missions into Sarajevo, Bosnia-Hercegovina, in late December. The Air Force transferred the mission to the 37th AS from Rhein-Main AB, which will partially return to the German government this month.

■ Gen. John M. Shalikashvili, Chairman of the Joint Chiefs of Staff, announced in late December that troops who served in or directly supported Operation Uphold Democracy will receive the Armed Forces Expeditionary Medal.

■ Most officers no longer need a photograph in their official personnel records, per a policy change approved by the Secretary of the Air Force and the USAF Chief of Staff. General officers and brigadier general select-

Senior Staff Changes

RETIREMENTS: L/G James E. **Chambers;** B/G Travis E. **Harrell;** M/G Ronald C. **Spivey.**

CHANGES: M/G Charles R. Heflebower, from Dir., Prgms. & Eval., Hq. USAF, Washington, D. C., to Cmdr., Interim Combined Air Ops. Ctr. 3, NATO; and Cmdr., 17th AF, USAFE, Sembach AB, Germany, replacing M/G Eugene D. Santarelli . . . **B/G John F. Miller, Jr.,** from Cmdr., 49th FW, ACC, Holloman AFB, N. M., to Cmdr., 57th Wing, ACC, Nellis AFB, Nev., replacing B/G John L. Welde . . . **M/G Eugene D. Santarelli,** from Cmdr., Interim Combined Air Ops. Ctr. 3, NATO; and Cmdr., 17th AF, USAFE, Sembach AB, Germany, to Dir., Ops., Hq. PACAF, Hickam AFB, Hawaii, replacing L/G Ronald W. Iverson . . . **B/G John L. Welde,** from Cmdr., 57th Wing, ACC, Nellis AFB, Nev., to Chief, Office of Defense Cooperation to Turkey, USEUCOM, Ankara, Turkey.

SENIOR ENLISTED ADVISOR CHANGE: CMSgt. William L. Richardson, to SEA, Hq. PACAF, Hickam AFB, Hawaii, replacing retired CMSgt. James B. Livesay.

SENIOR EXECUTIVE SERVICE CHANGE: John T. Manclark, to Dep. Dir., Test and Eval., Hq. USAF, Washington, D. C., replacing Carroll Jones. ■

ees must still maintain an official photo.

■ The Air Force has extended wear of the brown leather flight jacket to include nonrated mission crew members and all rated aircrews not previously eligible, such as pilots and navigators in staff positions.

■ The 437th Airlift Wing, Charleston AFB, S. C., received its twelfth C-17 Globemaster III ahead of schedule in late December. The plane is the eighteenth delivered to the Air Force.

■ Three Texas Air Education and Training Command bases received recognition for their child-care programs, dubbed "Youth Flight Programs," from the Texas-based Corporate Fund for Children. The bases are Sheppard AFB, Lackland AFB, and Goodfellow AFB. AETC is the first command in DoD to earn accreditation for all its centers from the National Academy of Early Childhood Programs, according to Air Force officials.

■ DoD has announced a health maintenance organization (HMO) option under its Tricare health-care program. The first region to offer the HMO option is Region 11 (Washington and Oregon), beginning this month. The option establishes fees and copayments for care provided to beneficiaries in participating civilian medical facilities. The new fees are, on average, significantly lower than existing fees and copayments.

■ The Air Force presented the Col. Joseph B. Duckworth Instrument Award to Maj. Donald W. Thompson, 92d Operations Group, Fairchild AFB, Wash. After four years of research, the Major developed a B-52 portable night vision lighting system to use with night vision goggles. The system allows pilots to view flight instruments without having the NVGs wash out the image.

■ The Women in Military Service for America Memorial Foundation, Inc., has asked women veterans to donate artifacts distinctive of their service branch and era to become part of a permanent memorial exhibit at Arlington National Cemetery. For information, contact the foundation curator at (800) 222-2294.

■ Capt. Martin Keillor won the American Defense Preparedness Association's Louis F. Polk Award by demonstrating outstanding academic performance and professional ability in solving a problem of value to the nation's defense. Captain Keillor maintained a 3.98 grade point average while enrolled in the Air Force Institute of Technology's applied physics graduate program. His master's thesis work contributed to the development of detectors to evaluate radiation from suspected nuclear fuels operations, to help identify incipient nuclear programs.

■ The Civil Air Patrol recently recognized Lt. Col. Johnnie Pantanelli, commander of the North Castle Squadron, New York Wing Southeastern Group, White Plains, N. Y., for her fifty years with the CAP.

■ The Lone Star Flight Museum, Galveston, Tex., has acquired a Douglas SBD/A-24B Dauntless World War II dive bomber (serial number 42-54682). The Scout Bomber participated in World War II Pacific naval engagements, including the Battle of Midway.

■ Headquarters Air Force Reserve will conduct its first new-style Quality Air Force Assessment at the 512th Airlift Wing, Dover AFB, Del., in June. AFRES inspectors will use Secretary of the Air Force criteria and Unit Self Assessment and Compliance to evaluate a unit.

The VISTA/NF-16D employs a production F-16D airframe, with features from different F-16 variants, plus a complex, custom-designed variable stability system. Materiel Command's Wright Laboratory will use the aircraft to simulate other aircraft, perform aeronautical research, and train new military test pilots.

Purchases

TRW Inc. received a $298.9 million contract for components and services required to engineer, install, and support local area network (LAN) communication service at various Air Force installations.

Electronic Data Systems Corp. received a $297 million contract for components and services to engineer, install, and support LAN communication service at various USAF installations. Expected completion: May 2000.

Carnegie Mellon University received a $197.4 million contract for software and engineering research and development for calendar years 1995 through 1999.

Martin Marietta Aerospace Corp. received a $216.6 million face-value increase to a fixed-price contract to rephase the Titan IV launch vehicle production program. Expected completion: September 1999.

Olin Chemical Division received a $92.1 million firm fixed-price contract for propellant hydrazine to support NASA and Air Force space and rocket launches and the F-16 Emergency Power Unit. Expected completion: December 1995.

CFM International received an $80.3 million face-value increase to a firm fixed-price contract for twenty-four CFM56 engines for the KC-135 aircraft. Expected completion: November 1996.

Northrop Grumman Corp., B-2 Division, received a $50 million face-value increase to a time-and-material contract for calendar 1995 hardware and software engineering support services for operational B-2s. Expected completion: December 1995.

Obituary

Ben R. Rich, who achieved international acclaim for innovative aircraft design, development, and production during a forty-year career at Lockheed Corp., died January 5, 1995, at age sixty-nine following a lengthy illness.

Mr. Rich headed the Lockheed "Skunk Works," now known formally as the Lockheed Advanced Development Co., from 1975 until his retirement in 1991. He joined Lockheed in 1950, participating in aerodynamic, thermodynamic, propulsion, and preliminary design aspects of the F-104, U-2, YF-12, SR-71, and other technologically sophisticated programs that earned Lockheed international recognition. He also led Lockheed's development of the world's first operational stealth aircraft, the F-117A.

He became a senior engineer for Lockheed's advanced programs in 1963 and served as Advanced Development Projects program manager and assistant chief engineer. He became vice president for fighter programs and preliminary design in 1972. He became a vice president of Lockheed in 1977.

Secretary of Defense William J. Perry presented Mr. Rich with the Pentagon's highest civilian award, the Distinguished Service Medal, in 1994. In a May speech, Secretary Perry asserted that "Ben Rich provided the intellectual and the spiritual leadership [of the stealth program] and . . . the title 'father of stealth' really belongs to Ben."

Born in Manila, the Philippines, June 18, 1925, Mr. Rich received a bachelor of science degree in mechanical engineering from the University of California at Berkeley and a master's degree in the same discipline from the University of California, Los Angeles. ■

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The new Chief hopes that his legacy will be a greater understanding of what the Air Force brings to the defense team.

Fogleman Begins His Mission

By John A. Tirpak, Senior Editor

At Phu Cat, South Vietnam, in 1969 they wore bars, oak leaves, and eagles. Within twenty-five years, the three flyers (opposite)—W. L. Creech, Merrill A. McPeak, and Ronald R. Fogleman—each achieved four-star rank: the latter two as USAF Chiefs of Staff, the former as commander of Tactical Air Command. General Fogleman (left) is the first USAF Academy graduate to head the Air Force.

GEN. Ronald R. Fogleman, the new Chief of Staff of the Air Force, rarely misses an opportunity to praise his predecessor, Gen. Merrill A. McPeak, for accomplishing the massive reorganization of the service over the last four years.

"I think that, clearly, we owe General McPeak a deep debt of gratitude for what he's done in restructuring and reengineering the Air Force," General Fogleman said in an interview not long after taking office in October.

He thinks the job was done well, and for the most part the turbulence of those changes "is behind us," General Fogleman added.

Now, however, comes the time to reconcile those changes with the real world, both inside the Air Force and out. Making those changes stick and work in a way that leaves everyone feeling confident in and comfortable about the service is among General Fogleman's top priorities.

The restructuring of the Air Force was caused by the end of the Cold War, the emergence of different kinds of threats in the post–Cold War world, and a sharp reduction in defense spending. The Pentagon's Bottom-

Up Review (BUR) two years ago called for a shift in strategy toward ensuring that US forces can fight and win two nearly simultaneous major regional conflicts.

Only the Air Force moved rapidly to reinvent itself to fit the new strategy. While the other services complain about being on "the razor's edge" of readiness, "the United States Air Force is nowhere near being a hollow force," General Fogleman asserted. "Readiness is not an issue."

That preparedness came at a price.

"We moved out smartly to reduce our force structure," said the General. "We elected to pull our force structure down to the Bottom-Up Review numbers quickly. We elected to take the dollars we would save by doing that and invest them in readiness. We have done that, and that's why, today, we are a ready force."

Among the Joint Chiefs, he added, "I'm the only guy at the BUR force structure."

While the Air Force was shrinking, the United States was gaining an education in what the post–Cold War world would really be like. The force has had little time to catch its breath since.

Tired and Very Tired

Noting the many relief efforts, interventions, and peacekeeping operations the Air Force has had to undertake over the last few years, General Fogleman acknowledged, "The force is in very high demand," and "there is an uneven 'tiredness' " among the units and personnel in the service. In some aircraft and mission areas, he conceded, "it's a very tired force."

"We do have an issue with operations tempo," he said. "Those things are sort of inversely proportional. If you get smaller quickly, at the same time your tasking increases fourfold, that same smaller force structure is going to have a higher optempo."

While a good number of units have been in almost constant demand—sometimes well exceeding the goal of under 120 days of deployment per year—other units have been less heavily taxed.

"We have to seek a better balance," General Fogleman said. "We can do something about it."

Sitting in the sparsely decorated Chief of Staff's meeting room, General Fogleman has the stocky fighter pilot build and heavy brow that suggest the cigar-chomping Gen. Curtis E. LeMay. The image is lightened somewhat by his openness and soft-spoken manner. Nevertheless, there's no doubt who's in charge here.

The first Air Force Academy graduate to occupy the top job in the Air Force, General Fogleman is also the only Chief ever to have been an instructor there. (He taught history.) He studied at the Army War College, was an F-15 demonstration pilot, and was commander of Korean and US air components under Combined Forces Command and commander in chief of US Transportation Command.

He is inclined toward taking action and not letting up. In Vietnam, in 1969, he won a Silver Star and a Purple Heart in two separate incidents in which he continued to press on to a target despite running into heavy flak. The Purple Heart was awarded for injuries sustained when his F-100F was shot down and he had to be rescued by an AH-1 Cobra gunship. Lying on an open machine-gun access door, he held on for miles until reaching a medical station. He left southeast Asia with eighteen Air Medals and 315 combat missions completed.

Staff photo by Guy Aceto

General Fogleman sees USAF as a "team within a team" and believes it is of paramount importance for him to communicate to the nation that the Air Force is "one hell of a bargain" for the US in terms of the return on its investment.

He is inclined to act now—to improve the quality of life for troops being taxed to their limits by the unrelenting pressures of the last few years. He wants to "not just talk about quality of life" but to make it genuinely better.

But he has to fight the urge to act impulsively. Before he undertakes any more significant reorganization, said the General, he needs to see more information and get a better feel for whether the operating tempo of the last few years is going to be "typical or atypical" of the post–Cold War Air Force.

"We'll get a year's worth of data and use it to get a fact-based decision," he said. "Hopefully, by next fall, when we're making the FY 1997 [budget], we'll have a fact-based decision." Until then, though, "we can't rely on the input."

In Search of Balance

The obvious answer, he thinks, is to spread the work around better. "In Europe last year," he said, "the A-10s were [on temporary duty] somewhere around 180 days a year" or more. Meanwhile, "Stateside A-10 units were gone something . . . less than forty days. So we have to do something to balance this optempo."

He added that in order to "stay engaged with a smaller force structure, we have to be more flexible in how we use it. And that flexibility has to start with the regional CINCs."

General Fogleman said he'll have to convince each regional CINC that "we can meet his demands with force structure other than that which is just stationed in his theater." To do that, he must also convince other CINCs that if they give up some of their assets to alleviate the strain elsewhere, "we can provide them with some kind of gap-filler in case something happens."

For instance, F-15Es in Europe are on deployment more than 180 days a year, while Alaska-based F-15Es barely deploy at all.

"We've got the flexibility to move some things around" and likely will, General Fogleman said.

Better distribution of the load won't completely solve the problem because some systems and crews simply are too scarce to be able to meet the demand.

"Where we get in a crush is when we get into these very specialized systems that only exist in one command, that have a very high optempo in peacetime," such as E-3 Airborne Warning and Control System aircraft or E-8 Joint Surveillance and Target Attack Radar System airplanes. In those cases, where simply spreading the work around won't do it, "we need to try and find a way to get better utilization out of the Guard and Reserve."

Where even that won't be enough, General Fogleman will put "increased resources in there to increase crew ratios" and maybe "buy more of those airplanes."

Using more Guard and Reserve to pick up the load is already being done and works like a champ, General Fogleman observed.

"Let me give you an example," he said. "I think everybody would acknowledge that Air Mobility Command has been pretty heavily tasked, supporting operations . . . around the world. But if you look at the number of days TDY for those units, it's not very high."

The reason, he pointed out, is the availability of Air Force Reserve Associate units, which flesh out the available crews for C-141s, C-5s, and other airlift aircraft.

"Twenty-five percent of the AMC mission is done by the Guard and Reserve through associate units," the General recounted with pride. More associate units may be in the cards, he added, and the next type of aircraft they get will be KC-135s.

"One of the things we have not focused on—and which will be a high-interest item—is the issue of [Air Force] people and how they see themselves and the institution they have pledged their service to," General Fogleman said.

Knowing the Concept

He has made it an objective of his tenure to make sure that everyone in the service understands the concept of the Air Force being "a team within a team." That means not only making everyone knowledgeable about the real contribution they make to national defense but also reassuring them, in practical ways, that the service and the nation appreciate them and their sacrifices.

According to the General, "Quality of life is all the things we normally think of," such as base facilities, leave, and pay, and "also how you perceive your personnel system, promotion system, assignment system—all those things that impact your life. I think we'll go look at . . . all those things" in the coming months.

His "salesmanship" job is important outside the service as well. "The legacy I would like to leave, when I step down as Chief, is that there will be a greater understanding on the part of the nation as a whole for what the United States Air Force brings to the team," General Fogleman said.

"We need to understand that as an

institution first, then . . . not be bashful about telling the nation what they're getting for their investment in . . . men and women and tax dollars. . . . The United States Air Force is one hell of a bargain for this country."

General Fogleman's senior officers will be more aggressive in making their other-service bosses and civilian hosts aware of just what the Air Force does and can do.

"If you're the air component [commander] on a CINC's staff, you need to know what your craft is all about so you can give that CINC all the capabilities you can. If you're in command of a depot near a large city, you need to be engaged with that community and let them know what the Air Force is all about."

As for himself, his job will be to sell the senior Pentagon leadership and Congress on airpower. He anticipated that his congressional testimony this year on the Fiscal 1996 defense budget would be his first salvo.

The Conventional Triad

"You're going to see me start a new thrust," he said. "We're going to present to Congress and the American public . . . the notion of a 'conventional triad.' " Just as the nation was well served during the Cold War by a nuclear triad, now General Fogleman sees an even greater importance on the conventional pillars of power projection and influence.

"What has become really relevant, now, is how do you project influence around the world in a nonnuclear environment?" he asked.

In his view, the first leg is air mobility, which can project "nonlethal" influence in the form of presence, by getting troops to a position of deterrence, relief, or peacekeeping.

Next come heavy long-range bombers, which can react within hours of a military incursion anywhere in the world and which can also slow or halt an enemy's advance until US troops can get to the fight.

Finally come the fighter and attack aircraft—what once were called "tactical" forces—which can provide air superiority and make possible the buildup necessary to fight an enemy back to his own lines and effect his defeat.

"If the influence you've tried to project doesn't get you the right results, . . . if negotiations have failed and you must engage in combat, these same forces that would allow you to influence events beforehand become the keystone" of a fighting force, he explained.

The conventional triad is the underlying rationale for the Air Force's spending plans for force structure and modernization beyond the turn of the century.

"We're not rushing to do all this in the next two years," General Fogleman pointed out. "We've laid out a long-term strategy that's the most affordable and makes the most sense in the environment we're operating in."

That program concentrates on near-, mid-, and long-term needs. In the near term, General Fogleman said, the emphasis must be on rehabilitating the strategic lift force with new aircraft, such as the C-17 and the nondevelopmental airlift aircraft.

The more C-17s that are finally approved "that can take care of more of the outsize/oversize lift, the better the NDAA is going to look in terms of being a supplemental airlifter to take care of bulk," he said.

General Fogleman raised eyebrows in the Pentagon and Congress last year when, as head of US Transportation Command and AMC, he said the Air Force could get along with sixty to eighty C-17s, when the stated requirement was for 120. But that was based on the availability of an NDAA, he said.

"I was the first guy to use that term, 'NDAA,' " General Fogleman noted. "I was not interested in us initiating some developmental program to take a commercial airplane and try to make it into some sort of specialized airplane. I still have that view. And I think the likelihood of executing [the NDAA] is directly proportional to how true we can stay to it being nondevelopmental."

The "midterm imperative" General Fogleman sees is to update the bomber force. Bombers give CINCs "tremendous leverage [against ground forces] while we're trying to move other forces into the theater," he said.

Because they were designed for the nuclear mission, B-52s, B-1Bs, and B-2s all need to be adapted to the conventional role. To free up money to do this, some bombers will be taken out of service—though not retired—for a few years, and the money saved on operating and maintaining them "will be invested in modifications to these aircraft and in procuring precision munitions" for them, General Fogleman said. At the end of the century, they will be brought back into active service.

Nothing Is Assured

Finally, the long-term priority is to get the F-22 developed and fielded to fulfill the air-superiority mission.

"The nation as a whole has lost sight of how valuable air superiority is," General Fogleman lamented. "For

Photo by Paul Kennedy

Though experienced in the ways of Washington, General Fogleman (shown here at the 1994 AFA Convention) credits his years as a commander in the field for the development of his commonsense approach to problem solving.

Staff photo by Guy Aceto

General Fogleman wants to emphasize that the Air Force must continue to modernize because it is "absolutely not true" that "air superiority is a God-given right of Americans," no matter how many people have begun to believe it is.

some reason, there are large numbers of people who think air superiority is a God-given right of Americans. [That's] absolutely not true."

Spanning the near, mid-, and long term is the procurement of the Joint Primary Aircraft Training System, the flight trainer conceived as a replacement for the aged T-37. The JPATS, he said, is "coming along well, we think it's a good program, it doesn't cost us that much money per year, so we just need to get on with it."

General McPeak's suggestions, offered near the end of his term, about how the armed services should divide up military roles and missions created an uproar in Washington. He drew particular ire from the Army for recommending the cancellation of the long-range Army Tactical Missile System (ATACMS) on the grounds that the Air Force should have responsibility for the "deep" battle. He also upset many in both the Army and the Air Force by predicting that USAF would eventually give up its A-10 close air support airplanes, arguing that CAS is a "sunset mission" and Army and Marine Corps attack helicopters are better CAS platforms anyway.

General Fogleman has a somewhat different view. He has no intention of giving up the A-10s, now or in the foreseeable future.

The A-10 is in Air Force spending plans "in the active and reserve force throughout the program period," General Fogleman said. There are also "improvements to an ever-increasing F-16 CAS-capable force" worth more than $500 million.

"It's not a question of whether I want to hang on to [the A-10s] or not. We have committed to do that," he said.

Shortly after taking over as Chief of Staff, General Fogleman made his own presentation to the Roles and Missions Commission.

"I characterize my presentation as not quite as high drama or good theater as some other presentations," he said. "What I tried to do was give them my own view, given my consultations with the other four-stars" in the Air Force.

"My intention was never to give point-counterpoint with the presentation made by General McPeak." The body of work done by General McPeak was "valuable" and "stands alone," General Fogleman said.

While General McPeak had argued for permitting the Air Force to assume the lead role in all airspace, General Fogleman contended that it should be the purview of a CINC's Joint Force Air Component Commander "whether he be Army, Navy, or Air Force." The ownership of surface-to-air missiles is not that important, he said, "as long as they are responsive to the JFACC."

General Fogleman did raise the issue of how money is divided between the services.

"Attack helicopters are costing between $20 [million] and $25 million a copy," he observed. "That makes them the same price as F-16s." Because the high cost of attack helicopters prevents the Army from buying as many as it would like for CAS, "from a national perspective, since fixed-wing aircraft provide a lot more flexibility to the JFACC . . . we need to leverage this fixed-wing air because it can swing in and pick up part of the load" that Army helicopters would otherwise have to do.

General Fogleman also didn't withdraw the argument that the ATACMS is redundant, essentially duplicating Air Force deep strike capabilities, and should be canceled.

One of his first acts as Chief was to repeal some of the uniform changes made by General McPeak. When asked if he now thinks it will be a tradition that each Chief of Staff alters the uniform, General Fogleman rolled his eyes and said, "I would hope not."

The uniform, he said, was "a personnel and morale issue that needed to be addressed. That's why I moved out quickly on that." It's an issue he hopes "to take off the scope with one last uniform board early this year. We'll get all the uniform items on the table, make some decisions, then disband the board." After that, "for the next few years, we'll be able to focus on other things."

Much has been written about General Fogleman's "style" of leadership ever since his name began appearing on short lists to succeed General McPeak more than two years ago. He has been called a "diplomatic" and a "straight business" general, both by other officers and by those on Capitol Hill.

Asked to describe his style in his own words, General Fogleman modestly declined but said, "I guess of all the descriptions I've read, what I would like to be true, whether it is or not, is that I have a commonsense approach, that I'm open. What you see is what you get. And I think that style is a direct result of the number of years that I've been able to spend as a commander in the field."

This attitude "seems to be what engenders the trust and support of the troops. I would hope it will help me survive in the Washington environment." ■

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In a major new report, the Congressional Budget Office looks ahead and sees funding problems.

The CBO's Air Force

What follows is a condensed version of "The Costs of the Administration's Plan for the Air Force Through the Year 2010," published in late 1994 by the Congressional Budget Office. CBO undertook the study to evaluate the cost of the future Air Force as specified in the Pentagon's 1993 Bottom-Up Review, which in early 1995 remained the Administration's official benchmark for defense planning. Figures are rounded throughout.

UNDER the Clinton Administration's plan, Air Force budgets would decrease through 1999. The Air Force budget in 1995—about $75 billion—will be approximately thirty percent lower than the service's 1990 funding. The budget would decline further to about $70 billion in 1997 and remain at roughly that level through 1999.

The Administration has not published full plans for the years after 1999. Based on the Administration's statements and goals, however, the Congressional Budget Office estimates that the Air Force would need only about $67 billion in 2000 under Estimate A, an assessment that assumes only limited growth in the future cost of weapons (Figure 1). Beyond 2000, CBO projects that Air Force budgets could remain at approximately that level, averaging $68 billion in the first decade of the new century, if weapons costs do not grow.

A somewhat more pessimistic outlook suggests tighter Air Force budgets. CBO made a second assessment, Estimate B, that projects Air Force budgets averaging about $74 billion during the 2000–10 period, or about $4 billion more than the Air Force's 1999 funding level.

The range of costs in CBO's long-run estimates reflects differing assumptions about the cost of new weapons. The $68 billion estimate assumes that prices of weapons bought in the future would not grow above current estimates. It also assumes that spending in funding categories for which detailed plans are not available would remain at previous levels, adjusted for changes in forces.

The higher cost estimates, which are more consistent with past experience, assume that there would be growth in the unit costs of major weapons that program planners do not anticipate. They also assume that spending for such activities as research and nonmajor procurement would grow along with increases in other types of funding.

The Administration plans an increase in Air Force procurement funding over the next five years. CBO estimates that under the assumptions of Estimate A, funding would remain near the planned 1999 level for most of the 2000–10 period. Thus, if the Air Force can hold down costs in ways assumed under

Estimate A, the service could afford to buy relatively few new weapons, including the F-22 aircraft and the F-16 replacement, without real increases in its budget.

If the higher cost estimates prove more realistic, however, the Air Force budget would have to increase in the next decade to finance this new family of weapons. Average annual funding during the 2000–10 period would need to be about six percent higher than the planned 1999 level.

The Administration's Plan

CBO's analysis assumes enactment and execution of the plans set forth in the Administration's Future Years Defense Program (FYDP) for Fiscal Years 1995 through 1999 (Table1).

Strategic forces. As a result of budgetary pressures and two Strategic Arms Reduction Talks treaties, strategic forces—including those of the two triad legs that the Air Force operates—will shrink sharply over the next decade. Through 1999, the largest reduction will occur in the ICBM force, which currently numbers about 670 missiles. By the end of 1995, as the Air Force retires the last of its Minuteman II ICBMs, the force will consist of 550 missiles and the number of warheads on ICBMs will fall from 2,117 to 2,000. The Air Force will procure no new ICBMs during this period, nor does it plan to in the foreseeable future. It plans to spend some $4 billion through 2002, however, to extend the service life of its 500 Minuteman III missiles.

The bomber force also faces turmoil during the next few years. At the end of 1994, the Air Force had a total inventory of 193 bombers: ninety-five B-1Bs, ninety-four B-52Hs, and four B-2s. Of those, only 152 were considered operational (eighty-four B-1Bs, sixty-four B-52Hs, and four B-2s); the rest were in maintenance or some other inactive status.

The Air Force plans to make changes for 1995. Although the service will have virtually the same total inventory of bombers (196), only 140 of them (sixty B-1Bs, seventy-four B-52s, and six B-2s) will be operational—an eight percent reduction from the previous year. Perhaps more important, the composition of the operational force will also change: The Air Force will have twenty-four fewer B-1Bs and ten more B-52Hs. Through 1999, the operational inventory will increase slightly as the last of the B-2s enter the force.

The Air Force plans to reduce the number of operational bombers largely for budgetary reasons, although the decision also reflects post–Cold War changes in threats. From a budgetary standpoint, it is cheaper to keep bombers on inactive status than to fly them. The Air Force will rotate a portion of its force—twenty-seven B-1Bs and twelve B-52Hs—through a status called attrition reserve. Bombers temporarily assigned to this category will be kept at their bases but not flown. The strategy is like that of a two-car family that decides for economic reasons to drive only one of its cars at a time. They save money on gas and maintenance and can use both cars simultaneously again when they have more money to spend. This alternative is attractive to the Air Force because it can save most of the money required to fly and crew a bomber. It also has the advantage of keeping additional aircraft as a hedge against an unexpected threat.

The disadvantage of this policy, of course, is that the Air Force will have fewer bombers available in the short run.

Tactical fighter forces. Tactical forces will decline to twenty wings by 1997. CBO assumes that they will remain at that level through 2010, which seems consistent with the goals expressed in the Bottom-Up Review.

The Air Force's tactical fighter forces consist of six types of aircraft. The Air Force plans to buy two new types of airplanes to replace many of those aircraft in the 1995–2010 period.

The F-22, formerly called the Advanced Tactical Fighter, will eventually replace today's F-15 aircraft

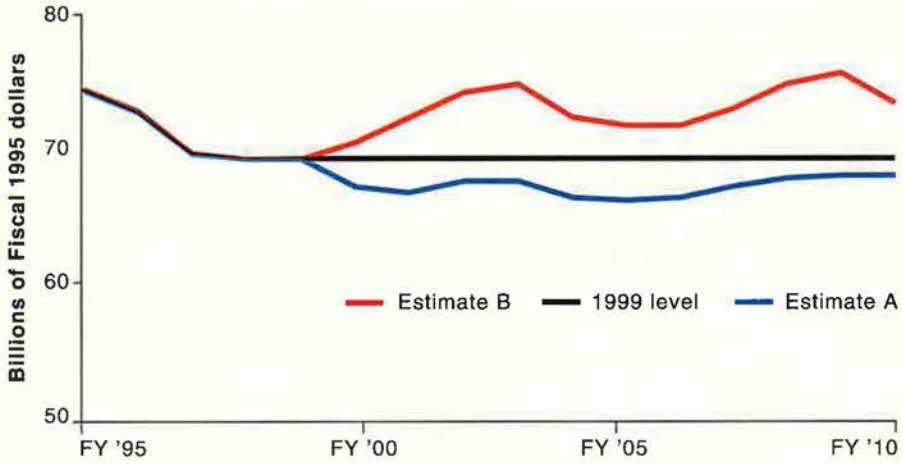
Table 1 **Air Force Budget**

(Billions of Fiscal 1995 dollars)

Appropriations Categories	1994	1995	1996	1997	1998	1999
Military personnel	18.2	19.2	17.6	17.1	16.7	16.7
Operations and maintenance	23.9	23.3	21.3	20.7	20.7	19.8
Procurement	18.4	18.2	19.8	19.6	20.8	22.0
Research, development, test, and evaluation	12.4	12.3	12.1	10.3	9.2	9.0
Military construction	1.2	0.6	1.4	1.2	1.0	0.9
Family housing	1.0	1.1	1.0	1.0	1.0	1.0
Total	**75.1**	**74.8**	**73.2**	**70.0**	**69.5**	**69.5**

Source: Congressional Budget Office, based on DoD data

Figure 1 **Air Force Budget Estimates A and B**



Source: Congressional Budget Office

as the Air Force's premier fighter. Procurement of the F-22, scheduled to begin with four aircraft in 1998, would increase to about forty-eight per year and continue at that level through 2009, according to current plans. The Air Force will complete its planned buy of 442 F-22s in 2010.

The Air Force halted procurement of the F-16 aircraft, which is less expensive and less capable than the F-15, in 1994. The Department of Defense plans to replace the F-16 with one of the aircraft that emerges from the Joint Advanced Strike Technology program. CBO assumes that the Air Force will begin buying JAST aircraft in 2007 at a rate of twelve per year and will increase annual procurement rates to forty-eight by 2010.

The modest procurement of tactical fighters will be roughly sufficient to support all of the Administration's planned tactical forces through most of the first decade of the next century—but only if the Air Force retains airplanes to meet overall requirements (Figure 2). It will not, however, prevent the fleet from aging. Between 2000 and 2010, the average age of tactical fighters—also shown in Figure 2—would increase from about fifteen years to about eighteen years. This is considerably older than the average age of today's fleet—about eleven years.

The Air Force will have to retain aircraft longer than it has in the past to meet these requirements, and it would need to retain some F-111s rather than retiring them all as currently planned. For example, if USAF were to maintain the same goals for certain missions, some F-111 aircraft would be more than forty years old before being retired. Furthermore, more than 200 aircraft—approximately ten percent of the inventory—would exceed currently scheduled retirement ages in 2010.

There is also a significant discrepancy between the types of aircraft the Air Force has in its inventory and the service's estimates of how many it needs for each mission.

Figure 2 **Inventory, Requirements, and Average Age of Tactical Fighter Fleets**

Source: Congressional Budget Office, based on Air Force data

The Air Force estimates that up to twenty percent of its tactical wings should be fighters, such as the F-15A to D models, and at least fifteen percent should be medium-range bombers, such as the F-111 and the F-15E. Multipurpose aircraft, such as the F-16, which attacks other aircraft and flies short-range bombing missions, and the A-10, which performs the close air support mission of attacking enemy ground forces that are engaged in combat with friendly forces, make up the rest of the tactical fleet.

The only aircraft to be bought in quantity during the 2000–10 period is the F-22, a fighter. The Air Force will have enough F-15s through much of this period to make up four wings, or twenty percent of the force. CBO assumes that several hundred fighters will be retired before their service lives are over; otherwise, the Air Force would have more fighters than it needs.

Some Air Force mission categories will be short of airplanes, however, although these shortages would be brought about in part by current retirement strategies. Early models of the F-16—the A/B models—will retire after 4,000 flight hours instead of the 8,000-hour service life planned earlier. Because of these changes in plans, the Air Force will run short of multipurpose aircraft around the turn of the century, well before the JAST program might be expected to produce tangible results. Shortages in the multirole mission will increase to more than 200 aircraft—or more than fifteen percent of requirements—toward the end of the first decade of the twenty-first century, if service lives are not extended.

The Air Force is retiring the venerable F-111 that made up about a third of 1994 interdiction forces. There will be no F-111s in the fleet by 1999. It is understandable that F-111s are being retired, considering their age (an average of about twenty-two years in 1994) and high operating costs (almost $5 million per plane, or about twice the operating cost of an F-16). But the retirement means that the Air Force will have only two wings of interdiction aircraft, rather than the three wings implied by the goal of having fifteen percent of the fleet able to perform the interdiction mission.

Airlift and tanker forces. The

Air Force expects its newest cargo aircraft, the C-17, to replace the aging C-141 as its "core" airlifter—that is, one that meets all of the service's unique military requirements. The Air Force plans to retire the C-141 from active-duty service by 2003 and from the reserves by 2006. Requirements call for the C-17 to carry loads of at least 110,000 pounds for a distance of 3,200 nautical miles without refueling. Like the C-5, its fuselage is large enough to carry such outsize cargo as AH-64 Apache helicopters. It was designed to land on short runways and maneuver easily on the ground.

Congress has authorized the purchase of thirty-two C-17s through Fiscal 1995, and the Air Force would like to buy eighty-eight more. Because the cost of the C-17 program has grown significantly and the program has had difficulty reaching its technical performance goals, however, the Secretary of Defense in December 1993 approved procurement of only forty C-17 aircraft. The Department of Defense may choose to purchase additional C-17s if the airplane's producer, McDonnell Douglas Corp., shows marked improvement in its management of the program. If it does not, DoD may buy commercial wide-body jets or a variant of the C-5 instead.

What mix of cargo aircraft the Air Force will ultimately have within its fleet is not clear. For the purposes of estimating long-term costs, CBO assumed that the Air Force will buy eighty-eight C-17s in addition to those already authorized, at a maximum rate of twelve aircraft a year, or a mix of C-17s and one or more alternate aircraft with combined procurement costs comparable to those of eighty-eight more C-17s.

The Air Force has a fleet of about 400 C-130 aircraft for shorter-range or intratheater transport. The size of this fleet should remain steady through the end of this decade.

Projected Operating Funding

The Administration's plans would affect funds for operating the Air Force. In the 1995 budget, the money for these activities totals about $44 billion. Because reductions in operating funding have been smaller than those in investment accounts, the share of the budget allocated to operations has risen from the 1990 level of about fifty-two percent to about fifty-eight percent today.

Military personnel appropriations. The number of people the Air Force employs and their rates of pay largely determine military personnel appropriations. The number of active-duty military personnel in the Air Force declined in the 1990s, although—as with operating costs—it did not drop as sharply as the forces that military personnel operate. Active end strength dropped from about 535,000 in 1990 to about 400,000 in 1995, a twenty-five percent reduction. The Administration plans to cut the number of active-duty Air Force service members only modestly beyond 1995. Thus, the number of Air Force active-duty personnel would total about 390,000 by 1999.

Cuts in personnel for the reserves—including the Air Force Reserve and the Air National Guard—are even more restrained. Personnel in the Reserve and Guard are expected to decrease from the 1990 levels of 84,000 and 118,000, respectively, to 79,000 and 116,000 by 1995. The Administration plans to cut total reserve end strength by only about 4,000 more positions during the 1995–99 period. As a result of these trends, the reserve share of total Air Force personnel would rise from twenty-seven percent in 1990 to about thirty-three percent in 1995 and remain at that share through the 1995–99 period.

The net effect of these changes is a decrease in overall spending on personnel of about twenty-three percent between 1990 and 1995, or from about $25 billion to $19 billion. By 1999, personnel spending will decline by about $3 billion more, a thirteen percent reduction.

CBO assumes that the real level of personnel funding will remain roughly constant at the 1999 level through 2010. This assumption seems consistent with the Clinton Administration's estimate of the forces it needs.

Operations and maintenance. O&M appropriations constitute most of the rest of the Air Force's operating costs. O&M funds pay for such items and activities as civilian pay, fuel, medical expenses, and maintenance of equipment and facilities. Air Force O&M funding totaled about $29 billion in 1990 and is scheduled to decrease to about $23 billion in 1995. O&M funding in the Administration's plan is scheduled to decrease by about $3 billion more by 1999.

Because most major force changes should be complete by 1999, CBO assumes that the real level of O&M appropriations will stay constant at the 1999 level through 2010.

There is, however, much uncertainty about projected O&M funding, particularly in the next decade. By that time, new pieces of equipment (including the F-22 fighter and C-17 aircraft) would have entered the inventory in substantial numbers. The Air Force has argued that the new equipment has been designed to hold down maintenance needs, which could reduce O&M costs.

Previous patterns—at least for fighter aircraft—do not provide much support for this argument. In addition, some of the new capabilities of the F-22, such as stealth and supercruise, may increase rather than decrease maintenance requirements, and new weapons are generally more complex than those they replace. This could add to O&M costs.

In addition to funds for military personnel and operations and maintenance, the Air Force operating budget includes a small amount of money to provide family housing. Including these funds, the total bill for the operating accounts is expected to decline from $55 billion in 1990 to $44 billion in 1995. Operating funding would drop further under the Administration's plan, to about $38 billion by 1999. CBO assumes that operating funding in all categories will remain constant in real terms beyond 1999 at the 1999 level of $38 billion.

Procurement Funding

Procurement funding is scheduled to decline to $18 billion by 1995, only slightly more than half the 1990 level. The Administration expects to spend more on procurement in the 1995–99 period. Funding would increase to about $22 billion by 1999, a rise of more than twenty percent, reflecting additional money for the F-22, the Joint Primary Aircraft Training System (JPATS), and other systems.

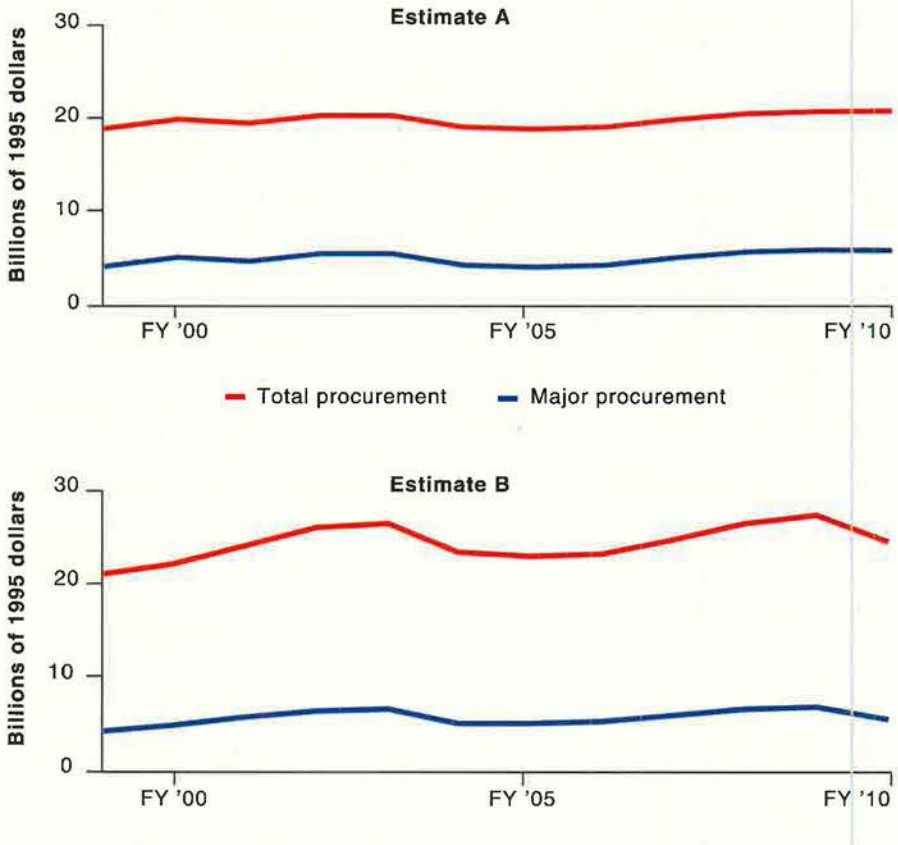
The F-22 is currently in its development phase. As a result, there is no procurement funding for the program in 1995. The Air Force expects to spend more than $1 billion of its procurement account on the program

in 1999. The Air Force also wants to spend about $280 million to buy JPATS trainers for fledgling pilots in 1999, up from $120 million in 1995.

The Air Force has suggested that almost half the 1995 procurement budget (about $8 billion of the $18 billion funding request) funds classified programs and provides dollars for the Special Operations Command and Defense Airborne Reconnaissance Program. By 1999, perhaps $7 billion or more of the Air Force's planned $22 billion procurement budget for 1999 might be devoted to intelligence funding, special operations, and airborne reconnaissance.

In the first decade of the twenty-first century, the pattern of funding depends on assumptions about the costs of various major weapons, particularly tactical fighters, and trends in costs for other armaments. Estimate A—which assumes that steps would be taken to hold down costs—projects that procurement would be at about $20 billion in 2000 (Figure 3). Procurement would then remain at approximately that level in 2002 and 2003 when, CBO assumes, the Air Force would still be buying the C-17 and purchasing the F-22 at peak rates. Funding would dip modestly to about $19 billion in the 2004–06 period before rising to $21 billion at the end of the decade, when CBO assumes JAST purchases will begin.

Figure 3 **Major and Total Procurement in the Air Force Budget**



Source: Congressional Budget Office

Annual procurement funding for the 2000–10 period in Estimate A averages about $20 billion, about $2 billion less than the 1999 funding level. This estimate suggests that the Air Force could absorb modest real decreases in its procurement accounts and still support its program.

Under the assumptions of Estimate B, which are more consistent with past experience, procurement funding would remain near $22 billion in 2000 and rise rapidly to about $26 billion in 2002 and 2003 as F-22 procurement increases and the service is still buying C-17s (see Figure 3). It would decline in the middle of the first decade of the twenty-first century but rise sharply toward the end, reaching a peak of $27 billion in 2009, the last year of F-22 procurement under CBO's assumptions. On average, annual funding would total $25 billion for the 2000–10 period. These trends reflect costs for all systems.

Major weapons. CBO bases both of its estimates on the number of major weapons to be bought under the Administration's plan.

Estimate A. In most cases, the lower estimate of costs assumes that new major weapon systems can be purchased at the unit costs currently estimated by the Administration. These unit costs suggest, for example, that F-22 fighters would cost about $90 million apiece and C-17s cost $260 million (Table 2).

The Administration has not estimated the cost of the aircraft that would emerge from the JAST program to replace the F-16. In Estimate A, CBO assumes that each fighter might cost about $35 million. This would represent an increase of about fifty percent above the cost of today's F-16—substantially less than the smallest increase in the price of a newly designed airplane compared with the price of its predecessor, at least since the 1950s.

Under the assumptions included in the lower estimate, the costs of major procurement would increase from about $4 billion in 1999 to around $6 billion in 2002 and 2003 and then fall back to about $4 billion before rising to about $6 billion at the end of the decade (see Figure 3). Almost all of the costs are associated with tactical aircraft. CBO assumed that there would be no costs associated with buying strategic aircraft or missiles throughout the period because the Air Force has announced no plans to do so. After C-17 purchases are completed in 2003, tactical aircraft procurement will account for all major procurement funding.

Estimate B. Estimate B assumes that costs of the F-22 fighter will rise to a level of about $120 million, roughly thirty percent higher than the Administration's current estimate (see Table 2). The higher F-22 cost is based on previous patterns. Specifically, this estimate applied the ratio between the average costs of

the A/B models of the F-15 and the cost of the F-4, its predecessor, to the costs of the F-15.

The higher cost of $55 million for the JAST is based on Air Force estimates of the cost of an F-21++, a radically modified version of the F-16 considered as an alternative to the F-22 aircraft. The F-21++ had substantial stealth capability and also greater range and enhanced avionics and in fact might have had more capability than the Air Force expects out of the JAST program. Despite these differences, the F-21++ may be a good proxy for JAST progeny because of its stealth capability and relatively modest cost.

Under the assumptions of the higher estimate, procurement costs of major weapons would rise from about $4 billion in 1999 to more than $7 billion in 2002 and 2003. They would drop to about $6 billion in the 2004–06 period and climb to almost $8 billion toward the end of the decade.

Both cost estimates assume that the Air Force purchases the same number of aircraft. There are, however, two major questions about the number of airplanes the Air Force will buy: Will more B-2s be bought, and what will the schedule be for the JAST program?

The future of the B-2. For the purposes of this analysis, CBO assumes no further purchases of B-2 aircraft. The assumption is reasonable because the analysis seeks to investigate the implications of the current Administration's plans and because the Administration has not requested continued B-2 procurement.

Some members of the Congress have discussed buying additional B-2s. The House Armed Services Committee, however, opposed continued B-2 purchases. The conferees provided $125 million in the 1995 budget to study requirements for bombers, preserve the bomber industrial base, or explore concepts for a new bomber. The conferees left the final decision of disposition of the funds up to Secretary of Defense William J. Perry. If Secretary Perry decides to request continued B-2 procurement in next year's budget, substantial additional funds must be found. CBO estimates that buying twenty more B-2s, for example, will cost about $26 billion more than the funding in the current plan—$10.3 billion more during the 1995–99 period and $15.7 billion in 2000 and beyond.

JAST schedule. CBO also assumes that to replace older F-16 aircraft, the Air Force would buy about 120 of the model that is expected to emerge from the JAST program during the latter part of the next decade. That schedule would leave the Air Force with sizable shortages of the aircraft that make up the multirole mission, unless service lives are extended.

In order to meet mission level requirements, the Air Force must retain about eighteen percent of the multirole fleet beyond expected retirement dates. Furthermore, aircraft in that fleet will be an average of about twenty-two years old, double the Air Force's expressed goal of about eleven years for tactical fighters.

It is possible, however, that diminished threats to US security will permit the Air Force to retain its F-16s much longer than twenty-two years. That figure is based on the assumption that after about twenty-two years, maintaining technological superiority over potential enemies would require a new airplane. It seems highly unlikely that any country now viewed as a threat could develop airplanes rivaling the capabilities of today's US aircraft and field them in significant quantities.

Nonmajor procurement. In addition to buying major weapon systems, such as strategic bombers, tactical fighters, and missiles, Air Force procurement budgets pay for other items, such as satellites, communications equipment, trucks, bombs, and spare parts. Many of these items represent relatively small amounts of money. For example, the "other procurement" account in the 1991 budget request contained almost 200 line items, only four of which cost more than $100 million.

Detailed plans for many of these weapons are not generally available to the public. Thus, the costs of nonmajor procurement cannot be estimated in the same way as those for major weapon systems. Instead, CBO's estimates of nonmajor procurement are based on general relationships that differ between Estimates A and B.

The higher estimate of the costs of nonmajor procurement may also be consistent with the potential for growth in the number and cost of spacebased assets. As the United States comes to rely more heavily on space for communications and other military purposes, the costs of assets related to activities in space could rise. Because the long-term plans for deployment of these systems are highly uncertain, highly classified, or both, these systems are included as nonmajor procurement items. Sharp growth in the cost of these systems would push the Air Force budget toward the assumptions of Estimate B.

CBO assumes that during the next decade, all major Air Force procurement will be devoted to tactical aircraft. This is consistent with service and Administration statements. Nevertheless, the Air Force has never before had the luxury of devoting so much of its funding to tactical aircraft, and other requirements could arise during this period. ■

Table 2 **Average Unit Procurement Costs for Air Force Systems**

(Millions of Fiscal 1995 dollars rounded to the nearest $5 million)

Aircraft	Estimate A	Estimate B
F-22	90	120
JAST	35	55
C-17	260[a]	260[a]

[a] $295 million including sunk costs in 1994 and previous years

Source: Congressional Budget Office, based on DoD data

Information may be the most fearsome weapon on the emerging techno-battlefield.

Information Warfare

By Peter Grier

IN THE early years of the twenty-first century, the most feared and important weapon in the US arsenal will not be a high-performance fighter, bomber, tank, or warship. It will be the vast torrent of data spewed out by revolutionary information systems.

So say top planners in the Pentagon and services, who are focusing with new urgency on the possibilities of "cyberwar."

Civilian officials and uniformed officers alike assert that the advent of advanced surveillance technologies, blindingly fast computers, sophisticated information networks, and highly precise seeker and guidance packages is destined to change the face of warfare profoundly, permanently, and soon. The impetus comes from current efforts to harness a global explosion in information technologies.

Information warfare may be "the most important facet of military operations since the introduction of stealth," claimed a Defense Science Board blue-ribbon task force formed to look at information architecture for the battlefield.

Those who have taken a close look

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at the possibilities maintain that US forces will be able to exploit their information superiority to paralyze a larger military opponent or rapidly destroy his forces and infrastructure, with startling speed and economy.

The military quest for accurate information is nothing new. Gaining an accurate picture of the foe and his intentions always has been crucial for commanders. However, officials say information warfare portends something altogether different from anything yet seen, even the high-tech successes of Operation Desert Storm.

Accurate and Lethal

For the Air Force, information warfare likely will be characterized by weapon accuracy and lethality far surpassing that of today's laser-guided bombs and missiles. Situational awareness—whether it pertains to air or ground combat—would be extremely exact.

Such mobile targets as Scud missile launchers, for instance, could be attacked by directly linking target data from satellites to individual pilots and their munitions. Small supercomputers on board fighter aircraft could process and display information from other aircraft, radars, and space assets—turning every plane into mini–Airborne Warning and Control System (AWACS) aircraft.

"The senior leadership of the Air Force has spent a lot of time on this and thinks it's very important," reported Maj. Gen. Robert E. Linhard, USAF's director of Plans in the office of the deputy chief of staff for Plans and Operations.

In a broader context, "info war" might change the very nature of struggle between societies. Nations could wreak havoc by directly attacking each other's important civilian computer and communications systems. In this kind of attack, subversion might be more effective than simple destruction.

"What would happen if you took Saddam Hussein's image, altered it, and projected it back to Iraq showing him voicing doubts about his own Baath Party?" asks Thomas Czerwinski, a professor in the School of Information Warfare and Strategy at the National Defense University in Washington, D. C. He adds, "That would be a kind of information war."

The explosive development of commercial computers, software, and communications technologies has brought such an electronic "attack" into the realm of possibility. It does not take the free-floating imagination of a futurist to realize that such breakthroughs as direct-satellite TV broadcasts, morphing software, commercial satellite imagery, and supercomputers-on-a-chip all have possible military applications.

At a minimum, "information warfare" means the emergence of greatly improved methods of command, control, and communications. It means thinking about a military organization as a network of networks, rather than a traditional general officer–directed hierarchy. In this sense, information warfare is a hot topic in the Pentagon, with services scrambling to draw up doctrines and some officials in DoD's leadership pushing for even more rapid progress.

The Big Box

Adm. William A. Owens, vice chairman of the Joint Chiefs of Staff, is one of the strongest voices calling for consideration of what he views as a broad technical revolution in equipping and training the US military of the twenty-first century.

The Admiral foresees advanced information systems enabling US commanders to know virtually everything relevant that is happening in an enormous battlefield area 200 miles square.

"I'm not just talking about information warfare," said Admiral Owens at a meeting with defense reporters. "I'm talking about a whole bunch of stuff—satellites and airplanes and UAVs [unmanned aerial vehicles] and battle links between these things and distributing information." According to Admiral Owens, the linking of this new information network with such weapons as B-2 Stealth bombers armed with precision guided munitions and the Army Tactical Missile System would greatly multiply the effectiveness of US forces against, say, an armored division located in the 200-square-mile box.

Joint warfare would take on increased importance, said the Admiral, arguing that no single service could expect its fighting units to perform well in such an information-directed manner by itself.

Accordingly, Admiral Owens has pushed the Joint Requirements Oversight Council, a multiservice panel he heads, into the business of examining which weapons should be purchased in coming years to make this military-technical revolution a reality. It is a controversial step, one that treads to some degree on the traditional responsibilities of service leaders.

This thinking needs to be done now, according to Admiral Owens, because major systems—the Milstar communications satellite, the E-8 Joint Surveillance and Target Attack Radar System aircraft, the upgraded E-3 AWACS aircraft, UAVs, and the like—will determine the nation's information capabilities well into the early decades of the next century.

The proponents of joint information warfare contend that each service has paid inadequate attention to methods of sharing information gathered by the others' surveillance assets. Admiral Owens, for example, said he is concerned about getting data from an E-3 AWACS quickly to an Army battlefield commander, who could use such information to help prepare his own air defense and protect his units from attack. Translinking information from a U-2 spy airplane to a Joint STARS aircraft to a submarine presents a major challenge as well, he added.

"The JROC has done a lot of work in this business of integrating cross-links across systems," said Admiral Owens. "We've also got to look at the platforms we're buying now and ask ourselves if we're going to be satisfied with them" in the future.

Some traditionalists in the military services have not exactly welcomed Admiral Owens's efforts. For one thing, they feel that equipping and training troops is properly their business, not that of the Joint Staff. For another, some think that the Admiral and other info war believers are putting far too much trust in the fast upward march of technology as a means of preserving the edge of an ever-shrinking US military.

In a recent speech at the Heritage Foundation, a think tank in Washington, D. C., Adm. Jeremy M. Boorda, the Chief of Naval Operations, asked a pointed rhetorical question that seemed directly aimed at Admiral Owens: "Can you actually have a battlefield 200 miles by 200 miles where you know everything about it?" The CNO answered his own question, "Maybe someday we will, but I don't think it will be anytime soon."

More Money, More Attention

Whatever the pace of change, it is clear that information operations are going to see increased money and attention in the Pentagon in coming years. The Persian Gulf War, in which an almost-blind Iraq was at the mercy of well-informed US attacks and maneuvers, proved that modern militaries ignore the information-gathering revolution at their peril. Military officials believe that information increasingly is becoming the currency of true military and economic power.

"It's natural for us to think about information in the context of that strategic importance to us," observed Maj. Gen. Kenneth A. Minihan, Air Force assistant chief of staff for Intelligence.

Air Force experts say that the technological basis of information warfare is changing so fast that the service does not fully understand it. They say the situation is similar to that at the end of World War II, when it took years to adapt military doctrine, plans, and organizations to the far-reaching new technology of nuclear weapons.

However, Generals Minihan and Linhard both say that a prominent feature of future information warfare will be "virtual battlespace," defined as the "ether" occupied by communications impulses, databases, and computer codes. Operations in this battlespace will be offensive and defensive. For the Air Force, the very meaning of the word "operator" may subtly change as operators begin to roam not only in actual space but also in virtual space.

General Linhard explained, "For us, information warfare is any action that we may take to deny, exploit, corrupt, or destroy an enemy's information and its functions, while protecting those actions, those functions, for ourselves."

This concept has several basic implications for the service, according to Air Force officers. One, they stress, is that information warfare has become an important subject of study for top leadership. USAF held a summit on this subject last summer, involving all general officers.

A second basic point, said General Linhard, is that the Air Force will have to figure out how to coordinate info war approaches with the Army and Navy, which are also looking at the subject intently. The Army has already issued an info war doctrine that forms the philosophical underpinning of its plans for a digitized battlefield.

"IW must be addressed by each of the military services separately and jointly," said General Linhard.

Finally, top Air Force officers are determined to prevent IW from mutating into a new service "stovepipe," separated from other commands and units. They say that IW systems, planning, and training should naturally permeate the planning process and conduct of all operations.

A current Air Force draft concept paper sweeps across all aspects of doctrine, calling for information war links between command-and-control warfare, psychological operations, electronic warfare, and so forth. One item on the "to-do" list that emerged from last year's Air Force summit was the task of figuring out how to integrate training on the subject in the service's educational institutions.

"You're going to want to see relationships between Keesler, say,

where we do computer training, and Goodfellow, where we do intelligence training, and then Randolph, Nellis, et al.," said General Minihan. Keesler AFB, Miss., Goodfellow AFB, Tex., and Randolph AFB, Tex., are Air Education and Training Command bases; Nellis AFB, Nev., an Air Combat Command base, is a prime operational training site.

A New Frontier

Air Force students should take naturally to the concept of information war, according to the service. Though the concept may sound somewhat futuristic to older service members, the younger ones—raised on computers and video games—find it familiar. "It's fair to think of it as a new frontier," said General Minihan.

What will this frontier look like in the first decades of the next century? Will military organization and weapons be radically different?

According to a recent study by RAND Corp., IW ("cyberwar" in RAND terminology) may imply a more decentralized command-and-control structure both within and between the military services. Paradoxically, higher military headquarters might also be able to exercise greater control over operations via info war, according to the study. That is because the new technology may also make possible a greater "topsight" or true understanding of the big picture.

New cyberwar doctrines might need to address such basic questions as where and how to place various kinds of sensors, computers, databases, and so on, said RAND researchers. Thinking about the deployment of information assets and support equipment, in this sense, might be similar to past planning for deployment of warplanes or tanks.

Information war, after all, may be a whole new way of fighting, as different from past modes of combat as the Japanese board game *go* is from chess. "In chess, you have clear front lines, with a heavy emphasis on maneuver," said David Ronfeldt, a coauthor of RAND's cyberwar paper. "If you can get to the king, the central object, the game's over."

"*Go* has no front line," Mr. Ronfeldt continued. "It is more about position than maneuver. Individual pieces are less specialized, and there is no king. Cyberwar is more about *go* than chess."

Study the Mongols

Cyberwar advocates readily acknowledge that victory in conflict via superior manipulation of knowledge is not a new concept. History is full of examples where outnumbered forces bested their foes through information strategies. The Mongol hordes, noted RAND, were often far smaller than standing armies they opposed, but Mongol leaders made a point of locating an opponent's forward dispositions and then avoiding them. They attacked when and where they wanted to and employed fast horse messengers to keep their own commanders in communication with each other and the Great Khan.

The mounted Mongol tribesmen were more maneuverable than their opponents, but that was only part of the secret of their success. Even a slow-moving force can best a fast-moving enemy who is largely blind. Mongol leaders employed cyberwar principles, which hold that neither mass nor mobility decides conflicts.

"Instead, the side that knows more, that can disperse the fog of war yet enshroud an adversary in it, will enjoy decisive advantages," said the RAND cyberwar study.

One controversial claim for cyberwar is that employment of these principles might allow the US to maintain its ability to defeat any possible regional foes even while continuing to shrink its forces.

Cyberwar against a regional aggressor, for example, might well follow what RAND calls a "Pusan-Inchon" pattern. First, an aggressor's attack would have to be blunted. This burden would fall heavily on the Air Force with its ability to kill a foe's logistics and communications ability. American airpower would then have to continue mounting its blinding attacks, in a kind of expanded version of the Desert Storm air war.

If a foe is truly blinded, said the RAND analysts, then even a small US force ought to be able to counterattack where least expected, destroying an invader's ability to fight cohesively. "As the Mongols defeated an army some ten times their size in the campaign against Khwarizm, so modern cyberwarriors should be able routinely to defeat much larger forces in the field," concluded the RAND paper.

Defeating an armed force on the battlefield may be only one level of information warfare. As modern societies become more and more computer- and information-dependent, they become more vulnerable to manipulation of this information by unfriendly nations or even terrorists.

What would happen, for instance, if a terrorist blew up the computers that run the New York Stock Exchange? Seized control of network TV satellite uplinks and began broadcasting propaganda? Destroyed satellite ground stations that handle military and civil communications traffic?

"We have more assets than anybody else, so we're more vulnerable," said Mr. Czerwinski of the National Defense University.

This flip side of information warfare could offer new vistas for a determined foe of the US. The electronic revolution, after all, has in some ways put much greater lethality within reach of the average despot. Navstar Global Positioning System satellite data are now widely available to anyone who can buy a cheap receiver. As Mr. Czerwinski noted, a Piper Cub packed with high explosives and guided by GPS electronics could be viewed as a poor man's cruise missile.

Information warfare might thus best be seen as something that spans a whole spectrum of conflict, from command-and-control warfare to terrorism to defense of the high-tech systems that are the foundation of the American economy. It's a struggle that the US cannot really choose to avoid, any more than it could wall itself off from the developments of the civilian computer industry that have brought about this new kind of conflict.

Said John Alger, an information warfare professor at NDU, "Once the genie is out of the bottle, it can't be put back in." ■

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The idea of putting the troops on overseas tours without their dependents has been tried before. It doesn't work.

The Unaccompanied Airman

By Bruce D. Callander

OVER the past year, both chambers of Congress briefly considered bills that would have barred most military dependents from Europe. Neither measure made much headway, but the notion of putting American troops on one-year unaccompanied tours could be increasingly attractive to cost-conscious lawmakers.

Sen. Dianne Feinstein (D-Calif.), who introduced the short-tour proposal in the Senate, quoted the Congressional Budget Office as saying the measure would enable taxpayers to avoid $1.5 billion in costs they would otherwise incur through 1999.

Senator Feinstein also cited a 1989 RAND Corp. analysis that cataloged many problems associated with dependents living abroad. These problems ranged from the constant need to find employment and child support for such dependents to evacuating them in time of crisis.

Service officials worry that such claims, coupled with the promise of big savings, in time will have strong appeal for other economy-minded lawmakers. Understandably, military officials oppose the idea. Any move to unaccompanied tours would create more problems than it solves, they say, and rather than save money, it would increase costs in the long run.

The biggest concern voiced by the services is that such a move would be a killer for troop morale. This is not just a vague sense of what might happen. They can cite a time when it actually was tried and turned out to be a major failure.

Early in the Kennedy Administration, the services were told to send more unaccompanied members to Europe. The reasons were the same as those put forward by Senator Feinstein: Having families abroad was costly and, because of high international tensions, risky. Within a few months, however, the Pentagon was forced to rescind the order. The services found that the move not only was threatening morale but also was affecting retention rates.

The Cost of Quality

Ever since that fiasco three decades ago, dependents have been allowed to accompany the US service member to all but the most remote locations. Every administration has accepted the associated costs as a price of maintaining high-quality forces.

Keeping families together can be a logistical headache in military life, but experience shows that investing the money and effort in accompanied tours is more than worth the return in troop morale and readiness—and family harmony.

Photo by Paul Kennedy

Though cost-cutting is a major incentive for going to unaccompanied tours, it is not clear whether the move would save money in the long run. USAF personnel officials claim that costs shape up to be higher under a short-tour arrangement. Any savings from not having to support dependents would be offset by having to move troops more often, they argue. Dependents (and their household goods) would have to be moved wherever they wanted to go in the continental US, and dependents would receive family separation allowances.

The CBO counters that argument with one of its own, asserting that some of the transportation costs could be reduced by moving whole units together, on short tours or on short periods of temporary duty (TDY).

Again, USAF personnel officials say the savings are illusory. They note that a 1994 Air Force study looked at various unit rotation scenarios and found that all of them would be more expensive than sticking with longer, accompanied tours. Not only would they raise training and transportation costs, said the Air Force, but they also would weaken mission capability and readiness.

Moreover, say the personnel experts, the adverse impact on morale and retention would be much the same whether members were sent abroad on unaccompanied tours as individuals or as part of a unit rotation.

When it comes to discussions of morale, the Defense Department can cite a historical precedent to bolster its case. DoD officials note that in the days when Strategic Air Command was the dominant organization within the Air Force, SAC managed its own overseas deployments. For years the command relied heavily on unit rotations and TDY. Dependents dutifully stayed home and waited.

In time, family problems mounted, and the divorce rate among SAC members rose dramatically. As retention dropped, command officials realized that frequent and prolonged separations had become a major irritant that threatened SAC's all-important readiness levels. SAC eased off on its deployment pace and reduced the frequency of rotations and TDY. Morale improved greatly.

Emotional Stress, Family Woes

Some family separations are inevitable and have an impact. USAF officials say that morale and retention problems are greatest among members on the short, unaccompanied tours that the Air Force still must maintain in some locations.

Statistically, the problems show up most often in the specialty codes with what officials call "unfavorable rotation indices." In short, they say, members whose skills are in greatest demand in short-tour areas have the highest incidence of emotional stress, financial difficulties, and family problems.

Ironically, the proposals to save money by shortening European tours have surfaced at a time when the Air Force plans to save money by doing exactly the opposite. USAF's overall game plan is to cut costs by reducing the number of permanent change of station (PCS) moves. This has been hard to do in a period when the drawdown and Air Force reorganization have engendered base closures, unit consolidations, and mission changes.

The service wants to hold members in place longer, not just to save money but also to reduce turbulence. Shortening overseas tours would run counter to that effort by lowering the

average time on station and forcing members to move more often, say Air Force personnel experts.

Even if Congress backs away from further efforts to limit dependents abroad, family separations will continue for another reason—the frequent use of US military forces for limited foreign policy purposes.

At present, military dependents are barred from only one major USAF overseas installation (Kunsan AB, South Korea) and the Air Force's few remote locations. They are allowed to take up residence at all other bases, although support facilities and other considerations may limit the numbers. In recent years, a more frequent cause of family separations has been the growing number of "Palace Manning" requirements. These are short deployments ordered by the White House for humanitarian, peacekeeping, and other nontraditional missions.

In 1991, the Air Force Military Personnel Center managed 1,450 such moves. In 1992, the number doubled. By 1993, the total reached 12,500. It climbed again last year. AFMPC expects to handle some 16,000 moves during 1995—and Air Force officials report that the number of such moves represents only about one-third of the total USAF contingency requirements.

"Unfortunately," says one USAF personnel planner, "the downsizing of the military, coupled with the increase of humanitarian and peacekeeping missions, will continue to drive the numbers of contingency TDYs."

Like unaccompanied tours, such assignments bring about family separations and associated problems, but there is some difference between the two. Dependents are more likely to accept the need for deployments if these deployments are short, well-defined, and backed by the public as being in the nation's best interest. They are less likely to buy the idea of being barred from bases in Europe—and proximity to a spouse or parent—just to save the taxpayers money, particularly in places that traditionally have been open to dependents.

Overseas Pullback

One reason for the rise in contingency deployments is the steep decline since 1987 in the number of Air Force troops based overseas. In that year, almost 158,300 members were permanently assigned abroad. In 1994, that total was down to about 88,500, and projections call for it to drop to about 78,300 by 1998.

Withdrawals have been modest in the Far East. In 1985, the Air Force had about 16,500 members based in Japan and still had almost 15,800 in 1993. Totals in Korea have dropped only from 12,000 to about 9,000.

Elsewhere, however, the withdrawals have been dramatic. Where USAF had almost 40,800 troops assigned to Germany in 1985, it was down to fewer than 18,000 last year. With the closure of bases in the Philippines, Air Force totals there dropped from more than 9,000 to eight. In Spain, the reduction was from 5,220 to 245. In Turkey, the number fell from 4,000 to just over 3,000. Sharp cuts brought USAF's strength in the United Kingdom down from almost 28,500 to barely 12,200, and forces in the Netherlands shrank from 2,000 to fewer than 400 over the nine years.

Despite the strength changes overseas, tour lengths in most areas have remained much the same. In both Europe and the Pacific, the stays at most major installations last for thirty-six months when accompanied and only twenty-four months when unaccompanied. The main exceptions are Guam and Incirlik AB, Turkey, where tours are twenty-four months with kin and fifteen without. In South Korea, those assigned to Osan and Kunsan ABs serve twelve-month tours. Kunsan does not allow dependents, but Osan permits them on twenty-four-month accompanied tours.

During the drawdown, the percentage of those on accompanied tours also has remained about the same for officers, but they have deteriorated slightly for enlisted members. In 1985, about 87.1 percent of officers and 85.8 percent of enlisted men and women overseas were on accompanied tours. In 1994, about eighty-seven percent of the officers were accompanied, but only about 82.7 percent of the airmen.

While the number of members assigned overseas is down to about one-half the 1984 total, the dependent population abroad is down by only about thirty-seven percent. This is because the active force has shrunk by about one-third during the drawdown, but the number of dependents has dropped by only a fourth.

Although there are fewer members in service, higher percentages have families. In 1984, 75.2 percent of officers and 60.8 percent of enlisted members were married. In 1994, the force was made up of 76.7 percent married officers and 67.2 percent married airmen.

Over the same period, the percentage of women in the force also increased, from eleven percent to 15.2 percent for officers and from 11.8 to 15.7 percent among airmen. Many of the active-duty women also are married, with a sizable number of them married to other service members.

Special Problems

The total number of couples in which both spouses are in service has dropped during the drawdown, but their ratio to total strength has remained about the same. In 1994, the Air Force had 3,964 such couples, and they made up about 1.9 percent of the force—about the same as in 1985, when there were more than 5,000 such couples.

Such couples pose a special assignment problem for the Air Force. Since the mid-1950s, it has allowed spouses to serve in the same locations when possible. As the drawdown gathered pace, officials began to worry that they might not be able to continue this "join spouse" policy. The problem is not only that the number of assignments is shrinking but also that many of the spouses in such marriages are moving into higher grades. Officials fear it will be increasingly difficult to find them two slots at the same place.

Even so, officials say, it still is policy to keep military couples together at both US and overseas locations whenever possible.

In one sense, assigning in-service spouses to the same overseas base poses fewer problems than assigning a member with a civilian spouse and children. Military spouses can use the same support facilities, and neither has to worry about finding a job locally. In the case of civilian dependents, the Air Force has to provide greater support, and it has drawn fire for the cost of doing so. Members of Congress who support limits on dependents in Europe say, for example, that the overseas bases must provide day care for dependent children.

Officials argue that the day-care programs abroad are much the same

Disruption as a Fact of Life

However frustrating overseas duty may be today, it still marks a major improvement over what members faced when the Air Force was in its infancy. Particularly for enlisted members, overseas tours then were a major cause of discontent.

Until the 1950s, Air Force dependents were not allowed anywhere abroad and airmen were given at most two weeks' notice of reassignment. They were ordered not to a specific location but to a general area and often spent the time en route doing administrative or "housekeeping" duties. Later, when dependents were allowed to join them, it was on the condition that the member first line up housing on base or on the local economy.

Until the mid-1960s, there was no system to prevent airmen from being assigned to back-to-back short tours, nor was there any requirement that they serve a given time on station between tours. In fact, until it began to automate its records, the Air Force kept little track of the number and kind of tours pulled by its enlisted troops.

Over the years, the Air Force adopted a succession of initiatives to make the assignment process less odious. The "join-spouse" policy was adopted in 1955, the "base-of-choice" policy in 1956, and the rule counting some US assignments as isolated in 1972. In 1973, the Air Force began allowing airmen in the same skills to trade overseas assignments. A year later, it adopted the policy giving enlisted troops follow-on assignments when they went overseas; in 1976, it launched the home-basing system to allow them to return to their former stations.

Such policies, most of them adopted to address personnel gripes and to improve retention, have given airmen more say in their assignments and eased some of the hardships on families.

Still, overseas duty remains a fact of service life. As the US responds to flare-ups in scattered parts of the world, its members can expect short-notice deployments and family disruptions.

as those provided by Stateside bases. Presumably, if dependent children remained at the member's former base, they would be eligible for the same care.

Finding jobs for dependent spouses is another problem that critics say argues against having families in Europe. Air Force officials admit that it is a concern and that the problem has grown with the drop in the value of the dollar against foreign currencies. Where families once looked forward to living well abroad on their military pay, many now find that they can't make it unless the dependent spouse also finds work.

Officials contend that overseas Family Support Centers have programs to deal exclusively with helping spouses find employment. In addition to opportunities in the local economy, they say, some jobs are tied to military-related agencies, such as overseas schools, base exchanges, and nonappropriated-fund agencies.

Still, say the critics, maintaining an adequate quality of life for dependents overseas can be difficult, even with two incomes.

Officials agree that conditions vary by location, but they argue that keeping families together, even in less desirable areas, is preferable to subjecting them to long separations. Life is not easy for a spouse who is left alone in the United States to maintain a household and care for children. Besides, USAF personnel experts say, an overseas tour remains an enriching experience for most service families.

Evacuation Plans

As for the safety of dependents, the Air Force says it is ready to deal with any contingencies likely to arise. During the Cold War, it developed evacuation plans throughout Europe and rehearsed them regularly. In the drills, dependents assembled on flight lines and went aboard transports, presumably the same ones that would bring in new troops. Everything except the actual takeoff for a safe haven was rehearsed in detail.

During one of the periodic US-Cuba crises in the 1960s, dependents were pulled out of Guantanamo Bay Naval Base quickly. During Operation Desert Storm, families were evacuated from Incirlik AB, Turkey. Both moves went smoothly, and similar strategies are in place in today's potential trouble spots.

An individual member's chances of being assigned overseas probably have decreased in recent years. The fact that overseas authorizations have dropped faster than total strength means that most members should have more time in the US between overseas tours. Statistically, too, those who are assigned face roughly the same chance of taking their dependents.

Those numerical odds break down, however, under a variety of circumstances. As already indicated, for example, the number of TDY deployments is increasing as the number of PCS assignments drops. For specific members, there are also the questions of skills and qualifications. With all its reorganization, the Air Force still must assign against requirements for specific specialties and experience levels. Where possible, it takes personal preference into account, but the overriding factor is the need of the service.

In the past, this has led to uneven assignment policies and some irritation among the members involved. Remote radar sites, for example, often used skills that were in less demand at US bases, and such specialists could expect repeated assignments to areas where dependents were not allowed.

At one point, the Air Force tried training members, particularly airmen, in two specialty codes, one for CONUS assignments and the other for use overseas. Results were mixed.

Automation has reduced the need for manning radar sites, but service members in other overseas-unique skills still face multiple short tours. USAF tries to limit the number and frequency of undesirable assignments and to give members more US time between short tours. Again, however, it cannot assure that everyone will be able to take his or her family on every assignment. Some still will face short-tour requirements and, from the forecasts, it appears that increasing numbers will be vulnerable for short-notice deployments. ■

Bruce D. Callander, a regular contributor to Air Force *Magazine, served tours of active duty during World War II and the Korean War. In 1952, he joined* Air Force Times, *becoming editor in 1972. His most recent article for* Air Force *Magazine, "New Concepts for the Force Mix," appeared in the December 1994 issue.*

Amid changing missions, T-1A instructors train USAF's future tanker and transport flight crews.

Texas Jayhawks

Photographs by Paul Kennedy and Guy Aceto, Art Director

Staff photo by Guy Aceto

At the 99th Flying Training Squadron, Randolph AFB, Tex., Air Force pilots learn to become flight instructors for the tanker/transport portion of specialized undergraduate pilot training (SUPT). The T-1A Jayhawk is their classroom.

Photo by Guy Aceto

Delivered to USAF in 1992 as the first new training aircraft procured in thirty years, the T-1A originated as the Beech 400A business jet. Modifications for the Air Force included cabin-mounted avionics, a single-point refueling system with greater capacity, increased birdstrike protection, and leading edges for sustained low-level operation.

Photo by Paul Kennedy

Photos by Guy Aceto

Instead of nine business people, the Jayhawk now seats a student on the left, an instructor on the right, and another student in the back (above). Instructor training with the jet began at Reese AFB, Tex., in 1992. The first T-1A arrived at Randolph in May 1993. In August 1993, the first class making the transition from the T-38 to the T-1A began. Before the advent of the Jayhawk, all students learned on the T-38 Talon, regardless of which aircraft type they would later fly. The T-1A allows the Air Force to focus their instruction on tanker and airlift skills.

Center right, Capt. Jason DuLaney, a 99th FTS instructor, covers the basics as he checks out his aircraft. He'll soon begin talking to assistant crew chief Amn. Dennis Benitez (bottom photo) through his headset as they spool up the engines for another mission.

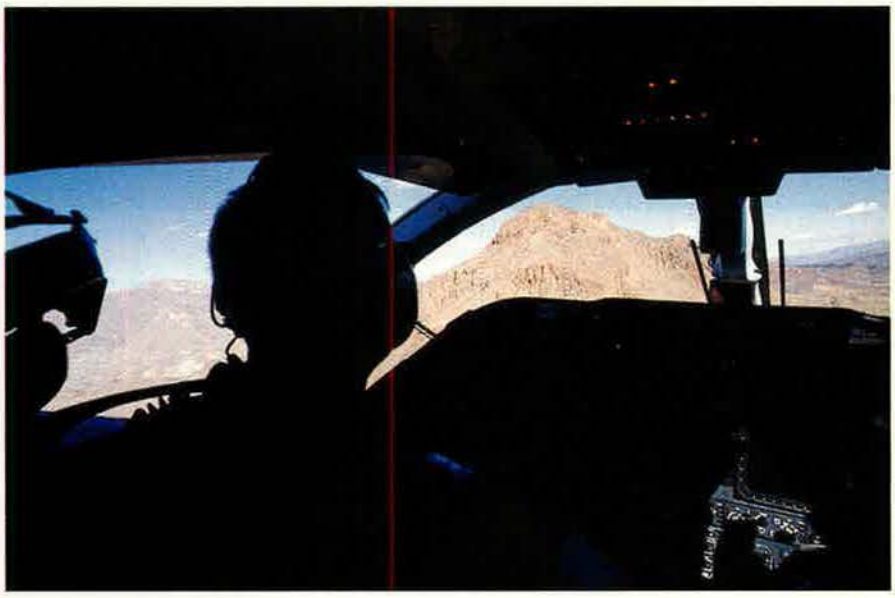
Photos by Paul Kennedy

The T-1A instructor course lasts sixty-six flying days. The graduates will go on to teach SUPT courses that last 125 days. Training sorties with the Jayhawk average 2.5 hours but can last up to four hours. Simulated low-level airdrops for the future transport pilot instructors and air-to-air refueling sorties for the tanker pilot instructors give them a good feel for the kinds of missions their students will routinely fly. T-1A training also emphasizes cockpit resource management (CRM)—communication and coordination among the crew.

"The avionics display and the capabilities that we have on this airplane are a cut above just about anything that is out there," says instructor pilot Capt. Stan Masters. Nevertheless, Capts. Greg Church and Darren Miller (center photo) also use the old-fashioned Mk. 1 eyeball to spot another T-1A during a tanker refueling exercise. The only item missing from their training scenario (top) is the boom. As for simulating an airdrop, says Captain Masters, "the only thing we don't have is the bundles coming out."

Photo by Guy Aceto

Learning to fly is the easy part, say the instructor pilots. Employing the array of technology in front of you is the real challenge. A state-of-the-art flat panel multifunction display allows the flight instructor to call up and combine "pages" for various scenarios. Those who go on to the C-17 or other new aircraft will be well prepared after training in this cockpit. Those headed for KC-135s, C-141s, or C-5s will have no problems adjusting to the analog aircraft, especially because the older airframes are gradually gaining more modern flight management systems. The Jayhawk stands ready for change, with space for GPS or other advanced avionics.



Photos by Guy Aceto

The last seven rides in the Jayhawk curriculum are demanding profiles oriented to the field to which the student will go. Above right, Captain Masters hugs a valley during an airdrop run. The low-level routes in west Texas, snaking through valleys, around mesas, and above the plains, are good practice for low-level drop missions. Having to fly such terrain while keeping an eye on the speed and time to the drop zone highlights the importance of CRM. A good map helps, too. Capt. Jim Plotz, a 99th FTS instructor, checks his map to locate landmarks around the drop zone.

Photo by Paul Kennedy

With USAF now flying an increasing number of humanitarian airlifts worldwide, producing top-notch transport and tanker pilots has become even more important. Above, students and instructors head out to their "classrooms" early in the morning at Randolph AFB. Captain Masters (right) tells his SUPT students to place a set of wings where they study and look at them whenever they feel like goofing off. He asks students, "How badly do you want them? If you tell me you want them, there's nothing I won't do to make sure you get the instruction and . . . the training you need to get them." After completing the teach-the-teacher program with the 99th FTS, the instructor pilots will head out to T-1A squadrons at Reese and Laughlin AFBs, Tex., Vance AFB, Okla., and Columbus AFB, Miss. Their experience at Randolph AFB will help them train pilots who can move into the operational world quickly.

Photo by Guy Aceto

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Deputy Secretary of Defense
John M. Deutch

Asst. to the Secretary of Defense for Public Affairs
Kenneth H. Bacon

Principal Dep. Asst. to the Secretary of Defense for Public Affairs
Clifford H. Bernath

Dep. Asst. to the Secretary of Defense for Public Affairs (Information)
Dennis R. Boxx

Dep. Asst. to the Secretary of Defense for Public Affairs (Communication)
William B. Blacklow

Deputy Inspector General (Acting Inspector General)
Derek J. Vander Schaaf

Inspector General (nominated)
Eleanor Hill

General Counsel
Judith A. Miller

Principal Deputy General Counsel
Steven W. Preston

ASD for Legislative Affairs
Sandra K. Stuart

DASD for Legislative Affairs
Rear Adm. Richard Kirkland, USN

Command, Control, Communications, & Intelligence

ASD for C^3I
Emmett Paige, Jr.

PDASD for C^3I
Barry Horton

DASD for C^3
Deborah Castleman

DASD for C^3I Acquisition
Tony Valletta

Director, Counterintelligence & Security Programs
John Elliff

DASD for Information Management
Cynthia Kendall

DASD for Intelligence
Keith Hall

DASD for Plans & Resources
Nathaniel Cavallini

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John J. Hamre

Deputy Chief Financial Officer
Alvin Tucker

Deputy Comptroller (Program/Budget)
Ronald A. Davidson

Principal Deputy Under Secretary Comptroller
Alice C. Maroni

Director, Program Analysis & Evaluation
William J. Lynn

KEY

USD Under Secretary of Defense
PDUSD Principal Deputy Under Secretary of Defense
DUSD Deputy Under Secretary of Defense

ASD Assistant Secretary of Defense
PDASD Principal Deputy Assistant Secretary of Defense
DASD Deputy Assistant Secretary Defense

Personnel & Readiness

USD for Personnel & Readiness
Edwin Dorn

PDUSD for Personnel & Readiness
Albert V. Conte

DUSD for Readiness
Louis Finch

DASD for Military Personnel Policy
Lt. Gen. Samuel E. Ebbesen, USA

DUSD for Requirements & Resources
Jeanne B. Fites

DASD for Personnel Support, Families, & Education
Carolyn H. Becraft

DASD for Civilian Personnel Policy
Diane M. Disney

DASD for Equal Opportunity
William E. Leftwich III

ASD for Health Affairs
Stephen C. Joseph

PDASD for Health Affairs
Edward D. Martin

ASD for Reserve Affairs
Deborah R. Lee

PDASD for Reserve Affairs
Vacant

DASD for Strategic Plans & Analysis
Joel B. Resnick

DASD for Manpower & Personnel
Frank Rush

DASD for Materiel & Facilities
John Rosamond

DASD for Program, Budget, & Systems
Jennifer Buck

Acquisition & Technology

USD for Acquisition & Technology
Paul G. Kaminski

PDUSD for Acquisition & Technology
R. Noel Longuemare, Jr.

Director of Defense Research & Engineering
Anita K. Jones

ASD for Economic Security
Joshua Gotbaum

PDASD for Dual-Use Technology Policy & International Programs
Kenneth Flamm

DASD for Installations
Robert E. Bayer

DASD for Industrial Affairs
John B. Goodman

DUSD for Acquisition Reform
Colleen A. Preston

DUSD for Advanced Technology
V. Larry Lynn

DUSD for Environmental Security
Sherri Wasserman Goodman

DUSD for Logistics
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The "Return to Duty" concept for handling casualties is being supplanted by "Evacuate and Replace."

A Bigger Job for Medevac

By James Kitfield

Staff photo by Guy Acelo

Air Force medics treat mock casualties at Brooks AFB, Tex. (above), as practice for real-life disasters like last spring's fatal F-16/C-130/C-141 crash at Pope AFB, N. C. (opposite). The Pope crash pointed up several weaknesses in the aeromedical evacuation system. As the Air Force takes on more responsibility for handling military casualties, it will need to strengthen that system.

ONE YEAR ago, on March 23, 1994, a C-9 Nightingale air ambulance landed at Pope AFB, N. C., at nightfall. Air Force Maj. Patty Vorwald, the flight's medical crew director, stepped out of the aircraft and came face to face with an eerie scene—the charred and still-smoking hulk of a C-141 transport aircraft surrounded by the smoldering jump packs of more than one hundred Army paratroopers killed or grievously injured during a single disastrous afternoon.

Major Vorwald and her medical crew didn't know it but, as they went to work, they were entering the vanguard of a movement that is reshaping the way the Air Force provides military casualty care.

The crew was confronting the aftermath of a catastrophic midair collision. Two aircraft—an F-16 fighter and a C-130 airlifter—crashed into each other while attempting to land. The F-16 then slid across the ground into a fully fueled C-141 parked on the runway, with paratroopers waiting to embark. It was one of the worst-ever US peacetime military accidents, and it created a need for air evacuation of critically injured

Photo by Cindy D. Burnham, Fayetteville, N. C., *Observer-Times*

patients that for sheer scope and magnitude was unmatched in recent years.

Major Vorwald and other members of the 375th Aeromedical Evacuation Squadron (AES) took up the task of rapidly and safely transporting twenty severely burned paratroopers to the Army burn center at Brooke Army Medical Center, Fort Sam Houston, Tex. In the process, they were helping to establish that the Air Force would be able to carry out rapid wartime air evacuation of severely injured patients over long distances.

"I had certainly never dealt with that many critically ill patients," recalled Major Vorwald, a flight nurse and director of quality management at the 375th AES, Scott AFB, Ill. "I was immediately concerned about how we could configure the aircraft and equipment to get that many patients out of there safely."

In the end, it took the medical crew nearly the entire night to stabilize and load twenty patients, many of whom had sustained burns over more than fifty percent of their bodies. All survived the flight to San Antonio, Tex.

The execution of such a demanding operation revealed a number of weaknesses in the aeromedical evacuation system. Many were concerned about whether the C-9's electrical system could handle so much medical equipment operating at once. Because of the inordinate amount of ground time it took to load so many critically injured patients, oxygen ran low during the actual flight. The batteries that powered all the heart monitors failed simultaneously, leaving the already overworked flight crew of two nurses and three medical technicians scrambling to replace them.

Communication breakdowns also plagued the operation. "In setting up command and control and coordinating between the crash site and our crews under way, it was initially difficult to figure out where the best points of contact were," said Col. Margaret Seibold, commander of the 375th AES.

Colonel Seibold noted that in the cases of some patients, there was a lack of detailed information on the severity of their injuries and, as a result, unnecessary confusion at the receiving flight line and hospital. "In a number of cases, we didn't even know the patients' names," she said, "which didn't stop us from treating them, but that's information we'd certainly like to have."

New Medevac Doctrine

The issue of aeromedical evacuation receives intense scrutiny these days because of the adoption of a new US doctrine that promises to place far more of the military casualty burden squarely on Air Force shoulders.

The new doctrine is being developed by the Joint Staff and US Transportation Command (USTRANSCOM), which in 1992 became the focal point of policy and procedures concerning treatment and movement of casualties. Called "Evacuate and Replace," the new doctrine will supplant the old "Return to Duty" model of military casualty care.

The change in doctrine coincides with the Pentagon's post–Cold War emphasis on globally projecting military power from the United States.

In Cold War times, the US had a concept of care based on a number of assumptions—that the conflict would be fairly protracted, that it would

USAF photo by TSgt. Jerry Baker

In the future, there will be fewer overseas bases providing hospital facilities in forward areas. Casualties will have to be evacuated and airlifted to available beds. Above: a medevac exercise in Team Spirit '93.

take place in well-known theaters of war, and that US forces would have enough prepositioned beds to treat casualties in forward areas until they were well enough to return to duty or be evacuated back to the United States almost at leisure.

Brig. Gen. Peter Hoffman, USTRANSCOM's command surgeon, said that all the old assumptions have vanished.

"Today, not only has the force gotten much smaller, but we've also dramatically reduced our forward footprint by closing overseas installations, which diminishes our ability to preposition hospital beds," said General Hoffman.

He added, "From a medical perspective, we now assume short but intense conflicts at locations yet to be determined, which means evacuating and replacing as quickly as possible those people lost to wounds or sickness. That's a much more demanding scenario. There's no question it will place increased strain on our aeromedical evacuation system."

Lucking Out

As noted in numerous Operation Desert Storm after-action reports, the weaknesses of the old system nearly caused it to crack under the strains of a major contingency. The General Accounting Office noted in a 1993 report that medical and evacuation units provided by the Air Force to US Central Command during Operations Desert Shield and Desert Storm would have been woefully insufficient to handle the level of casualties anticipated in prewar analyses.

"If the magnitude of the casualties that were anticipated had actually materialized, there would clearly have been severe problems," said Mark Gebicke, the GAO analyst who headed the study. "Even given the very small number of casualties during Desert Storm, there were problems."

A 1993 report by the DoD Inspector General on Medical Mobilization Planning and Execution detailed the sources of many of those problems. In terms of medevac and tracking of casualties, it faulted:

- Outdated medical mobilization plans lacking a joint planning perspective.
- Confusion over authority and responsibilities in aeromedical evacuation.
- Lack of standardization and interoperability within the services' various communications systems and automated systems necessary to match casualties with available treatment and airlift.
- Insufficient aeromedical assets, such as dedicated aircraft.

A spokesman for USTRANSCOM's command surgeon, Maj. Jack Simpson, confirmed these claims.

"We did find during Desert Storm that the process for treating and evacuating casualties differed between theaters and was fragmented, creating a lot of bottlenecks and delays," said Major Simpson.

"The technology was also outdated to the point that our medics had real problems tracking casualties once they entered the system. After-action reports also revealed that if we had the number of casualties originally anticipated, the airlift component of casualty evacuation would have come to a grinding halt on day three or four."

The first move to address those shortcomings came in 1992 when DoD designated USTRANSCOM as the single manager for setting policy and standardizing procedures for the flow and care of military casualties worldwide.

One Stop

USTRANSCOM leaders say that the goal from the beginning was to establish a "one-stop shop" for aeromedical evacuation, much as USTRANSCOM itself has become the single focal point for worldwide strategic lift.

USTRANSCOM's General Hoffman noted, "This reform finally enabled us to . . . bring together the two functions of aeromedical evacuation that have been separate for thirty years, which are matching the patient to the necessary medical care and lining up the aircraft and crews needed to move those patients. That really moves us toward becoming a one-stop shop where our customers can come with their patient movement requirements and get an integrated solution."

The actual shop to which theater commanders will come in the future is the Global Patient Movement Requirements Center, which USTRANSCOM stood up at Scott AFB in June 1994. GPMRC consolidates activities formerly conducted by the Pentagon's Armed Services Medical Regulating Office (which matched patients to hospital beds) and the Aeromedical Evacuation Coordination Center at Scott (which helped coordinate aeromedical evacuation for patients).

To further simplify command and control, USTRANSCOM has arranged for overseas theaters to consolidate their aeromedical evacuation operations.

US European Command signed a memorandum of understanding to establish a Theater Patient Movement Requirements Center at Ramstein AB,

Germany, combining its Joint Medical Regulating Office and the operations of the 86th Aeromedical Evacuation Squadron at Ramstein.

US Pacific Command has signed a similar memorandum and plans to establish sometime next summer its own Theater Patient Movement Requirements Center at Yokota AB, Japan. Meanwhile, GPMRC will have a second role as Theater Patient Movement Requirements Center for the continental United States.

"As GPMRC evolves and matures, we will ultimately become the one-stop shop that forecasts requirements and tasks assets, adjudicating between theaters so commanders don't have to go through this 'Mother, may I?' routine," said Lt. Col. Philip Mahlum, director of GPMRC.

In the meantime, Colonel Mahlum said, GPMRC's computerized data-

The C-9 Nightingale medical evacuation aircraft, originally designed to transport as many as forty fairly stable patients along with up to five medical personnel, has worked well for USAF since 1968 with few major changes.

Staff photos by Guy Aceto

In the aftermath of last year's accident at Pope, the C-9 was pushed to its limit. It was forced to sustain so many critically injured patients that oxygen ran low and all the heart monitor batteries failed simultaneously.

bases will act as the clearinghouse for information on available lift and hospital beds, with the responsibility for arranging for actual patient movement and treatment remaining with theater commanders.

Losing Track

"Before we can fully merge worldwide transportation and the identification of available beds," Colonel Mahlum said, "we need to overcome some limitations in our automated systems."

The DoD Inspector General's report singled out those systems for special criticism. "During contingency operations, such as Desert Shield and Desert Storm, commands are forced to rely on differing automated systems to compile information that is not standardized and to determine the location of patients who are not tracked by existing regulating systems," it said.

In 1992 congressional testimony, the Air Force Surgeon General put the problem succinctly: "Tracking patients throughout the entire healthcare delivery and aeromedical evacuation systems was cumbersome."

Lt. Col. Sam Taylor, a commander in the Persian Gulf War who now serves as a spokesman at USTRANSCOM, saw firsthand the human dimension of that lack of "visibility" of patients who had entered the casualty care system. "I had injured soldiers calling home from Kuwait, and when their families would later call me and ask where their loved one was, I had no idea," said Colonel Taylor. "I just had to hope the soldier would call me to let me know."

The system being developed to solve those disconnects is the USTRANSCOM Regulating and Command and Control Evacuation System (TRAC^{2}ES). Through it, software developer Carnegie Group is trying to combine information now segregated in the Defense Medical Regulating Information System and the Theater Army Medical Management Information System.

"Using some elegant leading-edge technology and advanced artificial intelligence algorithms, TRAC^{2}ES combines the database that tells us which doctors and beds are available worldwide with the database on what airplanes are available," said General Hoffman, noting that USTRANSCOM anticipates achieving initial operational capability with the new system by 1997 and projects full capability by 2000.

Staff photo by Guy Aceto

In future conflicts, the C-141 will handle most aeromedical transport missions. This one has been equipped to evacuate more serious casualties. A small fleet of C-9s will be on hand mainly for peacetime evacuation needs.

"At that time, we'll have a very flexible and transparent system with patients at one end, aircraft in the middle, and beds at the other end," he said.

The shift toward an Evacuate and Replace doctrine has forced USTRANSCOM to fundamentally reassess its personnel and force-structure requirements. Under the previous doctrine, for instance, planners assumed a ratio of one crew nurse or medical technician for every ten patients, but that will change.

"Previous aeromedical evacuation was based on the assumption that we would move stable patients who had undergone a period of recovery and who could thus be moved without requiring a physician or a large amount of nursing care," said General Hoffman. He added that USTRANSCOM is considering whether it should move to a ratio of one doctor or flight nurse for every three to five patients.

More Expertise Needed

"With this new paradigm," said the General, "we'll definitely be moving larger numbers of critically acute patients, and they will require a great deal more expertise to move."

A number of experts are also concerned about the demands the new doctrine will place on limited Air Force assets. Largely for its peacetime needs, the Air Force maintains a small fleet of twenty specially configured C-9A Nightingale aircraft dedicated to aeromedical evacuation. For the most part, however, physicians in a theater of war will rely on returning C-141 cargo aircraft specially equipped to evacuate casualties. If high casualty rates are anticipated, a theater commander may identify a portion of the airlift fleet to be dedicated specifically to aeromedical evacuation.

"During Desert Shield and Storm, for instance, Gen. [H. Norman] Schwarzkopf agreed that if casualties reached anticipated levels, then he would devote eleven C-141s exclusively to the medevac mission," said Colonel Mahlum.

Shortfalls in the availability of aircraft for aeromedical evacuation have been identified in a number of Joint Staff–sponsored exercises, including Reforger '87 and Wintex '88 and '89. According to the DoD Inspector General, a lack of dedicated aeromedical evacuation capability during the Wintex exercises in Europe "resulted in the entire combat zone becoming paralyzed until 3,000 casualties could be removed from the battlefield." The cause of bottlenecks, according to the report, was USTRANSCOM's lack of dedicated aeromedical evacuation aircraft.

In an effort to close that gap, USTRANSCOM has turned to the Civil Reserve Air Fleet (CRAF), a program under which commercial airlines make available some of their aircraft to USTRANSCOM in the event of an emergency. During Desert Storm, USTRANSCOM would have had to declare a Stage 3 activation—the most severe—before it could acquire any CRAF planes for aeromedical evacuation. Since that time, Air Mobility Command has changed the rule to allow medical access to CRAF planes in Stage 2.

The Joint Staff and USTRANSCOM have identified a requirement for forty-four wide-body 767 aircraft for aeromedical evacuation. To date, they have succeeded in convincing commercial carriers to sign up only nineteen 767s to the CRAF program.

"I think the lack of aeromedical evacuation aircraft is my primary concern with CRAF because those 767s are very efficient aircraft for commercial operations," said Col. Murrell Porter, Air Mobility Command's assistant for Civil Air Programs. "That makes it difficult for carriers to let them go. Right now we're studying whether it's possible to take the kits used to reconfigure the 767 to the aeromedical mission and modify them for use on other commercial aircraft."

Though he acknowledges the concerns about adequate aeromedical aircraft, General Hoffman puts it down as just one of many unknowns arising from a fundamental change in doctrine.

"We're just beginning to work many of these issues, but there's no doubt that the military's overseas footprint is getting dramatically smaller," he said. "That means if we don't want to force a CINC to choose between receiving a planeload of troops or one of medics, we have to decide what is just the right amount of forward medical presence to process casualties and how much medical air evacuation we need to get everyone out of Dodge. That's a tough balancing act." ■

James Kitfield is the defense correspondent for Government Executive *Magazine in Washington, D. C., and a regular contributor to* Air Force *Magazine. His most recent article, "Airlift at High Tempo," appeared in the January 1995 issue.*

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Gallery of Russian Aerospace Weapons

By John W. R. Taylor

Attack Aircraft

Sukhoi Su-17 (NATO "Fitter-C, D, G, H, and K")

Swingwing Fitters serve in diminishing numbers with ground-attack units of the Russian Air Forces and at land bases of the Baltic Fleet and in the Pacific for antiship strikes and amphibious support roles. Variants are as follows:

Su-17M (Fitter-C). Basic single-seat attack aircraft. Manual wingsweep control, to 30°, 45°, and 63°. Gun in each wingroot. Equipment includes SRD-5M I-band centerbody ranging radar, ASP-5ND fire-control system, Sirena-3 omnidirectional radar warning system, and SRO-2M IFF.

Su-17M-2/M-2D (Fitter-D). Generally similar to Su-17M, but forward fuselage lengthened by 15 inches and drooped 3° to improve pilot's view. Added undernose pod for Doppler navigation radar. Klen laser rangefinder in intake centerbody.

Su-17UM-3 (Fitter-G). Two-seat trainer variant of Su-17M-3, with combat capability. Drooped front fuselage like Su-17M-2. Deepened dorsal spine fairing for additional fuel tankage. Taller vertical tail surfaces. Starboard gun only. Laser rangefinder standard.

Su-17M-3 (Fitter-H). Improved single-seater with same deepened spine and tail modifications as Su-17UM-3. Doppler navigation radar fitted internally in deepened undersurface of nose. Retains both wingroot guns. Launcher for R-60 (AA-8 "Aphid") AAM between each pair of underwing pylons. About 165 Fitter-H/Ks were equipped for tactical reconnaissance, typically with a centerline sensor pod, an active ECM pod under the port wing glove, and two underwing fuel tanks.

Su-17M-4 (Fitter-K). Single-seat version in service since 1982. Dorsal fin embodies small cooling air intake at front. Chaff/flare and decoy dispensers standard. Weapons include four S-25 tube-launched rockets with 325-mm head. When four SPPU-22 gun pods are fitted, with downward attack capability, the two underfuselage pods can be arranged to fire rearward. *(Data for Su-17M-4.)*

Power Plant: one Saturn/Lyulka AL-21F-3 turbojet; 24,800 lb thrust with afterburning.

Dimensions: span 44 ft 10½ in spread, 32 ft 10¾ in swept, length 62 ft 5 in, height 16 ft 0½ in.

Weights: empty, equipped 23,737 lb, gross 41,887 lb.

Performance: max speed at height Mach 1.74, at S/L Mach 1.1, ceiling 46, 585 ft, T-O run 2,955 ft, landing run 3,120 ft, max range at height 1,430 miles, at S/L 870 miles.

Accommodation: pilot only.

Armament: two 30-mm NR-30 guns, each with 80 rds, in wingroots; nine pylons under fuselage and wings for up to 8,820 lb of nuclear weapons, bombs, rocket pods, air-to-surface rockets, 23-mm SPPU-22 gun pods, two R-3 or R-13M (AA-2 "Atoll"), R-60 (AA-8 "Aphid"), or R-73A (AA-11 "Archer") AAMs, Kh-25ML (AS-10 "Karen"), Kh-27 (AS-12 "Kegler"), Kh-29 (AS-14 "Kedge") or Kh-58 (AS-11 "Kilter") ASMs, or a reconnaissance pod.

Sukhoi Su-17UM-3 ("Fitter-G") (F. G. Rozendaal)

Sukhoi Su-24MR ("Fencer-E") (F. G. Rozendaal)

Sukhoi Su-24 (NATO "Fencer")

About 480 Su-24s form primary strike components of the Russian Air Forces, with 90 more for reconnaissance and ECM. Naval Aviation has 107 for attack and 20 for reconnaissance and electronic warfare. Smaller and lighter than USAF's F-111, with four-position (16°, 35°, 45°, 69°) variable-geometry wings, the Su-24 became operational in 1976. Its ability to deliver a wide range of ASMs provides defense suppression and some hard-target kill potential, with the emphasis on low-level attack. Major operational versions:

Su-24M (Fencer-D). Primary version, introduced in 1983. Believed to have terrain-following radar instead of former terrain-avoidance system. Longer nose (approx 2 ft 6 in) for new avionics bay. Added in-flight refueling capability, with centrally mounted retractable probe forward of windshield. Laser ranger/designator added aft of nosewheel bay. Overwing fences integral with extended wingroot glove pylons fitted when carrying Kh-29 (AS-14 "Kedge") ASMs.

Su-24MR (Fencer-E). Reconnaissance variant used by tactical and Naval Air Forces. No overwing fences. Internal equipment includes Shtik side-looking airborne multimission radar in shorter radome, Zima IR reconnaissance system, Aist-M TV reconnaissance system, and panoramic and oblique cameras in ventral fairing. A Shpil-2M laser pod can be carried on the centerline, with a Tangazh electronic intelligence (elint) pod or Efir-1M radiation detector pod on the starboard underwing swiveling pylon, and two R-60 AAMs under the port wing. Data can be transmitted to the ground by data link. Flight refueling and ASM capabilities are retained.

Su-24MP (Fencer-F). Electronic warfare/jamming/signals intelligence (sigint) version. Added small fairing under nose. Centerline EW pod. *(Data for Su-24M.)*

Power Plant: two Saturn/Lyulka AL-21F-3A afterburning turbojets; each 24,690 lb thrust.

Dimensions: span 57 ft 10½ in spread, 34 ft 0 in swept, length 80 ft 8¼ in, height 20 ft 3¾ in.

Weights: empty, equipped 49,162 lb, gross 87,520 lb.

Performance: max speed at height Mach 1.35, at S/L (clean) Mach 1.08, ceiling 57,400 ft, T-O run 4,265 ft, landing run 3,120 ft, combat radius (lo-lo-lo) more than 200 miles, (hi-lo-hi, with 6,615 lb of weapons and two external tanks) 650 miles.

Accommodation: pilot and weapon systems officer, side by side.

Armament: one GSh-6-23M six-barrel 23-mm Gatling-type gun on starboard side of belly; nine pylons under fuselage, wingroot gloves, and outer wings for 17,635 lb of air-to-surface weapons, including TN-1000 and TN-1200 nuclear weapons, up to four TV- or laser-guided bombs, conventional bombs (typically 38 x 220-lb FAB-100), 57-mm to 370-mm rockets, 23-mm gun pods, and such ASMs as Kh-23 (AS-7 "Kerry"), Kh-25ML (AS-10 "Karen"), Kh-58 (AS-11 "Kilter"), Kh-25MP (AS-12 "Kegler"), Kh-59 (AS-13 "Kingbolt"), Kh-29 (AS-14 "Kedge"), and Kh-31A/P (AS-17 "Krypton"). Two R-60 (AA-8 "Aphid") AAMs can be carried for self-defense.

Sukhoi Su-25 (NATO "Frogfoot")

First flown February 22, 1975, the Su-25 is a close-support aircraft, intended to battle through to ground targets at low level with a heavy weapon load. The pilot is protected by an all-welded cockpit of titanium armor, almost one inch thick. Pushrods rather than cables actuate the control surfaces, main load-bearing members are damage-resistant, the engines are widely separated in stainless steel bays, and the fuel tanks are filled with reticulated foam for explosion protection. A total of 256 flares can be packed into dispensers above the engine nacelles and tailcone for use during eight attack runs. The big wings support 10 pylons for a wide range of ordnance, including self-protection AAMs. The engines will run on any fuel likely to be found in a combat area, including MT gasoline and diesel oil.

Production of this basic version has ended. The most recent inventory showed 192 in Russian Air Force service, plus 55 with Naval Aviation. Versions identified to date:

Su-25 (Frogfoot-A). Basic single-seat close-support aircraft.

Su-25UB (Frogfoot-B). Tandem two-seat operational conversion and weapons trainer. Raised rear cockpit. Taller tailfin. Gun and weapons pylons retained.

Su-25UT (Frogfoot-B). As Su-25UB but without weapons. Prototype first flew August 6, 1985. Few only.

Su-25UTG (G for *gak*, "hook") (Frogfoot-B). As Su-25UT, with arrester hook added under tail for deck landing training on dummy flight deck marked out on runway at Saki Naval Airfield, Ukraine, and for use on the carrier *Admiral Kuznetsov*. Ten built; four based at Severomorsk, Kola Peninsula, for service on *Admiral Kuznetsov*.

Su-25BM. Standard Su-25 with added underwing pylons for rocket-powered targets released for missile training by fighter pilots.

Su-25T. See Su-39 entry. *(Data for Frogfoot-A.)*

Power Plant: two Soyuz/Tumansky R-195 turbojets; each 9,921 lb thrust. To reduce infrared signature, a small pipe in the tailcone of each turbojet on later aircraft expels air to lower exhaust temperature.

Dimensions: span 47 ft 1½ in, length 50 ft 11½ in, height 15 ft 9 in.

Weights: empty 20,950 lb, gross 32,187–38,800 lb.
Performance: max level speed at S/L Mach 0.8, max attack speed, airbrakes open, 428 mph, ceiling 22,965 ft, T-O run 1,970–3,935 ft, landing run 1,312–1,970 ft, range with 9,700 lb of weapons at S/L 466 miles, at height 776 miles.
Accommodation: pilot only.
Armament: one twin-barrel AO-17A 30-mm gun in port side of nose, with 250 rds. Eight underwing pylons for 9,700 lb of air-to-surface weapons, including Kh-23 (AS-7 "Kerry"), Kh-25 (AS-10 "Karen"), and Kh-29 (AS-14 "Kedge") ASMs, SPPU-22 pods for 23-mm guns with twin barrels that pivot downward, 57-mm to 330-mm rockets, laser-guided rocket-boosted bombs, and 1,100-lb incendiary, antipersonnel, and other cluster bombs. Two small outboard pylons for R-3S (AA-2D "Atoll") or R-60 (AA-8 "Aphid") AAMs.

Su-39

Known initially as the Su-25T, the Su-39 is a considerably upgraded "Frogfoot" derivative with improved navigation and attack systems and new missiles. The first development aircraft flew August 17, 1984. Ten preseries aircraft were delivered to the Russian Air Forces from 1989. Twenty production Su-39s had been delivered by January 1994, with IOC in the previous year.

Embodying lessons learned during action in Afghanistan, the three original development aircraft utilized converted Su-25UB airframes, with the humped rear cockpit faired over and the internal space used to house new avionics and an extra metric ton of fuel. The navigation system, with two digital computers and an inertial platform, permits flights to and from combat areas under largely automatic control. The widened nose houses a TV system, laser rangefinder, and target designator of improved capability. The TV can be activated some six miles from the target, after which target tracking, weapon selection, and release are automatic.

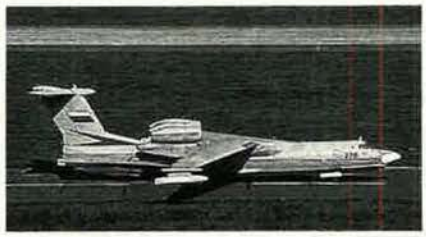
Chaff/flare dispensers are installed in the top of the fuselage tailcone and in a large cylindrical housing at the base of the rudder. This housing also contains an infrared jammer, optimized against Stinger and Redeye frequencies. A radar warning/emitter location system is standard. The Voskhod nav/attack system and Schkval electro-optical system are intended to ensure precision attacks on enemy armor. A Khod centerline IR pack enables a main battle tank to be identified at night over a distance of nearly two miles. The gun is transferred to an underbelly position on the starboard side of a farther-offset nosewheel.
Power Plant: as for Su-25.
Dimensions: span 47 ft 7¾ in, length 50 ft 4½ in, height 17 ft 0¾ in.
Weight: gross 42,990 lb.
Performance: max speed 590 mph, ceiling 32,800 ft, T-O and landing run on unpaved runway 2,300 ft, combat radius with 4,410 lb of weapons at S/L 248 miles, at height 435 miles.
Armament: one twin-barrel NNPU-8M 30-mm gun, with 200 rds. Ten underwing pylons for 9,612 lb of weapons, including two eight-round clusters of Vikhr (AT-9) tube-launched ASMs able to penetrate 900 mm of reactive armor, KAB-500 laser-guided bombs, Kh-25ML (AS-10 "Karen"), Kh-58 (AS-11 "Kilter"), Kh-29L (AS-14 "Kedge"), and Kh-31A/P (AS-17 "Krypton") ASMs, and R-60 (AA-8 "Aphid") AAMs.

Bombers and Maritime

Antonov An-72P (NATO "Coaler")

The first order for this twin-turbofan STOL maritime patrol aircraft was placed by Russia, which ordered 20. Based on the airframe of the An-72 transport, the An-72P is intended for armed surveillance of coastal areas, within 230 miles of shore, in all-weather day/night conditions. On-board avionics permit automated navigation at all stages of flight and precise fixing of the coordinates, speed, and heading of surface ships. Fixed cameras for photographing targets are supplemented by a TV scanning system, with flares for night use. The TV equipment is carried in the port main landing gear fairing. The day/night cameras are carried in the fuselage aft of the rear loading hatch; bombs can be carried in the roof of the hold, above the hatch, with the loading ramp slid forward under the cabin to make their release practicable. An upgraded version, equipped by Israel Aircraft Industries, is available with digital cockpit avionics, Elta EL/M 2022A maritime surveillance radar, El/Op day/night long-range observation system, and Elisra electronic warfare suite. *(Data generally as for An-72.)*

Sukhoi Su-25 ("Frogfoot-A") (Piotr Butowski)



Beriev A-40 Albatross ("Mermaid") (Mark Wagner)

Beriev M-12 ("Mail") (Piotr Butowski)

Weights: mission load 1,433 lb, gross 82,670 lb.
Performance: patrol speed at 1,640–3,280 ft 186–217 mph, ceiling 33,135 ft, field requirement 4,600 ft, max endurance 7 hr 18 min.
Accommodation: crew of five; on secondary missions can carry and air-drop 22 fully equipped paratroops, or transport 40 passengers, 16 litter patients and attendant, or up to 11,020 lb of ammunition, vehicles, or equipment.
Armament: one GSh-23L 23-mm gun pod, with 250 rds, forward of starboard landing gear fairing; two UB-32M rocket packs underwing (Griffin laser-guided bombs on IAI upgraded aircraft); four 220-lb bombs.

Beriev A-40 Albatross and Be-42 (NATO "Mermaid")

In its basic **A-40** form, the Albatross was designed to replace the Il-38 "May" and M-12 "Mail," though not on a one-for-one basis. Equipped for ASW/surveillance/minelaying duties, it carries weapons and other stores in a 21 ft 4 in bay in the bottom of the hull aft of the step. The prototype made its first public appearance in the Aviation Day flyby at Tushino Airport, Moscow, August 20, 1989. An initial batch of 20 is in production for Russian Naval Aviation. Features include booster turbojets in pods with eyelid nozzles at the rear of the pylon supports for the primary turbofans, a large nose radar, cylindrical containers for ESM above the wingtip floats, and an in-flight refueling probe on the nose.

Variants of the A-40 include the **Be-42** search-and-rescue amphibian, design of which began in 1988. Its equipment includes extensive radio, radar, electro-optical sensors, and searchlights to detect shipwreck survivors by day or night. A rescue team with power boats, life rafts, and other specialized equipment can be carried, and there is room for up to 54 survivors, who enter the aircraft via hatches in the side of the hull with the aid of mechanized ramps. On-board equipment to combat hypothermia is available, together with resuscitation and surgical equipment and medicines. All ASW equipment, the booster turbojets, and ESM are deleted.

Further versions of the A-40 are projected as the **Be-40P** to carry up to 105 passengers and the **Be-40PT** transport for mixed cargo/passenger payloads. *(Data for basic A-40.)*

Power Plant: two Aviadvigatel D-30KPV turbofans, each 26,455 lb thrust, on pylons above rear of hull (33,070 lb thrust engines to be fitted later). Two RKBM RD-60K booster turbojets, each 5,510 lb thrust.
Dimensions: span 136 ft 6½ in, length 143 ft 10 in, height 36 ft 3¾ in.
Weights: max payload 14,330 lb, gross 189,595 lb.
Performance: max speed at 19,700 ft 472 mph, max cruising speed 447 mph, ceiling 31,825 ft, T-O run 3,280 ft, landing run 2,955 ft, range with max payload 2,547 miles, with max fuel 3,417 miles.
Accommodation: crew of eight.
Armament: not yet specified.

Beriev M-12/Be-12 Tchaika (NATO "Mail")

About 55 of an estimated 100 **M-12** twin-turboprop amphibians, built from 1964, remain in Naval Aviation service. Built for overwater surveillance and antisubmarine duties within a 230-mile radius of shore bases, some have been converted into **Be-12PS** search-and-rescue amphibians. *(Data for M-12.)*
Power Plant: two ZMKB Progress/Ivchenko AI-20M turboprops; each 4,190 ehp.
Dimensions: span 97 ft 5¾ in, length 99 ft 0 in, height 22 ft 11½ in.
Weight: gross 68,345 lb.
Performance: max speed 378 mph, service ceiling 37,000 ft, max range 4,660 miles.
Accommodation: crew of five.
Armament and Operational Equipment: torpedoes, depth charges, mines, and other stores for maritime search and attack carried in internal bay aft of step in bottom of hull and on four pylons under outer wings. Radar in nose "thimble"; MAD (magnetic anomaly detection) tailsting.

Ilyushin Il-38 (NATO "May")

Thirty-six Il-38 intermediate-range, shore-based, antisubmarine/maritime patrol aircraft, derived from the Il-18 airliner, serve with Naval Aviation units at coastal bases. Standard equipment includes nav/weather radar in the nose, search radar in a large radome under the front fuselage, and an MAD tailsting, with two internal weapons/stores bays forward and aft of the wing carry-through structure.
Power Plant: four ZMKB Progress/Ivchenko AI-20M turboprops; each 4,190 ehp.
Dimensions: span 122 ft 9¼ in, length 129 ft 10 in, height 33 ft 4 in.
Weights: empty 79,367 lb, gross 140,000 lb.
Performance: max speed at 21,000 ft 448 mph, patrol speed at 2,000 ft 248 mph, T-O run 4,265 ft, landing run 2,790 ft, max range 4,473 miles, patrol endurance 12 hr.
Accommodation: crew of nine.
Armament and Operational Equipment: attack weapons and sonobuoys in weapons bays.

Sukhoi Su-34

This side-by-side two-seat development of the Su-27 series is a theater bomber to replace MiG-27s, Su-17s, and some Su-24s. It was developed via the experimental Su-27IB, described in the 1994 "Gallery of Russian Aerospace Weapons." The first production Su-34, built at Novosibirsk, flew December 18, 1993, at Zhukovsky Flight Test Center. It has a dielectric nose, wider than that of the Su-27, to house nav/attack and terrain following/avoidance radar; foreplanes; a deep fairing behind the canopy, containing a toilet and galley; and wing extensions carried forward as chines to the tip of the nose. Additional fuel is carried in the tailfins. The nosewheel leg has been moved forward and now retracts rearward into a large bay that contains the hatch for crew access to the cockpit. The main landing gear units are entirely new, with smaller, tandem wheels. Titanium armor protects the cockpit.

The longer, larger diameter tailsting has been raised and now extends as a spine above the rear fuselage, blending into the cockpit fairing. It houses at its tip a rearward-facing radar. Aircraft approaching from astern can be attacked with rearward-firing IR-homing AAMs carried underwing.
Power Plant: two Saturn/Lyulka AL-31FM turbofans; each 30,865 lb thrust with afterburning.
Dimensions: not available.
Weight: gross 97,800 lb.
Performance: max speed at height Mach 1.8, at S/L Mach 1.15, range 2,485 miles.
Accommodation: crew of two, on side-by-side zero/zero ejection seats.
Armament: one 30-mm GSh-301 gun in starboard wingroot extension; high-precision ASMs, KAB-500 laser-guided bombs; R-73 (AA-11 "Archer") and R-77 (AA-12) AAMs.

Sukhoi T-60S

The Sukhoi OKB is developing a new intermediate-range bomber to replace the Tu-16, Tu-22, and some Su-24s, under the project designation T-60S. No details are available.

Tupolev Tu-22M (NATO "Backfire")

Of 195 medium-range bombers equipping Russian Air Forces, about 100 are Tu-22Ms, intended to attack deep theater targets; Naval Aviation units have more than 160. A high proportion of these forces are equipped with the Tu-22M-3, newest of the two versions in service:

Tu-22M-2 (Backfire-B). Initial series production version, with 48,500 lb thrust NK-22 turbofans. Wingsweep variable from 20° to 65°. Slightly inclined lateral engine air intakes, with large splitter plates. Armament up to three Kh-22 (AS-4 "Kitchen") ASMs or conventional bombs or mines. Two GSh-23 twin-barrel 23-mm guns in radar-directed tail mounting. Above-nose fairing replaces formerly observed in-flight refueling probe.

Tu-22M-3 (Backfire-C). Advanced production version with more powerful engines and wedge-type air intakes, deployed from 1985. Upturned nosecone. No visible in-flight refueling probe. Can carry Kh-15P (AS-16 "Kickback") SRAMs. Single GSh-23 gun, with barrels one above the other, in aerodynamically improved tail mounting.

Backfire is capable of performing nuclear strike, conventional attack, and antiship missions, its low-level penetration features making it more survivable than earlier Tupolev bombers. Deployment of SRAMs with Backfire-C has improved deliverable warhead potential and increased flexibility for air force strategists. A possible electronic warfare version has been reported. *(Data for Tu-22M-3).*

Power Plant: two KKBM/Kuznetsov NK-25 turbofans; each 55,115 lb thrust with afterburning. Provision for JATO rockets.

Dimensions: span 112 ft 5¾ in spread, 76 ft 5½ in swept; length 139 ft 3¾ in; height 36 ft 3 in.

Weight: gross 273,370 lb (278,660 lb with JATO).

Performance: max speed at high altitude Mach 1.88, at low altitude Mach 0.86, nominal cruising speed 560 mph, ceiling 43,635 ft, T-O run 6,560–6,890 ft, landing run 3,940–4,265 ft, max unrefueled combat radius with 26,455 lb weapons: supersonic hi-hi-hi 930-1,150 miles, subsonic lo-lo-lo 930–1,035 miles, subsonic hi-lo-hi 1,495 miles.

Accommodation: crew of four, in pairs on ejection seats.

Armament: max offensive weapon load comprises three Kh-22 (AS-4 Kitchen) ASMs, with one semi-recessed under the center-fuselage and one under the fixed center-section panel of each wing; or 52,910 lb of conventional bombs or mines, half of them carried internally and half on external racks under the wings and engine air intake trunks. Internal bombs can be replaced by a rotary launcher for six Kh-15P (AS-16 Kickback) SRAMs, with four more underwing as alternative to Kh-22s. Normal weapon load is a single Kh-22 or 26,455 lb of bombs. Typical loads are two FAB-3000, eight FAB-1500, 42 FAB-500, or 69 FAB-250 or -100 bombs (figures indicate weight in kg), or eight 3,300-lb or 18 x 1,100-lb mines. Single GSh-23 twin-barrel 23-mm gun in radar-directed tail mounting.

Tupolev Tu-95 and Tu-142 (NATO "Bear")

Still spearheads of Russian airpower, these remarkable propeller-driven aircraft continue to impress at international airshows 43 years after the prototype first flew. The Russian Air Forces have 43 Tu-95K-20/22 and 27 Tu-95MS missile carriers; Naval Aviation has about 85 maritime reconnaissance/ASW/"TACAMO equivalent" versions. Major current versions:

Tu-95K-20 (Bear-B). Missile carrier, with Kh-20 (AS-3 "Kangaroo") ASM under fuselage.

Tu-95RT (Bear-D). Maritime reconnaissance aircraft with I-band surface search radar in a large blister fairing under the center-fuselage. Glazed nose with undernose radome and superimposed refueling probe. Elint blister fairing on each side of its rear fuselage. Added fairing at each tailplane tip. I-band tail-warning radar in large fairing at base of rudder. Defensive armament of six 23-mm NR-23 guns in pairs in remotely controlled rear dorsal and ventral turrets and manned tail turret. Carries no offensive weapons, but tasks include pinpointing of maritime targets for missile launch crews on board ships and aircraft that are themselves too distant to ensure precise missile aiming and guidance. A Bear-D was the first version seen with a faired tailcone housing ECM in place of the normal tail turret and associated radome.

Tu-95MR (Bear-E). Reconnaissance version with rear fuselage elint fairings and refueling probe. Seven camera windows in bomb bay doors. Armament as Tu-95RT.

Tu-142 (Bear-F). Antisubmarine aircraft. Extensively redesigned, with double-slotted flaps, and longer fuselage forward of the wings. Deployed initially by Naval Aviation in 1970. Reentered production in the mid-1980s. Originally, Bear-F had enlarged and lengthened fairings for 12-wheel main landing gear bogies aft of its inboard engine nacelles and undernose radar. The main underfuselage J-band radar housing is considerably further forward and smaller than on Bear-D. There are no large blister fairings under and on the sides of the rear fuselage. Two stores bays for sonobuoys, torpedoes, and nuclear or conventional depth charges in its rear fuselage, one of them replacing the usual rear ventral gun turret and leaving the tail turret as the sole defensive gun position. Later variants of Bear-F are identified as follows:

Mod 1: Reverted to standard-size nacelles and four-wheel main landing gear bogies. Chin-mounted J-band radar deleted. Fewer protrusions.

Mod 2 (**Tu-142M**): Nose lengthened by 6 ft 6¾ in, and roof of flight deck raised. Angle of refueling probe lowered by 4°. INS standard.

Mod 3 (**Tu-142M**): MAD boom added to fintip. Fairings at tips of tailplane deleted.

Mod 4 (**Tu-142M**): Chin radar reinstated. ECM thimble radome on nose, plus other fairings. Observation blister each side of rear fuselage deleted.

Most Bear-Fs in service are now to Mod 3 or Mod 4 standard. All versions of the Tu-142M were scheduled to have provision for eight Kh-35 active radar homing antiship missiles in underwing pairs from 1994.

Tu-95K-22 (Bear-G). Bomber and elint conversion of early Bear-B/C bombers, able to carry two Kh-22 (AS-4 "Kitchen") ASMs, on a large pylon under each wingroot. Upgraded undernose radar, an ECM thimble under the in-flight refueling probe, and a "solid" tailcone, containing ECM. Defensive armament of two 23-mm guns, in ventral turret.

Tu-95MS (Bear-H). Late-production bomber based on Tu-142 airframe, but fuselage shortened to length of Tu-95. Initial **Tu-95MS6** version carries six Kh-55 (AS-15A "Kent") long-range cruise missiles on an internal rotary launcher. The **Tu-95MS16** carries two more under each wingroot and a cluster of three between each pair of engines, for a total of 16. Bear-H attained IOC in 1984. Features include a larger and deeper radome ("Clam Pipe") built into the nose and a small fintip fairing. There are no elint blister fairings on the sides of the rear fuselage, and the ventral gun turret is deleted. Some aircraft have a single twin-barrel 23-mm gun, instead of the usual pair, in the tail turret. An active electronic jammer, RWR, missile warning receivers, and chaff/flare dispensers are standard.

Tu-142MR (Bear-J). Soviet equivalent of the US Navy's E-6A and EC-130Q TACAMO aircraft, with VLF communications avionics to maintain an on-station/all-ocean link between national command authorities and nuclear missile armed submarines under most operating conditions. Large ventral pod for VLF trailing-wire antenna, several kilometers long, under center-fuselage in weapons bay area. Undernose fairing as on Bear-F Mod 4. Fintip pod with trailing-edge like that on some Bear-Hs. Satcom dome aft of flight deck canopy. Operational in comparatively small numbers with the Northern and Pacific Fleets, it appears to use a modified Tu-142 Bear-F airframe. *(Data for Tu-95MS.)*

Power Plant: four KKBM/Kuznetsov NK-12MV turboprops; each 14,795 ehp. Equipped for in-flight refueling.

Dimensions: span 167 ft 8 in, length 162 ft 5 in, height 39 ft 9 in.

Weights: empty 198,415 lb, gross 414,470 lb.

Performance: max speed at 25,000 ft 575 mph, at S/L 404 mph, nominal cruising speed 442 mph, ceiling 39,370 ft, combat radius with 25,000-lb payload 3,975 miles, with one in-flight refueling 5,155 miles.

Accommodation: crew of seven.

Armament: as described for individual versions.

Sukhoi Su-34

Tupolev Tu-22M-3 ("Backfire-C") (Neville M. Beckett)

Tupolev Tu-95MS ("Bear-H") (Piotr Butowski)

Tupolev Tu-160 (NATO "Blackjack")

The Russian strategic air force had only five Tu-160s in mid-1994, the remaining 20 operational Blackjacks being based in Ukraine. Unlike USAF's highly stealthy B-2, the supersonic, four-crew Tu-160 is configured like the B-1B, with scant attention to low-observables. As well as being able to operate as a high-altitude standoff cruise missile carrier, it can carry SRAMs, as an alternative or in addition to ALCMs, on the rotary launcher inside each of its two weapons bays, for defense suppression during low-altitude penetration missions at transonic speed. An active jamming self-defense system is standard.

The fly-by-wire Blackjack is about 20 percent longer than the B-1B, with greater unrefueled combat radius and maximum level speed comparable with that of the original B-1 prototypes. It is in no way a simple scale-up of Tupolev's earlier Tu-22M. Common features include low-mounted variable-geometry (20°, 35°, and 65°, manually selected) wings and a massive dorsal fin, but the Tu-160's horizontal tail surfaces are mounted high, near the intersection of the dorsal fin and all-moving main fin. When the wings are fully swept, the inboard flap-ends hinge upward as large fences. The very long and sharply swept fixed root panel of each wing, and the engine installation, resemble those of the long-retired Tu-144 supersonic transport. The flight deck has no head-up display (HUD) or CRTs.

Power Plant: four Samara/Trud NK-321 turbofans; each 50,580 lb thrust with afterburning. Provision for in-flight refueling.

Dimensions: span 182 ft 9 in spread, 116 ft 9¾ in swept; length 177 ft 6 in; height 43 ft 0 in.

Weights: empty 242,500 lb, gross 606,260 lb.

Performance: max speed at high altitude Mach 1.88, nominal cruising speed 497 mph, ceiling 60,000 ft, max unrefueled range 7,455 miles.

Accommodation: crew of four, in pairs, on ejection seats.

Armament: no guns; internal stowage for up to 88,185 lb of free-fall bombs, SRAMs, or ALCMs. Each rotary launcher carries 12 Kh-15P (AS-16 "Kickback") SRAMs or six Kh-55 (AS-15 "Kent") ALCMs.

Fighters

MiG 1-42

Like USAF's F-22, the 1-42 is single-seat, twin-engine fighter, with twin fins, and will offer multirole air-to-air and air-to-surface capability. It is a tailless delta, with canards that improve on the agility of even the Su-27, and is designed to have thrust-vectoring engine nozzles. A degree of stealth can be assumed. As with other Russian designs, this is likely to result more from careful conventional airframe configuration, use of RAM (radar absorbent materials), and use of countermeasures than from such operationally restrictive features as internal weapons stowage. A new Phazotron-developed phased-array fire control radar is fitted.

The 1-42 has a wingspan comparable with that of the Su-27 series. Its first flight was delayed by incomplete development of its Lyulka AL-41F afterburning turbofans but is expected in the first quarter of 1995.

MiG-25P (NATO "Foxbat-A, C, E, and F")

With the building up of the MiG-31 force, the number of MiG-25 interceptors in service has fallen to 174 for home defense, 21 with the tactical air forces. To make possible a speed of Mach 2.83, never exceeded by a combat aircraft, the airframes of the MiG-25s are manufactured of 80 percent tempered and welded steel, with eight percent titanium in areas subject to extreme heat, such as the wing and tail unit leading-edges, and 11 percent D19 heat-resistant aluminum alloy. Current versions:

MiG-25PU (Foxbat-C). Training version of MiG-25P series. Redesigned nose section, containing separate cockpit for instructor, with individual canopy, forward of standard cockpit and at lower level. No radar in nose and no combat capability. Simulated weapon release standard. Limited to Mach 2.65.

MiG-25PD (Foxbat-E). Development of original MiG-25P single-seat interceptor, produced 1978–82. Uprated R-15BD-300 engines, with life of 1,000 hr instead of former 150 hr. Sapfir-25 radar and IRST, giving look-down/shoot-down capability comparable with that of the (now retired) MiG-23M. Sirena-3 RWR in wingtip antiflutter bodies and starboard fintip. Basic armament of two R-40R/T (AA-6 "Acrid") and four R-60 (AA-8 "Aphid") AAMs. Provision for 1,400-gallon underbelly fuel tank.

MiG-25PDS (Foxbat-E). As MiG-25PD but converted from MiG-25P from 1979. Nose lengthened by 10 inches to house in-flight refueling equipment on some aircraft.

MiG-25BM (Foxbat-F). "Wild Weasel"-type of defense-suppression aircraft produced 1982–85. Airframe generally similar to MiG-25RB but with dielectric panel for ECM aft of radome on each side of longer nose. (The MiG-25R series—Foxbat-B/D—is described in the Reconnaissance, ECM, and Early Warning section.) Small blister each side at rear of radome. Dielectric panel on nose of each outboard weapon pylon. Underbelly auxiliary fuel tank as MiG-25PD. Carries four Kh-58 (AS-11 "Kilter") antiradiation missiles to attack SAM sites over standoff ranges. *(Data for MiG-25PDS.)*

Power Plant: two Soyuz/Tumansky R-15BD-300 turbojets, each 24,675 lb thrust with afterburning.

Dimensions: span 45 ft 11¾ in, length 78 ft 1¾ in, height 20 ft 0¼ in.

Weight: gross with four AAMs and full internal fuel 80,950 lb.

Performance: max speed at height Mach 2.83, at S/L Mach 0.98, ceiling 67,900 ft, T-O run 4,100 ft, landing run 2,625 ft, range on internal fuel at supersonic speed 775 miles, subsonic 1,075 miles.

Armament: no gun; two R-40 and four R-60 AAMs underwing initially. Later, two R-23 (AA-7 "Apex") and four R-73A (AA-11 "Archer") or R-60 AAMs.

MiG-29 (NATO "Fulcrum")

The basic MiG-29, operational since early 1985, is a twin-engine combat aircraft comparable in size to the US Navy's F/A-18 Hornet. Its N019 Sapfir-29 coherent pulse-Doppler look-down/shoot-down radar (search range 62 miles; ability to track 10 targets simultaneously) is supplemented by a laser rangefinder and infrared search/track sensor forward of the windscreen. Both systems operate in conjunction with the pilot's helmet-mounted target designator. Primary operational role is as a single-seat counterair fighter, but the MiG-29 has dual-role air combat/attack capability. About 430 are in service with Russian tactical air forces and 47 with naval forces, for which production has ended. Current versions:

MiG-29 (Fulcrum-A). Landbased single-seater. During takeoff and landing, hinged doors shield the engine air intakes against foreign object ingestion; engine air is then taken in through louvers in the upper surface of the wingroot extensions. Flying controls actuated hydraulically. IRCM flare dispensers in "fences" forward of dorsal tailfins. Airbrakes above and below rear fuselage. Max gross weight 40,785 lb, including 6,615 lb of weapons; optional external fuel tanks under wings and belly. Some have deeper spine and extra internal fuel, like MiG-29S, and are identified by NATO as Fulcrum-C.

MiG-29UB (Fulcrum-B). Combat trainer. Second seat forward of the normal cockpit, under a continuous canopy, with periscope for rear occupant. Nose radar replaced by a radar rangefinder. Underwing stores pylons retained.

MiG-29S (Fulcrum-C). As Fulcrum-A but with more deeply curved top to fuselage aft of cockpit, containing additional avionics, including active jammers. Internal fuel increased by 20 gallons. Upgraded radar (N019M) can engage two targets simultaneously. Able to carry R-77 (AA-12) AMRAAM-class AAMs or up to 8,820 lb of bombs. Approx two squadrons only.

Programs for the greatly redesigned **MiG-29M** and its carrier-based counterpart, the **MiG-29K**, have been canceled, though features of these variants may be offered on export models or in upgrade contracts. Details of the M can be found in the 1994 "Gallery of Russian Aerospace Weapons." *(Data for MiG-29S.)*

Power Plant: two Klimov/Sarkisov RD-33 turbofans; each 18,300 lb thrust with afterburning.

Dimensions: span 37 ft 3¼ in, length 56 ft 10 in, height 15 ft 6¼ in.

Weights: normal T-O weight 33,730 lb, gross 43,430 lb.

Performance: max speed at height Mach 2.3, at S/L Mach 1.06, ceiling 59,055 ft, T-O run 820 ft, landing run 1,970 ft, range on internal fuel 932 miles, with external tanks 1,800 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Armament: six close-range R-60MK (AA-8 "Aphid") AAMs, or four R-60MK and two medium-range R-27R-1 (AA-10A "Alamo-A"), on three pylons under each wing. Alternative AAMs include R-73E (AA-11 "Archer"). Able to carry bombs, submunitions dispensers, napalm, 80-mm, 130-mm, and 240-mm rockets, and other stores (including nuclear weapons) in attack role. One 30-mm GSh-301 gun in port wingroot leading-edge extension, with 150 rds.

MiG-31 (NATO "Foxhound")

Although similar in configuration to the MiG-25, Foxhound is a very different aircraft. The requirement was for an all-altitude, all-weather interceptor, embodying advanced digital avionics and carrying a crew of two. There was no call for higher red-line speed than that of the MiG-25, but a longer range was specified, together with a stronger airframe to permit supersonic flight at low altitude. Mikoyan reduced the airframe's steel content to 50 percent, with 16 percent titanium, 33 percent aluminum alloy, and negligible composites except for the radome.

The first prototype flew September 16, 1975. Four years later, production of the fully developed **MiG-31** (Foxhound-A) began at the Gorky works. Its Zaslon ("Flash Dance") radar was the first electronically scanned phased-array type to enter service, with a search range of 124 miles in the forward clutter-free sector and the ability to track 10 targets and engage four simultaneously, including targets below and behind its own location. Foxhound can be guided automatically and can engage targets under ground control. Operational equipment includes a retractable IRST sensor, RWR, and active infrared and electronic countermeasures.

Artist's impression of MiG 1-42 (Jane's/Keith Fretwell)

MiG-29S ("Fulcrum-C") (Piotr Butowski)

MiG-31 ("Foxhound-A") (Piotr Butowski)

Offset tandem twin-wheel main landing gear units facilitate operation from unprepared ground and gravel. A semiretractable flight refueling probe is mounted on the port side of the front fuselage. About 300 are deployed for home defense and 30 with tactical air forces.

Developed by means of eight prototypes, since 1984, the **MiG-31M** (Foxhound-B) has a new Phazotron radar, with a 55-in-diameter antenna, in a 3.5° downward-inclined nose. It is identified by a one-piece rounded windshield, small side windows for the rear cockpit, a wider and deeper dorsal spine, more rounded wingtips (except when carrying ECM jammer pods), taller fins with larger curved root extensions, modified and extended wingroot leading-edge extensions, a non-retractable IRST, upgraded engines with modified nozzles, and four new-type underwing pylons for R-77 (AA-12) active radar-guided AAMs. It has no gun, but the number of fuselage weapon stations is increased to six, with two centerline pylons carrying R-33S missiles and four R-37 AAMs on the side mounts. All systems are upgraded; digital flight controls and multifunction CRT cockpit displays are standard.

Some basic MiG-31s have been converted and others buil: as **MiG-31Ds**; these are compatible with R-37 missiles but retain basic radar. *(Data for MiG-31 Foxhound-A.)*

Power Plant: two Aviadvigatel D-30F6 turbofans; each 34,170 lb thrust with afterburning.

Dimensions: span 44 ft 2 in, length 74 ft 5¼ in, height 20 ft 2¼ in.

Weights: empty 48,105 lb, gross 90,390–101,850 lb (MiG-31M 114,640 lb).

Performance: max speed at height Mach 2.83, at S/L Mach 1.23, ceiling 67,600 ft, T-O run 3,940 ft, landing run 2,625 ft, combat radius at Mach 2.35 450 miles, at Mach 0.85 with external tanks 870 miles.

Accommodation: crew of two, on tandem zero/zero ejection seats.

Armament: basic armament of four R-33 (AA-9 "Amos") radar-homing, long-range AAMs, in pairs under fuselage; two R-40T (AA-6 "Acrid") medium-range, infrared-homing AAMs on inner underwing pylons; and four R-60 (AA-8 "Aphid") close-range, infrared-homing AAMs on two outer underwing pylons. One 23-mm GSh-6-23 six-barrel Gatling-type gun in fairing on starboard lower fuselage, with 260 rds.

Sukhoi Su-27 (NATO "Flanker")

The T-10-1 (Flanker-A) prototype of the Su-27 first flew May 20, 1977. More than 200 production Su-27s now equip Russian air defense units; 150 others serve with tactical air forces, their duties including escort of Su-24s on deep penetration missions. A range of 2,500 miles on internal fuel makes use of external tanks unnecessary. Current variants:

Su-27 (Flanker-B). Basic single-seat production version, first flown April 20, 1981. Square wingtips carrying launchers for AAMs in interceptor role, cylindrical ECM jammer pods in ground-attack configuration. Four-channel analog fly-by-wire flight controls without mechanical backup. Inherently unstable. No ailerons; one-piece differential/collective tailerons operate in conjunction with flaperons and rudders for pitch and roll control. Wing leading-edge flaps and flaperons are controlled manually for takeoff and landing, computer-controlled in flight. Fine-grille hinged screens in the engine air intake ducts guard against foreign-object damage during takeoff and landing. No composites, but a considerable quantity of titanium in the airframe. Integrated fire-control system enables the track-while-scan coherent pulse-Doppler radar, IRST, and laser rangefinder to be slaved to the pilot's helmet-mounted target designator and displayed on the wide-angle HUD. Radar has search range of 150 miles and tracking range of 115 miles. Provision for reconnaissance pack on centerline pylon. Three banks of chaff/flare dispensers in bottom of long tailcone.

Su-27UB (Flanker-C). Tandem two-seat trainer with full combat capability, based on Flanker-B.

Su-27PU, Su-27K, and Su-27IB: see Su-30, Su-33, and Su-34, respectively. *(Data for Flanker-B.)*

Power Plant: two Saturn/Lyulka AL-31F turbofans; each 27,557 lb thrust with afterburning.

Dimensions: span 48 ft 2¾ in, length excl noseprobe 71 ft 11½ in, height 19 ft 5½ in.

Weight: gross 48,500–67,240 lb.

Performance: max speed at height Mach 2.35, at S/L Mach 1.1, ceiling 59,055 ft, T-O run 1,640 ft, landing run 1,970 ft, combat radius 930 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Armament: one 30-mm GSh-301 gun, with 150 rds, in starboard wingroot extension. Up to 10 AAMs, including pairs of R-27 (AA-10 "Alamo-A/B/C/D"), or R-33 (AA-9 "Amos"), and four R-73A (AA-11 "Archer") or R-60 (AA-8 "Aphid"). Able to carry a wide range of air-to-surface weapons, including five-rd packs of 130-mm rockets, or larger rockets. Latest weapons include a podded 30-mm gun with downward-deflecting barrel for air-to-ground and air-to-air use.

Sukhoi Su-30

This production development of two Su-27PU prototypes (first flown December 30, 1989) is available in two forms:

Su-30. Basic two-seat interceptor for missions of 10 hr or more, including group actions with four Su-27s. Only the Su-30 would operate its radar, so that it could assign targets to the other aircraft by radio data link, while the Su-27s maintained radar silence. Able to carry bombs and rockets but not guided ASMs. New avionics: nav system based on Loran, Omega, and Mars; fire-control system able to engage two air-to-air targets simultaneously. Flight refueling probe and buddy refueling standard. Without foreplanes, static instability, and new engines of Su-35. Phazotron Zhuk-PH phased-array radar optional (range 87–113 miles forward, 37 miles to rear, able to detect 24 targets and attack six to eight simultaneously).

Su-30M. As Su-30 but equipped for multirole operations, with high-precision guided weapons. *(Data for Su-30MK, except where indicated.)*

Dimensions: as Su-27, except height 20 ft 10¼ in.

Weights: normal gross 52,910 lb, max 72,750 lb.

Performance: max speed at height Mach 2.0, T-O run 1,805 ft, landing run 2,200 ft, combat range with internal fuel 1,865 miles, with one in-flight refueling 3,230 miles.

Accommodation: crew of two, on zero/zero ejection seats in tandem identical cockpits.

Armament (Su-30): gun and AAMs as Su-27, plus R-77 (AA-12) AAMs.

Armament (Su-30MK): as Su-30 for air-to-air role. More than 17,635 lb of stores on 12 hardpoints for ground attack role, including Kh-59M (AS-18) cruise missiles, Kh-31 (AS-17 "Krypton") and Kh-29 (AS-14 "Kedge") ASMs, ARMs, bombs, KAB-500Kr TV-guided bombs, rockets, and an APK-9 data link pod.

Sukhoi Su-33

An initial series of 20 Su-33 single-seat fighters has been delivered to an air base on the Kola Peninsula for eventual operation from the *Admiral Kuznetsov*. Intended primarily for air defense, but with antiship capability, they are basically similar to the Su-27K (Flanker-D) prototype described and illustrated in last year's "Gallery of Russian Aerospace Weapons." Their airframe differs from that of the Su-27 (Flanker-B) in having collectively movable foreplanes, folding outer wings and tailplane, strengthened landing gear with twin-wheel nose unit, an added arrester hook, and navaids for maritime operations. The long tailcone of the landbased version is shortened to prevent tailscrapes during takeoff and landing. A retractable in-flight refueling probe is mounted on the port side of the nose, and there is provision for a centerline external fuel tank or buddy refueling pack.

Power Plant: as Su-27.

Dimensions: span 48 ft 2¾ in, length 69 ft 6 in, height 19 ft 4¼ in.

Weights: not available.

Performance: max speed at height Mach 2.165, T-O run with 14° ramp 395 ft, range on internal fuel 1,865 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Armament: as Su-27, plus Kh-31 (AS-17 "Krypton") ASMs or underfuselage Kh-41 Moskit antiship missile.

Sukhoi Su-35

The first of six prototypes of this advanced single-seat development of the Su-27, designed to have digital fly-by-wire controls and static instability, flew for the first time June 28, 1988. The airframe resembles that of the Su-33, with foreplanes, but without specifically shipboard features, such as folding wings and an arrester hook. Preseries Su-35s have followed, and the fighter is scheduled to enter Russian Air Force service during the second half of the 1990s. The engines are AL-35F (AL-31FM) turbofans, uprated by comparison with the AL-31F. Three-dimensional thrust-vectoring nozzles are to be offered for later use.

The Su-35's Phazotron Zhuk primary radar is of an improved look-down/shoot-down type, with the ability to acquire airborne targets at ranges up to 250 miles and ground targets up to 125 miles. Fifteen targets can be tracked, and six engaged, simultaneously. There is a rearward-facing radar in the enlarged tailcone. IRST and wingtip ECM jammer pods are standard. All combat flight phases are computerized, with terrain following/avoidance. Cockpit displays include three-color CRTs.

Power Plant: two Saturn/Lyulka AL-35F turbofans; each 30,865 lb thrust with afterburning. In-flight refueling probe standard.

Dimensions: span over ECM pods 49 ft 2½ in, length 72 ft 2¼ in, height 19 ft 8 in.

Performance: max speed at height Mach 2.35, at S/L Mach 1.18, ceiling 59,055 ft, runway required 3,940 ft, max range on internal fuel more than 2,485 miles, with one in-flight refueling more than 4,040 miles.

Accommodation: pilot only, on zero/zero ejection seat.

Sukhoi Su-35 (Jay Miller)

Kamov Ka-27PL ("Helix-A") (F. G. Rozendaal)

Kamov Ka-50 Werewolf ("Hokum") (Peter J. Cooper)

Armament: one 30-mm GSh-30 gun. Fourteen weapon mounts for R-27 (AA-10 "Alamo-A/B/C/D"), R-40 (AA-6 "Acrid"), R-60 (AA-8 "Aphid"), R-73A (AA-11 "Archer"), and R-77 (AA-12 AMRAAM-class) AAMs. Optional air-to-surface weapons include Kh-25ML (AS-10 "Karen"), Kh-25MP (AS-12 "Kegler"), Kh-29 (AS-14 "Kedge"), and Kh-31 (AS-17 "Krypton") ASMs, KAB-500 bombs, and rocket packs. Max external stores 17,635 lb.

Helicopters

Kamov Ka-25 (NATO "Hormone")

Ka-25s remain in service with Russian Naval Aviation in four forms:

Ka-25PL (Hormone-A). Basic ship-based ASW version, with typical Kamov contrarotating three-blade rotors. Undernose search radar; racks for small stores, including sonobuoys, on the starboard side of the fuselage. Dipping sonar is housed in a compartment at the rear of the cabin, but the Ka-25 is unable to operate with this at night or in adverse weather, due to lack of automatic hover capability. About 88 operational.

Ka-25Ts (Hormone-B). Special electronics variant, to provide over-the-horizon target acquisition for cruise missiles carried by the cruisers and destroyers on which Ka-25Ts helicopters are based. Larger undernose radome than that of Ka-25PL, with spherical undersurface. When radar is operating, all four wheels of landing gear can be retracted upward to offer minimal interference to emissions. Cylindrical fuel canister on each side of lower fuselage.

Ka-25BShZ. Equipped to tow minesweeping gear. No sonar.

Ka-25PS (Hormone-C). Search-and-rescue version with hoist and other role equipment. *(Data for Hormone-A.)*

Power Plant: two Mars GTD-3F turboshafts; each 888 shp (later aircraft have 986 shp GTD-3Ms).

Dimensions: rotor diameter (each) 51 ft 7¾ in, length of fuselage 32 ft 0 in, height 17 ft 7½ in.

Weights: empty 10,505 lb, gross 15,873 lb.

Performance: max speed 130 mph, ceiling 11,000 ft, range 250–405 miles.

Accommodation: crew of two on flight deck; main cabin is large enough to contain 12 folding seats.

Armament: one 18-in ASW torpedo in underfuselage weapons bay.

Kamov Ka-27, Ka-29, and Ka-31 (NATO "Helix")

The prototype Ka-27 flew in 1973. Retaining the Ka-25's proven contrarotating rotor configuration, it was able to stow in much the same space as the earlier helicopter with the rotors folded, despite its greater power and capability. The basic ASW version was first observed on the stern platform of the guided missile destroyer *Udaloy* in 1981. Other versions followed, and the military "Helix" now serves in the following forms:

Ka-27PL (Helix-A). Basic ASW helicopter, with crew of three (pilot, tactical coordinator, ASW systems operator). Described as being effective against submarines cruising at up to 40 knots, at a depth of 1,640 ft, out to 124 miles from its base, by day or night. Equipment includes undernose 360° search radar, ventral weapons bay for torpedoes, depth charges, and other stores, internally stowed sonobuoys, IR jammer above engine bay fairing, chaff/flare dispensers, IFF, RWRs on nose and above tailplane, ESM radomes above rear of power plant pylon fairing and at tailcone tip, flotation gear container on each side of fuselage, dipping sonar compartment in rear of fuselage, MAD, and Doppler box under tailboom. Normally operated in pairs; one aircraft tracks the hostile submarine, the other drops depth charges. About 88 operational with Naval Aviation.

Ka-29 (Helix-B). Combat transport version; entered service 1985. Heavy armor on wider flight deck and engine bay. Four-barrel Gatling-type 7.62-mm machine gun behind downward-articulated door on starboard side of nose. Four pylons on outriggers carry two four-round clusters of 9M114 (AT-6 "Spiral") ASMs and two 57-mm or 80-mm rocket pods; alternative loads include four rocket pods, two ZB-500 incendiary tanks, or 23-mm gun pods. Provision for 30-mm Type 2A42 gun above port outrigger. Undernose sensor pods for missile guidance and electro-optics. ESM "flower pot" above engine bay fairing, forward of IR jamming pod. Two-part upward/downward-opening cabin door for speedy exit of 16 assault troops from cabin. Casualty evacuation capability as Ka-27PL. About 30 in service.

Ka-27PS (Helix-D). Search-and-rescue and plane guard version. Basically similar to Ka-27PL but some operational equipment deleted. Winch beside cabin door on port side. External fuel tank above flotation gear on each side of cabin.

Ka-31. Radar picket version, first flown 1988 and shown on carrier *Admiral Kuznetsov* in August 1990. Crew of two. Large rotating radar antenna that stows flat against underfuselage and deploys downward, turning through 90° into vertical plane before starting to rotate. Landing gear retracts upward to prevent interference with emissions. Large pannier embodying fairing for retracted front wheel on each side, forward of main landing gear. Further large equipment pannier aft of main gear on starboard side. Two-piece airstair type cabin door aft of flight deck on starboard side, divided into upward and downward opening sections. APU repositioned above rear of power plant fairing, with air intake at front. No ESM or IR jamming pods above fairing. Longer conical tailcone. No stores pylons, gun door, or armor. *(Data for Ka-29)*

Power Plant: two Klimov TV3-117V turboshafts; each 2,190 shp.

Dimensions: rotor diameter (each) 52 ft 2 in, length of fuselage 37 ft 1 in, height 17 ft 8½ in.

Weights: empty 12,170 lb, gross 27,775 lb.

Performance: max speed at S/L 174 mph, ceiling 14,100 ft, range 285 miles.

Accommodation: flight crew of two, with seat for third person; up to 16 combat-ready troops, or four litters and six seated casualties, as alternative to mission equipment.

Armament: see above.

Kamov Ka-50 Werewolf (NATO "Hokum")

This unique single-seat close-support helicopter has been flying in prototype form since July 27, 1982, but was not displayed in public until the 1992 Farnborough Air Show. It is in small-scale initial production for the Russian Army. Retention of Kamov's familiar coaxial rotor configuration, and small fuselage cross-section, ensure compact dimensions, with no tail rotor to cause problems during nap-of-the-earth operation. Composite materials constitute 35 percent by weight of the structure, including the three-blade rotors. The Ka-50 is intended to attack targets fast and low, with great

Mil Mi-6 ("Hook") (Piotr Butowski)

agility, at close range. Its avionics and missions require four computers to meet navigation, mission control, and display demands. Equipment in the nose includes a laser marked-target seeker and rangefinder, but the intention is to rely on another aircraft or ground personnel to locate and designate targets. Basic equipment includes a forward-looking infrared (FLIR) pod, TV, and cockpit CRT. The pilot has a MiG-29-type helmet sight and HUD. Development emphasis is on improving night operational capability, and one Ka-50 is flying with an undernose sensor bail turret.

All canopy and windscreen panels are of heavy bulletproof glass, and the double-wall steel armor surrounding the pilot will resist hits by 20-mm and 23-mm gunfire over ranges as close as 330 ft. In an emergency, at any altitude, the rotor blades and cockpit roof are separated by explosive charges; the pilot is then extracted from the cockpit by a large rocket. Alternatively, he can jettison the cabin doors and stores before rolling out of the cockpit sideways. The Ka-50 can be air-ferried, partially disassembled, in an Il-76 freighter. All systems are configured to permit combat flying from an advanced base for at least two weeks without need for ground maintenance equipment. A tandem two-seat training or combat version has been projected.

Power Plant: two Klimov TV3-117VK turboshafts; each 2,190 shp.
Dimensions: rotor diameter (each) 47 ft 7 in, length (rotors turning) 52 ft 6 in, height 16 ft 2 in.
Weights: normal T-O weight 21,605 lb, max gross 23,810 lb.
Performance: max speed in shallow dive 217 mph, in level flight 193 mph, vertical rate of climb at 8,200 ft 1,970 ft/min, hover ceiling out of ground effect 13,125 ft, estimated combat radius 155 miles, endurance 4 hr.
Accommodation: pilot only.
Armament: one flexibly mounted 30-mm 2A42 gun with 500 rds on starboard side of fuselage; four wing pylons for two six-round clusters of Vikhr M (AT-12) laser-guided ASMs, up to four packs of 20 x 80-mm S-8 rockets, 23-mm gun pods, Kh-25MP (AS-12 "Kegler") ASMs, AAMs, or dispenser weapons.

Mil Mi-6 (NATO "Hook")

Basic task of the 350 Mi-6s in service with Russian armies is to haul guns, armor, vehicles, supplies, freight, or troops in combat areas; but some are equipped for command support roles (see Reconnaissance, ECM, and Early Warning Aircraft section). Replacement with Mi-26 Halos has been only partially acceptable, due to the hazards of operating helicopters as large as the Mi-26 in combat areas. Mil is proposing a 66,000-lb helicopter, designated Mi-46T, for service at the end of this century.

Power Plant: two Aviadvigatel/Soloviev D-25V turboshafts; each 5,425 shp.
Dimensions: rotor diameter 114 ft 10 in, length of fuselage 108 ft 10½ in, height 32 ft 4 in.
Weights: empty 60,055 lb, gross 93,700 lb.
Performance: max speed 186 mph, ceiling 14,750 ft, range with 17,637-lb payload 385 miles.
Accommodation: crew of five; normally, 70 combat-equipped troops, 26,450 lb of internal freight, or 41 litters and two medical attendants. Max slung cargo (usually with wings removed) 17,637 lb.
Armament: some aircraft have a 12.7-mm gun in the nose.

Mil Mi-8 (NATO "Hip")

Mi-8s and uprated Mi-17s (described separately) are the standard general-purpose helicopters of the Russian armies and air forces. One of their primary combat tasks is to put assault troops, equipment, and supplies behind enemy lines, which their crews are trained to do within 15–20 minutes of a nuclear or conventional bombardment/strike. Versions as follows:

Mil Mi-8MT ("Hip-H") (F. G. Rozendaal)

Hip-C. Standard equipment of army support forces, carrying 24 troops or freight, loaded via rear clamshell doors and ramp. Twin rack for stores on each side of cabin, able to carry 128 x 57-mm rockets in four packs or other weapons. Some uprated to Mi-17 standard, as **Mi-8MT** and **Mi-8MTV.** Estimated 1,520 in service with Russian armies, 100 with the Navy.

Hip-D. For airborne communications role; see p. 66.

Hip-E. Development of Hip-C, with emphasis on weapons for escort duties. One flexibly mounted 12.7-mm machine gun in nose. Triple stores rack on each side of cabin, able to carry up to 192 rockets in six suspended packs plus four 9M17P Skorpion (AT-2 "Swatter") antitank missiles on rails above racks. Some uprated to Mi-17 standard, as **Mi-8MTV.** About 250 in service.

Hip-G. See Mi-9 entry on p. 66.

Hip-H. See Mi-17 entry.

Hip-J and **K.** ECM versions; see p. 66.

Power Plant: two Klimov TV2-117A turboshafts; each 1,677 shp.
Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 59 ft 7¼ in, height 18 ft 6½ in.
Weights: empty 16,007 lb, gross 26,455 lb.
Performance: max speed at 3,280 ft 161 mph, ceiling 13,125 ft, range as personnel transport 311 miles.
Accommodation: crew of two or three; normal military configuration for 24 combat-equipped troops on tip-up seats along cabin side walls; 8,820 lb of freight internally, 6,614 lb externally; or 12 litter patients and attendant.
Armament: see individual model descriptions.

Mil Mi-14 (NATO "Haze")

Overall dimensions, power plant, and dynamic components of this shore-based amphibious helicopter are generally similar to those of the Mi-17. New features to suit the Mi-14 for its maritime roles include a boat hull, a small float attached to the tailskid, and a sponson on each side at the rear, carrying an inflatable flotation bag. The landing gear is fully retractable.

Three Navy versions of the Mi-14 are in service:

Mi-14PL (Haze-A). ASW version, with crew of four. Equipment includes an undernose radome, a retractable sonar housed in the starboard rear of the planing bottom forward of two sonobuoy or signal flare chutes, and a towed MAD "bird" stowed against the rear of the fuselage pod. Torpedoes, bombs, and depth charges are carried in a weapons bay in the bottom of the hull.

Mi-14BT (Haze-B). Mine countermeasures version. Long duct for hydraulic tubing, and air-conditioning pod, on starboard side of cabin. No MAD. Container for searchlight to observe MCM gear during deployment and retrieval under tailboom, forward of Doppler box.

Mi-14PS (Haze-C). Search-and-rescue version. Double-width sliding door at front of cabin on port side, with retractable rescue hoist able to lift three persons in basket. Searchlight on each side of nose and under tailboom. Fuselage duct and air-conditioning pod as Mi-14BT. Room for 10 survivors in cabin, including two on litters; provision for towing many more in 10 x 20-place life rafts carried on board. Normal crew of three.

About half of the 230 Mi-14s built were delivered to Naval Aviation; 63 Mi-14PLs remain in service, plus unknown numbers of other versions.

Power Plant: two Klimov TV3-117 turboshafts, each 1,923 shp.
Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 60 ft 3½ in, height 22 ft 9 in.
Weights: empty 25,900 lb, gross 30,865 lb.
Performance: max speed 143 mph, ceiling 11,500 ft, max range 705 miles.
Accommodation and Armament: as described above.

Mil Mi-17 and Mi-171 (NATO "Hip-H")

The **Mi-17** has an airframe basically identical to that of the Mi-8 but with more powerful TV3 engines in shorter nacelles, with the intakes positioned above the midpoint of the sliding cabin door. The tail rotor is repositioned on the port side of the vertical stabilizer, and the engine air intakes are fitted with deflectors to prevent the ingestion of sand, dust, or foreign particles at unprepared landing sites. Military versions have the same armament options as the Mi-8, supplemented by 23-mm GSh-23 gun packs, and with external armor plate on the cockpit sides.

Details of two special-duty versions can be found in the Reconnaissance, ECM, and Early Warning Aircraft section. Mi-8s can be uprated to Mi-17 standard (see Mi-8 entry). All Mi-17s in Russian military service retain Mi-8MT/MTV designations

Power Plant: two Klimov TV3-117MT turboshafts; each 1,923 shp.
Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 60 ft 5¼ in, height 15 ft 7¼ in.
Weights: empty 15,653 lb, gross 28,660 lb.
Performance: max speed 155 mph, ceiling 11,800 ft (16,400 ft at normal gross weight), max range 307 miles.
Accommodation and Armament: as for Mi-8 Hip-E.

Mil Mi-24 (NATO "Hind")

Around one-third of more than 2,300 Mi-24s (including export Mi-25s and -35s) built in Arsenyev and Rostov are at the disposal of the Russian Army, in the following gunship and special-duty variants:

Mi-24D (Hind-D). First observed in 1977. Front fuselage completely redesigned by comparison with original Hind-A, B, and C armed assault transports. Transport capability retained and airframe heavily armored. Tandem stations for weapon operator (in nose) and pilot have individual canopies, with rear seat raised to give pilot an unobstructed forward view. Under nose is a four-barrel Gatling-type 12.7-mm machine gun in a turret, slaved to adjacent electro-optical sight, and providing air-to-air as well as air-to-surface capability. Four hardpoints under stubwings for 32-rd packs of 57-mm rockets, 20-rd packs of 80-mm rockets, UPK-23 pods each containing a twin-barrel 23-mm gun, GUV pods each containing one four-barrel 12.7-mm gun and two four-barrel 7.62-mm guns or a 30-mm grenade launcher, up to 3,300 lb of bombs, mine dispensers, or other stores; four 9M17P Skorpion (AT-2 "Swatter") antitank missiles on wingtip launchers, with RF guidance pod under nose on port side. Provisions for firing AKMS guns from cabin windows. IFF and RWR. IR jammer in "flower pot" container above forward end of tailboom; three 32-rd ASO-2V chaff/flare dispensers initially under tailboom; later triple racks (total of 192 flares) on sides of center-fuselage. Engine exhaust suppressors standard. **Mi-24DU** training version has no gun turret.

Mi-24V (Hind-E). As Mi-24D but with modified wingtip launchers and four underwing pylons for up to 12 x 9M114 Shturm (AT-6 "Spiral") radio-guided, tube-launched antitank missiles in pairs, and enlarged undernose guidance pod on port side, with fixed searchlight to rear. R-60 (AA-8 "Aphid") AAMs can be carried on the underwing pylons. HUD replaces former reflector sight.

Mi-24VP. Variant of Mi-24V with twin-barrel 23-mm GSh-23 gun in place of four-barrel 12.7-mm gun in nose. Small series built.

Mi-24P (Hind-F). Generally similar to Mi-24V, but nose gun turret replaced by a twin-barrel 30-mm GSh-30-2 gun, with 750 rds, on starboard side of front fuselage. Bottom of nose smoothly faired above and forward of sensors.

some SA-6As at divisional level, for defense against high-performance aircraft and cruise missiles at low to medium altitudes. The SA-11 system is self-contained on a GM-569 tracked vehicle, which carries a 360° traversing four-rail launcher and "Fire Dome" monopulse guidance and tracking radar. The missile can sustain 23*g* maneuvers.

An SA-11 regiment is made up of five batteries, each with six TELs, and similar GM-569 vehicles carrying early warning and acquisition radars and reload missiles. The same chassis is also used to carry the regiment's long-range early warning radar ("Snow Drift"). If this is not available, the SA-11 TELs can be integrated into an SA-6 battery, using the latter's "Straight Flush" fire-control radar.

Type: low/medium-altitude, mobile SAM.
Power Plant: solid-propellant.
Guidance: semiactive monopulse radar command.
Warhead: HE fragmentation (154 lb).
Dimensions: length 18 ft 2½ in, body diameter 1 ft 3¾ in, wingspan 2 ft 9⅞ in.
Launch Weight: 1,520 lb.
Performance: max speed Mach 2.5, slant range 1.85–21.75 miles, effective ceiling 50–72,000 ft.

SA-12A (S-300V/9M83; NATO "Gladiator")

Deployment of the land-mobile tactical SA-12A began in 1986, primarily for use against aircraft and ASMs. All components of the system are based on the tracked MT-T chassis, a derivative of the T-64 main battle tank. The four batteries of a typical SA-12A brigade each have up to six TELARs, a "Grill Pan" fire-control vehicle, and three reload transporters. The main "Bill Board" long-range target search and acquisition radar and sector-scanning radar ("High Screen") vehicles are held at battalion hq. level. Each TELAR carries four recyclable missile container/launchers that can be raised independently to a vertical position for launch and a missile guidance radar. The latter controls the missile in flight after its target has been tracked and handed on by Grill Pan.

The SA-12A missile is conical, like the long-abandoned US Sprint ABM. It ignites at a height of about 165 ft after ejection from its launcher.

Type: all-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: radar command and midcourse inertial, with semiactive radar terminal homing.
Warhead: HE focused fragmentation (330 lb), with selectable in-flight proximity fuzing.
Dimensions: length 26 ft 11 in, body diameter 2 ft 3½ in.
Launch Weight: 2,800 lb.
Performance: max speed Mach 5.75, slant range 3.7–47 miles, effective ceiling 820-82,000 ft.

SA-12B (S-300V/9M82; NATO "Giant")

This derivative of the SA-12A appears to have the same 21-ft-long, 1,800-lb second stage mated to a much longer first stage. It was intended to be deployed to defend road-mobile SS-25s and as part of the rail-mobile SS-24 Mod 1 ICBM system with its MT-T two-round tracked TELs carried on low-loader railcars. After an SS-24 train emerged from its tunnel concealment to move to its launch area, the SA-12Bs were to disperse into the surrounding area to defend the Scalpel launchers from attacking and standoff jamming enemy aircraft, short-range ballistic missiles, and near-strategic missile reentry vehicles.

Type: all-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: as SA-12A.
Warhead: as SA-12A.
Dimensions: length 34 ft 5½ in, body diameter 3 ft 3½ in.
Launch Weight: 4,250 lb.
Performance: max speed Mach 8, slant range 8–62 miles, effective ceiling 3,300–98,400 ft.

SA-13 (9M37 Strela-10; NATO "Gopher")

At its peak, production of SA-13 four-missile tracked launchers for the Russian Army and Naval Infantry, and for export to at least 16 nations, was at the rate of around 2,800 a year. Replacing the SA-9, the basic **9M37** missile was followed by the **9M37M Strela-10M2,** offering choice of an uncooled lead sulphide, near-IR homing seeker, or cooled indium altimonide mid-IR homing type, in each case with all-aspect and IRCCM capabilities. The missiles are carried in two twin-box launchers on TELAR vehicles, some with four "Flat Box B" passive radar detection antennas on their upper surface. Four reload missiles are normally carried by each of the vehicles, which are fully amphibious. The associated "Dog Ear" acquisition/tracking radar vehicle of the SA-9 is retained, with range-only radar ("Snap Shot") on each TELAR.

The latest known version of the missile is the **9M333 Strela-10M3,** intended for use in the mobile battle and to defend troops in movement from attack by low-level aircraft, helicopters, and precision guided weapons, as

SA-15 (9M330 Tor, "Gauntlet")

SA-19 (9M311 "Grison")

well as from observation by UAVs. It has a dual-mode optical photocontrast/infrared seeker to improve adverse weather operation. *(Data for 9M37M; 9M333 in parentheses.)*

Type: low-altitude, mobile SAM.
Power Plant: solid-propellant.
Guidance: infrared passive homing in two frequency bands (optical photocontrast/IR).
Warhead: HE fragmentation rod; 6 lb and 100 rods. Lethal burst radius 16 ft. Contact and active xenon lamp proximity fuzing (contact and active laser proximity fuzing).
Dimensions: length 7 ft 2½ in, body diameter 4¾ in, wingspan 1 ft 3¾ in.
Launch Weight: 87 lb (93 lb).
Performance: max speed Mach 2, slant range 0.3–6.2 miles, effective ceiling 33–16,400 ft.

SA-14 (Strela-3; NATO "Gremlin")

This development of the SA-7 shoulder-fired SAM, with much-improved effective altitude capability, began to replace the earlier weapon one for one in 1978. Compared with the SA-7, it has an uprated rocket motor, a more powerful warhead, and a cryogenically cooled IR seeker with proportional guidance that is effective in head-on as well as tail-chase firings and against targets maneuvering at up to 8*g*. Effectiveness against targets equipped with flare dispensers and IR jammers is claimed to be much enhanced. A passive RF direction-finder antenna system is optional.

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.2 lb), with contact and graze fuzing.
Dimensions: length 4 ft 8 in, body diameter 2⅞ in.
Launch Weight: 22.7 lb. Launcher: 12.6 lb.
Performance: average speed Mach 1.38, slant range 0.37–2.8 miles, effective ceiling 50-9,840 ft.

SA-15 (9M330 Tor; NATO "Gauntlet")

In service since 1992, the large, highly automated, Tor-M1 mobile SAM system is immensely more formidable than the SA-8 it was designed to replace. Its modified GM-569 tracked vehicle is air-transportable but not amphibious. A box-like turret on top of the hull houses eight vertically mounted missiles in two rows and carries the engagement radars. Above the rear of the box is a 3-D pulse-Doppler H-band surveillance radar able to detect up to 48 targets over a range of 15 miles. It then assesses in order of priority, and tracks, the 10 most threatening targets. The pulse-Doppler phased-array K-band target tracking and missile guidance radar at the front can simultaneously track and engage two targets traveling at 22–1,565 mph, by day or night, in all weather, and in dense ECM environments. It is supplemented by an autonomous automatic TV tracking system that enhances the SA-15's capability in battlefield clutter and dense ECM. Reaction time is five to eight seconds from target detection. The missiles are cold-launched, at minimum three-second intervals, and able to maneuver at 23*g* to 30*g* against fixed-wing aircraft, helicopters, UAVs, precision guided weapons, and some types of guided missiles. The SA-15 vehicle carries a crew of three.

Type: low/medium-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: radar command.
Warhead: HE fragmentation (33 lb), with proximity fuzing.
Dimensions: length 9 ft 4¼ in, body diameter 1 ft 1¾ in, wingspan 2 ft 0 in.
Launch Weight: 368 lb.
Performance: max speed Mach 2.5, slant range 1–7.5 miles, effective ceiling 33–19,700 ft.

SA-16 (9M313 Igla-1; NATO "Gimlet")

Together with the self-propelled 2S6 antiaircraft weapon system (see SA-19 below), the third-generation SA-16 has been replacing the SA-7, SA-14, and ZSU-23-4 gun system for the past decade. Its configuration is similar to that of the SA-7 and SA-14, but it is an entirely new weapon, with a conical nose. Deployment time is 13 seconds, and launch time from target acquisition is five seconds. The cooled IR seeker improves resistance to countermeasures. Maximum target-bearing angle for launch is ±40°.

Type: low-altitude, man-portable SAM.
Power Plant: dual-thrust solid-propellant.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.9 lb), with contact and graze fuzing.
Dimensions: length 5 ft 5⅞ in, body diameter 2⅞ in.
Launch Weight: 23.8 lb. Launcher 12.9 lb.
Performance: average speed Mach 1.68, slant range 0.37–1.86 miles, effective ceiling 33–11,500 ft.

SA-17 (9M38M2 Buk-2M; NATO "Grizzly")

Intended to supersede the SA-11 "Gadfly," this new low/medium-altitude SAM was identified by NATO in 1986–87 and is now ready for deployment. It has a similar configuration to the SA-11 and is based on a similar tracked vehicle. A major innovation is a new engagement radar known to NATO as "Chair Back," which replaces the SA-11's "Fire Dome," has a range of 75 miles, and enables two to four targets to be engaged simultaneously. Data generally as for SA-11, except:

Dimensions: length 18 ft 0½ in.
Launch Weight: 1,587 lb.
Performance: max speed Mach 3.5, slant range 1.85–31 miles, effective ceiling 33–78,750 ft.

SA-18 (9K38 Igla)

This fourth-generation shoulder-fired SAM has been operational since the late 1980s. The basic **9K38 Igla** is designed to engage low-flying maneuverable and nonmaneuverable targets and hovering helicopters. It can be used against approaching targets flying at up to 805 mph and targets receding at up to 715 mph. Developed versions are the **Igla-D** with improved operational features, and **Igla-N** with improved lethality. *(Data for 9K38 Igla.)*

Type: low-altitude, man-portable SAM.
Power Plant: dual-thrust solid-propellant.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.8 lb), with contact and graze fuzing.
Dimensions: length (launch tube) 5 ft 7¼ in, body diameter 2⅞ in.
Launch Weight: 23.4 lb. Launcher 14.1 lb.
Performance: slant range 0.31–3.2 miles, effective ceiling 33–11,500 ft.

SA-19 (9M311; NATO "Grison")

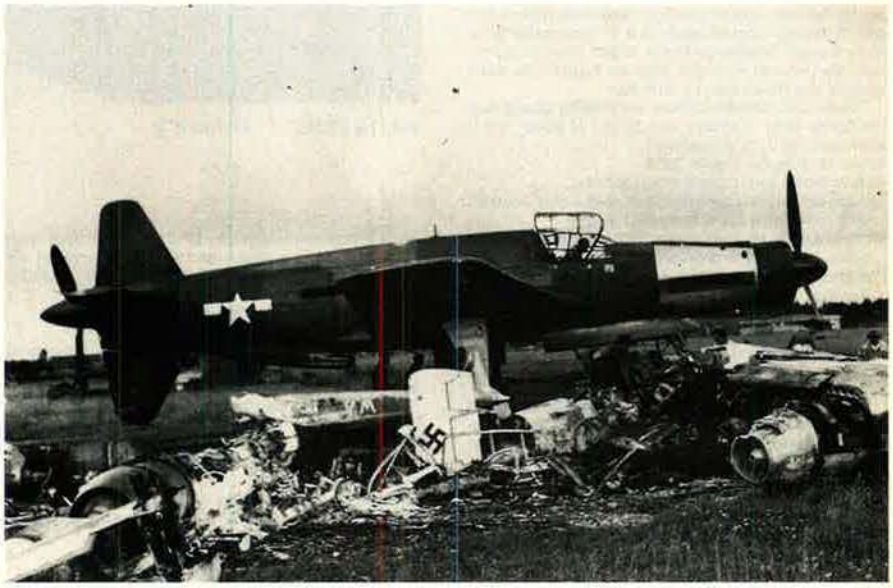
This tube-launched hypersonic missile was developed as one element of the 2S6 Tunguska gun/missile tracked regimental air defense vehicle, which entered service in 1986 as an SA-13 replacement, for use against low-flying aircraft and ASMs. Eight SA-19s are mounted in clusters of four on each side of a turret that also carries four 30-mm guns, and fire-control and "Hot Shot" surveillance and target acquisition radars.

Type: tube-launched, low/medium-altitude SAM.
Power Plant: two-stage solid-propellant.
Guidance: semiautomatic command to line-of-sight (SACLOS), supplemented by thermal imaging sight, TV, and laser rangefinder/designator.
Warhead: high-explosive fragmentation (19.8 lb).
Dimensions: length 8 ft 2½ in, body diameter 5⅞ in.
Launch Weight: 93 lb.
Performance: speed hypersonic, max range 1.5–5 miles. ■

As aviation technology advanced, flyers needed ejection seats to help them survive.

Punching Out

By Robert E. van Patten



Europeans led the way in developing ejection seats. After World War II, the US sent a fact-finding team to study the work of the Germans, British, and Swedes. A captured Do-335 (pictured above with US markings) provided the Allies with data on ejection seat technology, which they later used on such jets as the F-86 (opposite, in German livery).

THE FIRST recorded mention of an ejection seat came in 1910, seven years after Kitty Hawk. Professor J. S. Zerber, the designer of a multiwing aircraft, was said to have incorporated such a device in his flying machine. The seat evidently was propelled by the detonation of an explosive cartridge. Nothing more is known about the professor or his invention.

It *is* known that on December 12, 1912, at an airfield near Paris, French technicians tested an ejection seat developed by one Baron d'Odkolek. The firing of a small cannon during the flight ejected a parachute-equipped dummy. Some believe the aircraft used was a Wright Flyer, but the claim almost certainly is inaccurate.

These early attempts to create a workable ejection seat, primitive though they were, formed the basis for the modern type that has paid big dividends for every military pilot who has ever been saved by one. Virtually all modern ejection seats have been powered either by compressed air or some form of chemical propellant—mortar cartridges, rockets, or both.

Development was slow. In World

War I, no one paid much attention to the issue of escape from disabled aircraft. This was particularly true among the Allied air services. Some in the upper echelons of the Royal Flying Corps, for example, felt that equipping pilots with parachutes would "contribute to a lack of moral fiber," as one officer of the day put it.

In the German air service, parachutes were well known. Germany put them to particularly good use for the crews of observation balloons. Late in the war, a few German aircraft pilots also used parachutes.

Parachute technology advanced considerably after the war. In 1920, Maj. T. Orde Lees, a Royal Air Force pilot, carried out a successful jump from 250 feet using a parachute called "the Guardian Angel." In October 1922, US Army Lt. Harold Ross Harris bailed out over Dayton, Ohio, becoming the first American military pilot to be saved by his parachute.

This flurry of activity in the immediate postwar years was followed by a long hiatus in development of both the parachute and its companion ejection systems. Not until the mid-1930s did serious work resume. Most subsequent pioneering achievements stemmed from the work of German and Swedish aeromedical scientists and engineers.

Germany Leads the Way

In 1934, the world saw the first truly modern application of an ejection seat. It was employed during dangerous test flights of the German Dornier Do-23 aircraft.

The Do-23 was a bomber. In 1934 the Nazis were still giving lip service to the Versailles Treaty, which barred Germany from possessing military aircraft, so the Do-23 was officially listed as a cargo plane. A twin-engine, high-wing monoplane with fixed gear, it was equipped with engines positioned on the same horizontal plane as the open cockpit. This made it impossible for the pilot to escape, inasmuch as the propellers were located scarcely six inches behind his seat.

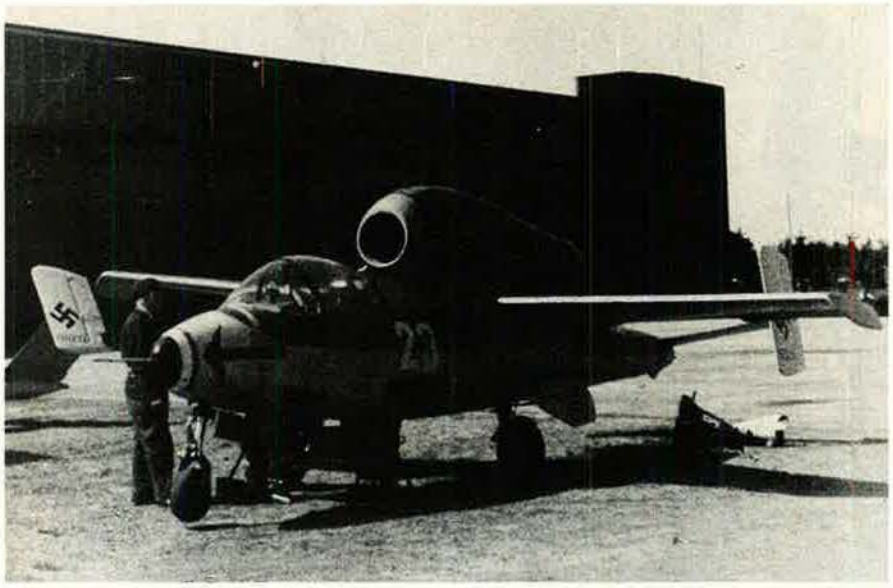
The Do-23 copilot's seat was a folding chair mounted on a tube. It was further to the rear and could be ejected from the aircraft. The seat is believed to have been powered by a compressed spring. On dangerous test flights, only one pilot came on board; he sat in the copilot's seat.

During an acceptance flight, this seat was accidentally but successfully employed. The checkout pilot inadvertently released the seat and found himself raised above the slicing arcs of the propellers, after which he bailed out using his parachute in the usual fashion and landed unharmed but surely terrified from the experience.

Ejection seat development had picked up strongly by 1939. The Luftwaffe's Aviation Medicine Institute had acquired an impact pendulum and horizontal catapult sled for the study of the physiological effects of impact or ejection accelerations. German investigators had determined that the maximum acceptable acceleration impulse for an ejection seat was approximately +20 Gs with a duration of 0.1 second.

By 1941, the Junkers Ju-87 Stuka single-engine dive-bombers were being used in the Luftwaffe's ejection seat flight-test program. The Junkers Ju-88 twin-engine light/dive-bomber was also used as a test-bed. Test flights in these aircraft were in straight and level flight in the early tests and in power dives later.

The need to provide a means of



From 1944 on, the Germans installed ejection seats in all experimental aircraft, including this He-162 jet, already sporting such unusual features as tricycle landing gear, bent wingtips, split tail, and engine atop the fuselage.

escape under sustained acceleration (particularly in the pullout phase of dive-bombing) led to the use of increased air pressure in the compressed air–driven seats being developed by the German manufacturer Heinkel. Throughout World War II, Heinkel was the prime supplier of ejection seats, including the "Pressluft" compressed air–driven seat and the "Kartusche" explosive cartridge–driven seats.

On April 2, 1941, pilot Fritz Shäfer made the maiden flight of the Heinkel He-280V-1—the first twin-engine jet fighter—which was equipped from the outset with the Heinkel compressed-air seat. Only eight of these aircraft were built, and all were used in various flight-test programs, some of them ejection seat tests. By July 1942, the first successful twin-engine jet fighter, the Messerschmitt Me-262V-3 prototype, was in its first flight trials, and the Luftwaffe was moving rapidly toward an operational capability with jets.

First Pilot Saved

In 1942, an ejection seat saved the life of a pilot for the first time. One historical source places the event on January 13. Another accident, well documented by an authoritative German source and which may have been the same event, happened on July 15 when one Flugkapitän Pancherz escaped from a Ju-290 twin-engine, high-altitude bomber that became uncontrollable and broke up in flight. At an altitude of 9,900 feet, Pancherz found himself tumbling wildly in the ejection seat but was able to separate from it and deploy his parachute at an altitude of 3,300 feet. He landed safely a short distance from the wreckage of his aircraft.

In the period 1943–45, the ejection seat came into its own. The Luftwaffe equipped the Heinkel He-177 twin-engine strategic bomber with ejection seats (two per aircraft). By 1944, the Heinkel He-219 "Uhu" (Owl) twin-engine night fighter was operationally equipped as well. From 1944 on, all experimental and prototype aircraft built by the Luftwaffe were equipped with ejection seats. During 1944–45, the Heinkel He-162 Volksjäger (People's Fighter) low-budget jet became operational with an ejection seat.

Examples of these explosively propelled seats captured intact were later copied by both the French and the Soviets in their development of ejection seats after the war. This seat strongly influenced postwar American designs as well.

An ejection seat was specially designed for the prototype Focke-Wulf/Tank Ta-154 (the "Tank" designation refers to Kurt Tank, the designer). This aircraft was made largely of wood, like the RAF's Mosquito, and was a twin-engine, two-place, night and all-weather fighter equipped with ejection seats. The Ta-154V1-V15 series aircraft were on the verge of operational capability when the destruction of the -154's main production site in Poland halted any further development or production. Still, more than eighty percent of production aircraft were equipped with ejection seats.

At least some versions of the Messerschmitt Me-262 had what is referred to as a "Katapultsitz," which was probably driven by an explosive cartridge. The operational Me-262s were not equipped with ejection seats, according to some authorities. It is possible that the Me-262 design may have been frozen too early in the war to permit operational retrofits of seats.

The Dornier Do-335 "Pfeil" (Arrow) tractor/pusher piston-engine heavy fighter, with a top speed close to 500 mph, was put in production, equipped with an ejection seat. Very few of these aircraft were produced, and their performance was overtaken by the operational debut of jets. The tiny Messerschmitt Me-163 "Komet" rocket fighter had an ejection seat driven by a large compressed spring, according to some reports.

The last Luftwaffe bomber built, a one-place twin-engine jet, was the Arado Ar-234B "Nachtigall" (Nightingale), a twin-engine night fighter that was built in considerable numbers. This craft was a high-altitude type with a pressurized cockpit. An authoritative historical source describes the aircraft as one of the first production planes equipped with an ejection seat.

By the end of the war, German ejection seats had been used in more than sixty escapes. German scientists were using specially modified aircraft to study windblast effects on unprotected humans and using special blast chambers to study effects on unprotected humans of windblast velocities of more than 500 mph.

Swedish Seats

In their pursuit of workable ejection seats, the Germans were not alone. The year 1939 saw the initiation of an ambitious Swedish ejection seat program at the Swedish Aircraft Corp. (SAAB). By 1941, the design analysis had been completed for the SAAB-21 ejection seat. In early 1942, the first in-flight verification test of the SAAB ejection seat was flown using a dummy. The program quickly advanced to flight

testing of the ejection seat in July 1943, followed by serial production.

Swedish engineers and scientists continued their work through the war years and into the postwar period. The first in-flight emergency ejection using the SAAB seat took place on July 29, 1946. Of the twenty-five subsequent ejections, twenty-three were successful. Versions of the SAAB seat became operational that year in the SAAB-18 two-place bomber and in the SAAB-210.

In 1948, Sweden developed an ejection seat application that was duplicated nearly thirty years later in the F-16. The SAAB Type 2 seat, selected for installation in the SAAB-29 aircraft, was inclined 30° to reduce frontal area and increase the pilot's G tolerance. A version of this seat was subsequently used in the British Folland "Gnat."

It was the use of German ejection seats during World War II, however, that really propelled research. In 1944, Allied military authorities met in Britain with representatives from Martin-Baker Aircraft Co., Vickers, and Mobbs-Lobelle Aviation to discuss how to match the enemy in this technology.

The practical genius of James Martin, founder of Martin-Baker, prevailed. After having first considered using a kind of swinging arm to lift the pilot clear of an aircraft, Martin concluded that an explosive charge would have to be used. In this approach, he was duplicating earlier work done by German engineers.

USAAF's first live, in-flight ejection took place in 1946 at 228 knots and 7,800 feet. In 1968, two General Dynamics crewmen in this McDonnell Douglas module landed unhurt after being ejected at 29,000 feet over Texas at Mach .87.

In December 1944, Martin developed an inclined test fixture to investigate ejection accelerations and to study control of G onset. In 1945, the first human subject in British tests, Bernard Lynch, was fired up the ramp of this apparatus to heights of five to ten feet. He reported considerable discomfort at the highest levels.

Proper Posture Required

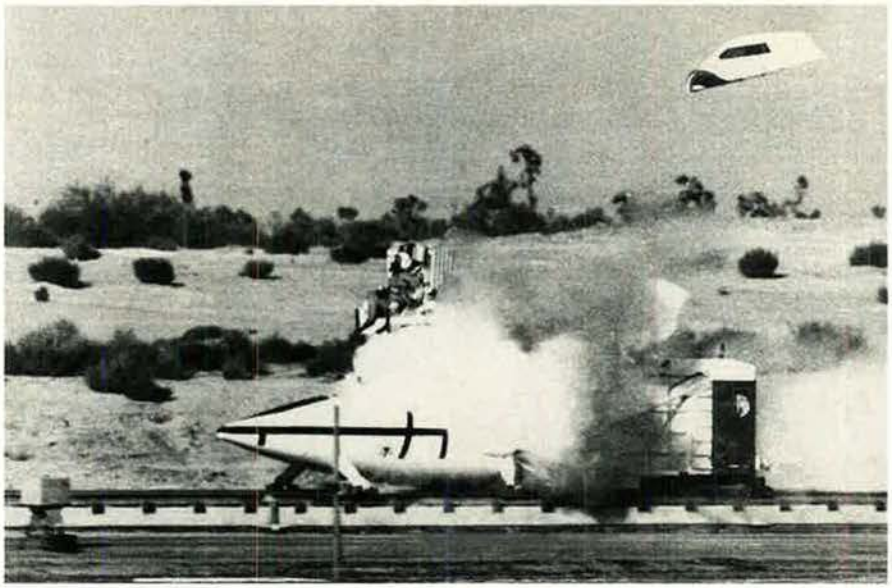
The British used this rig to carry out some 180 live ejection experiments, including one in which spinal injuries proved the importance of the pilot's position before ejection and of limiting catapult acceleration to about twenty Gs. Earlier German determinations of pulse shape, magnitude, and duration were not yet known to Martin-Baker.

Convinced of the necessity for in-flight tests, the RAF lent an obsolescent Boulton Paul Defiant two-place fighter to Martin in 1945 to be modified for ejection seat research. Using this aircraft, the first successful in-flight dummy ejection with a Martin-Baker seat was achieved in May 1945. The same month saw six more successful dummy ejections at speeds up to 300 mph. Impressed by these results, the US Navy invited Martin to erect an ejection seat test fixture at the Philadelphia Navy Yard.

By 1946, Martin-Baker was testing an operational design in a Gloster Meteor Mk. 3, an early jet fighter. Unsatisfactory dummy ejection performance, owing to parachute fouling at 425 mph, occurred during tests that year. This problem led to development of a drogue chute mortar to get the parachute clear of the seat wake. The first live ejection in the UK succeeded on July 24 when Bernard Lynch ejected from the Meteor at 320 mph at 8,000 feet.

By 1947, the RAF had initiated a policy to equip British military aircraft with ejection seats. Work com-

An early type of American ejection seat appeared in the Vought XP-54* Swoose Goose. *The pilot entered the aircraft from the bottom fuselage, on a seat that raised him into the cockpit. In an emergency, it reversed to catapult him away.



Ejection seat developers used blast chambers, catapult sleds, ramps, and towers in experiments. At Edwards AFB, Calif., X-15 engineers used high-speed sleds to work out the split-second timing for safely ejecting at Mach 3+.

menced in June to produce a standard seat for Meteor, Attacker, Wyvern, Canberra, Sea Hawk, and Venom aircraft. The redoubtable Bernard Lynch successfully ejected from a Meteor at 420 mph at 12,000 feet. This test validated the catapult design, face protection screen, drogue chute, and proper pre-ejection posture.

On May 30, 1949, a Martin-Baker ejection seat saved its first pilot. Test pilot John O. Lancaster ejected from an experimental Whitworth flying wing jet aircraft when wing flutter developed. The aircraft flew itself to a crash landing. Subsequently, the de Havilland Venom FB.1 twin-boom jet fighter became operational, equipped with an ejection seat.

The Americans Lag Behind

Surprisingly, US aviation tended to lag behind European nations in development of this critical technology. In 1937, Dr. J. W. Heim established the first impact facility in the US in a hangar at Wright Field, Ohio, to assist in the study of human tolerance to abrupt accelerations. The impact device was a simple swing hung from forty-foot cables. It used a brake and windlass to produce accelerations of sixteen Gs with a pulse duration of about 0.15 second.

There is a story, possibly apocryphal, that the Air Corps experimented in the late 1930s with a spring-propelled, pivoted beam to control the initial course of a seat used in a rear-engine fighter prototype. This approach was subsequently considered and abandoned by both German and British developers.

In a frantic game of catch-up at the end of the war in Europe, the Army Air Forces sent a fact-finding aeromedical team to Britain, Germany, and Sweden in 1945 to gather technical and scientific data on the design of ejection seats. A German ejection seat, application unknown, was brought to Wright Field and tested on a thirty-foot ejection seat tower that had recently been completed. This seat, which appeared in a contemporary photograph of the tower, probably was a Heinkel explosive cartridge ejection seat.

By the end of 1945, it had become clear that ejection seats were the wave of USAAF's future. The experimental Vought XP-54 *Swoose Goose* and XP-68 "Tornado"—both single-seat, twin-tail, pusher-engine, high-altitude interceptors—were equipped with a type of ejection seat. The pilot entered the aircraft through the bottom of the fuselage by a seat that was raised and lowered. In an emergency, this seat would lower the pilot below the arc of the propeller in a manner reminiscent of the 1934 Do-23 seat.

USAAF's first live, in-flight ejection seat test took place on August 17, 1946, at Patterson Field, Ohio. The test volunteer, 1st Sgt. Larry Lambert, successfully ejected from a P-61 Black Widow at 228 knots and an altitude of 7,800 feet. In 1949, Capt. Vince Mazza became the first American to eject from a jet. An ejection seat propelled him from a specially modified TF-80C at 430 mph over San Pablo Bay near Hamilton AFB, Calif.

The F-84 was the first USAF fighter to be operationally equipped with an ejection seat. The pace of development from that time on can be judged by the fact that on February 26, 1955, test pilot George Smith became the first person to survive an ejection at supersonic speed when he abandoned a North American F-100 Super Sabre at Mach 1.05.

Ever since, the history of the ejection seat has been written as much in engineering and aeromedical laboratories as in the air. During 1968–75, technical and aeromedical work led to the McDonnell Douglas ACES II (advanced-concept escape system) seat, which incorporated a controlled-force catapult, a gyro-stabilized vernier rocket, and a sustainer rocket, all of which ensured safe ejection over a broader spectrum of speed and altitude. The new design prevented tumbling and minimized parachute opening shock. ACES II has been installed in the F-15, F-16, A-10, and F-117 fighters and in the B-1B and B-2 bombers.

In following years, the Air Force initiated the Crew Escape Technology program to design a next-generation ejection seat. In 1990, the first interaction between US laboratory personnel and Soviet scientists took place and has led to joint venture investigations of the remarkable K-36D ejection seat used in the MiG-29. Other engineering and test work shows no sign of slackening. ■

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Valor

By John L. Frisbee, Contributing Editor

AACMO—Fiasco or Victory?

In 1934, the Air Corps took on a project that would test the courage and dedication of its young pilots and mechanics.

FEW READERS will recognize the names of Lts. Jean D. Grenier, Edwin D. White, James Eastman, or Durward Lowry. They were among those who gave their lives in what Air Force historian Maurer Maurer has called "one of the largest projects—and in many ways the most important"—of the years between world wars. That project was AACMO (Army Air Corps Mail Operation), in the winter of 1934. It was the first troubled step in a chain of events that ultimately led to an independent United States Air Force.

In early February 1934, President Franklin D. Roosevelt directed Postmaster General James A. Farley to cancel airmail contracts with the airlines because of contractual irregularities. The previous year, the airlines had carried several million pounds of mail over routes in the US that totaled nearly 25,000 miles. Most of the mail was flown at night in modern passenger planes equipped with the latest flight instruments and radios. Along the routes were well-equipped maintenance facilities.

On February 9, Air Corps Chief Maj. Gen. Benjamin D. Foulois was directed to take over the airmail operation covering a reduced route structure. He was given ten days to prepare for the task. Driven by the can-do spirit that impelled him to teach himself to fly, Benny Foulois enthusiastically accepted the assignment, underestimating the magnitude of the task and overestimating the capacity of the Air Corps to handle it.

An organization to manage the operation had to be set up and en-route maintenance sites established in whatever facilities were available. Where there were none, maintenance often had to be done in the open, sometimes in subzero weather. That, and the shortage of spare parts, resulted in many in-flight emergencies and accidents.

Air Corps aircraft of that day were designed and equipped for clear-weather, daytime use. Few had any instruments beyond needle-and-ball, altimeter, and airspeed indicators. With one or two exceptions, all the pursuit and observation planes and bombers that would be used as mail planes were open-cockpit aircraft.

Pilots had little experience in instrument and night flying and were generally unfamiliar with the routes they were to fly. What radios were on hand were of very short range and questionable reliability. General Foulois directed that all AACMO aircraft be equipped with directional gyros, artificial horizons, and radios. There were not enough to go around, and some flight instruments were installed improperly.

The Air Corps decided not to draw personnel from the training schools, where most of the experienced pilots were assigned. Thus, the great majority of AACMO pilots were lieutenants with limited flying experience. More than half of the 260 pilots had less than two years' flying experience. Only thirty-one had more than fifty hours of night time; the great majority had less than twenty-five hours of actual weather or hood time. Most of their flying would be done at night, in fog, snowstorms, and extreme turbulence.

The winter of 1934 brought the worst and most prolonged bad flying weather in many years. In route-familiarization flights over the Rockies, Lieutenants Grenier, White, and Eastman crashed in bad weather and were killed before the operation actually began. Lt. Joseph Hopkins, later a brigadier general, described one flight into Denver, Colo., in an open-cockpit P-12. After he landed, he had to use his right hand to remove his frost-bitten left from the throttle. Another AACMO pilot told a New York *Times* reporter, "Picture an Army aviator flying at night in subzero weather . . . in the open with a biting wind [lashing] him at 100 miles an hour. . . . He is trying to navigate his ship . . . to operate the radio . . . [and] hang onto the controls [while] sitting in a tiny cockpit with hardly enough room to move."

As the toll rose (the final count was twelve deaths and sixty-six crashes), the Air Corps came under harsh criticism from the public and Congress. General Foulois several times issued safety orders, but the young pilots, who often cleared themselves for a flight, continued to fly into weather they should not have attempted. Despite all these hardships and hazards, there were more volunteers to fly the mail than there were spaces available. These young men were out to prove the Air Corps could do the job.

With the coming of spring weather and with experience, crashes and casualties declined. On June 1, 1934, new contracts with the airlines were signed, and the Air Corps was relieved of all responsibility for the mail. Its operation, labeled a fiasco or a victory depending on one's point of view, had focused attention on the Corps's inadequacies in equipment, training, and organization. It was largely responsible for appointment of the Drum and Baker Boards that led to the establishment of the General Headquarters Air Force in March 1935—the first long stride toward an independent Air Force—and for more generous appropriations beginning the following year. The young lieutenants who suffered and too often died during that terrible winter of 1934 deserve a large share of credit for an outcome that few had foreseen. Valor takes many forms in peace and in war. ■

Grrrronimo!

Photo courtesy C. V. Glines

This is definitely not a walk in the park. Coaxed by fellow paratrooper Sgt. Francis M. Dowdy, of the 10th Rescue Unit, Ladd AFB, Alaska, Paratrooper Joe (foreground) is about to make his fifth jump out of this Douglas C-47 Skytrain on a simulated rescue mission. During World War II, dogs like Joe were trained to bail out (with automatically opening chutes) onto snow-covered mountain tops and into dense forests, areas often inaccessible to planes and human paratroopers. Stranded parties then waited for sleds and supplies to be dropped, hitched up the dogs, and rescued themselves.

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Air Force Association - Working for its National Membership. March 1995

National Report

Senate Defense and Veterans' Issues in Seasoned Hands

While 25 percent of House members on the National Security and Veterans' Affairs committees are new to Congress [See February 1995 National Report], all the members of the Senate Armed Services and Veterans' Affairs committees have previous congressional experience. Of the two new members of the Senate Armed Services Committee, both served in the House, and one was a member of the House Armed Services Committee. Other new members of these two key Senate committees have previous Senate experience on other committees. The greatest change in the Senate involves the reversal of majority and minority status. Listed below are the committee lineups. Take the opportunity to renew your previous contacts and to get to know members who are new to the committees. (New members' names are marked with asterisks.)

Senate Armed Services Committee
(party ratio 11R/10D)

Majority Members:
Strom Thurmond (R-SC)
John Warner (R-VA)
William Cohen (R-ME)
John McCain (R-AZ)
Trent Lott (R-MS)
Dan Coats (R-IN)
Bob Smith (R-NH)
Dirk Kempthorne (R-ID)
Kay Bailey Hutchison (R-TX)
Jim Inhofe (R-OK)*
Rick Santorum (R-PA)*

Minority Members:
Sam Nunn (D-GA)
James Exon (D-NE)
Carl Levin (D-MI)
Edward Kennedy (D-MA)
Jeff Bingaman (D-NM)
John Glenn (D-OH)
Robert Byrd (D-WV)
Charles Robb (D-VA)
Joseph Lieberman (D-CT)
Richard Bryan (D-NV)

Senate Veterans' Affairs Committee
(party ratio 7R/5D)

Majority Members:
Alan Simpson (R-WY)
Strom Thurmond (R-SC)
Frank Murkowski (R-AK)
Arlen Specter (R-PA)
Jim Jeffords (R-VT)
Hank Brown (R-CO)*
Larry Craig (R-ID)*

Minority Members:
John D. Rockefeller IV (D-WV)
Bob Graham (D-FL)
Daniel Akaka (D-HI)
Ben Nighthorse Campbell (D-CO)
Byror. Dorgan (D-ND)*

Smithsonian Cancels *Enola Gay* Exhibit

AFA Praises Congressional Allies

After a year of calling for a revised script that would add historical balance and context to the politically biased *Enola Gay* exhibit planned for May 1995, on January 20, the Air Force Association blasted the National Air and Space Museum for backtracking on previously agreed-to script changes.

In a nationally disseminated news release, AFA Executive Director Monroe W. Hatch, Jr., stated, "We do not believe that a fair and balanced presentation of the *Enola Gay* is possible with the present director-curator team in charge. We conclude, therefore, that it is time to cancel this exhibit."

A day earlier, Rep. Peter Blute (R-MA) and Rep. Sam Johnson (R-TX) called for the resignation of Air and Space Museum Director Martin Harwit. A few days later, 79 members of the House of Representatives joined them in co-signing a letter to Secretary of the Smithsonian Institution I. Michael Heyman. On January 30, Secretary Heyman announced that the *Enola Gay* exhibit would be replaced by a simple display of the airplane's fuselage, along with video recollections of the crew.

Much of the credit for this development belongs to the veterans who first raised the issue and to individual members of AFA who wrote to their congressmen. Support on Capitol Hill has been tremendous, and AFA is grateful to all members of the House and Senate who took an active interest in this matter, both in public and private.

For its part, AFA published the initial and definitive articles on this subject in AIR FORCE Magazine and launched a national communications campaign that reached hundreds of newspapers, dozens of regional radio stations, and all the major television networks. The facts spoke for themselves, and the reaction against the Air and Space Museum was overwhelming.

"Without help from the AFA, we might have lost the opportunity to see this great airplane displayed with the respect it deserves."

--Rep. Sam Johnson (R-TX)

AFA/AEF Report

By Daniel M. Sheehan, Assistant Managing Editor

Razorback Returns

Deputy Secretary of Veterans Affairs Hershel W. Gober returned to his native Arkansas to brief **Razorback Chapter** members on how his department is changing to better meet the needs of those who have served in the US military. Mr. Gober, former Arkansas director of Veterans Affairs, told his audience that the VA believes in "putting veterans first."

He described the success the department has had in the past two years in reducing waiting times at its facilities and in improving the responsiveness of its 260,000 employees. He reached out to veterans in the audience, asking them to inform the VA if their problems are not being addressed, and he thanked them in particular and AFA in general for helping to keep the department on its toes.

Chapter President John Burrow introduced the twenty-two-year Marine Corps veteran, who was wounded during his service in the Vietnam War. Mr. Burrow also noted the chapter's efforts to serve all its constituencies, pointing with pride to the participation of the University of Arkansas's AFROTC unit and local Arnold Air Society and Angel Flight units in chapter activities.

Jack Gates (second from right) gave members of the Everett R. Cook (Tenn.) Chapter a moving account of his ordeal on the Bataan Death March and as a Japanese POW during World War II. After his talk, he met with (from left) Chapter Vice Presidents John Wilkinson III, Noal Damron, and Bill Freeman.

Chapter News

In a time when both interest in military service and the number of serv ce-age young people are declining, the **Colorado Springs/Lance Sijan (Colo.) Chapter** has brought in some heavy hitters to capitalize on the younger generation's fascination with space. Chapter Executive Vice President Chuck Zimkas arranged for astronaut Charles Duke to speak with a group of students at Horace Mann Midcle School. Mr. Duke, who as an Air Force lieutenant colonel piloted the lunar module and walked on the moon during the Apollo 16 mission, addressed the 300 students under the aegis of the "Visions of Exploration" program. AFA cosponsors the "Visions" program with *USA Today* and NASA to help foster an interest in science and technology among the nation's young people.

Two prize-winning high school science fiction writers got a somewhat unusual reward for their work, thanks to the Sijan Chapter. Their stories were launched into space as part of a time capsule included on a direct broadcast TV satellite. The writings of Jeremy Tippetts and Aaron Borland, two Colorado Springs students, are now orbiting the Earth through the efforts of the Sijan Chapter and the Rochester Museum and Science Center. Mr. Zimkas presented both students with framed photographs of the satellite launch.

Joining AFA Board Chairman James McCoy (second from right) and Montgomery (Ala.) Chapter President Roy Boudreaux (right) at the unveiling of the Air Corps Tactical School Memorial, (from left) former Montgomery Chamber of Commerce Chairman Will Tankersley, Montgomery Mayor Emory Folmar, Air University Ccmmander Lt. Gen. Jay Kelley, and Montgomery Chamber of Commerce Chairman Mike Jenkins paid tribute to USAF's roots.

Staff photo by Lindsey Farley

Through the generosity of National Director Jack Gross, headquarters staff members (from left) Bill Cox, Katie Storm, Wendy Rivera, and Gilbert Burgess, shown here with Executive Director Monroe W. Hatch, Jr. (center), were each honored as employees of the quarter in 1994. Mr. Burgess was named employee of the year.

Crawford and Ethell Honored

National Director and former National President and Chairman of the Board O. R. Crawford has been elected an honorary member of the Order of Daedalians for his longtime support of airpower, both as a pilot and an advocate. Also inducted in the Texas-based order, which traces its roots to an organization of World War I veteran pilots, was Jeffrey L. Ethell, who has contributed articles and photographs to AIR FORCE Magazine.

Have AFA/AEF News?

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

Coming Events

April 29, **Massachusetts State Convention,** Boston, Mass.; May 5–6, **Mississippi State Convention,** Columbus, Miss.; May 12–13, **Louisiana State Convention,** Baton Rouge, La.; May 12–13, **South Carolina State Convention,** Columbia, S. C.; June 9–10, **Missouri State Convention,** Branson, Mo.; June 16–18, **New York State Convention,** Melville, N. Y.; June 23–25, **Ohio State Convention,** Wright-Patterson AFB, Ohio; July 7–8, **Arkansas State Convention,** Jacksonville, Ark.; July 7–9, **Washington/Oregon State Convention,** Tacoma, Wash.; July 21–23, **Pennsylvania State Convention,** Harrisburg, Pa.; July 21–23, **Texas State Convention,** Wichita Falls, Tex.; July 28–30, **Florida State Convention,** Tampa, Fla.; July 28–30, **Iowa State Convention,** Sioux City, Iowa; August 3–5, **California State Convention,** Monterey, Calif.; August 4–5, **New Mexico State Convention,** Alamogordo, N. M.; August 12, **North Carolina State Convention,** Greenville, N. C.; August 12–13, **Michigan State Convention,** Alpena, Mich.; August 18–19, **Colorado State Convention,** Colorado Springs, Colo.; September 18–20, **AFA National Convention and Aerospace Technology Exhibition,** Washington, D. C.

Unit Reunions

Air Commando Ass'n. October 5–8, 1995, in Fort Walton Beach, Fla. **Contact:** Air Commando Association, 2 David St., Fort Walton Beach, FL 32547. Phone: (904) 864-1953.

Berlin Airlift Veterans. September 24–27, 1995 in Charleston, S. C. **Contact:** Joseph W. Studak 3204 Benbrook Dr., Austin, TX 78757-6804 Phone: (512) 452-0903.

"Coconut Heads" and "Gooney Hens," Christmas Island (World War II). September 21–23 1995, in Hampton, Va. **Contact:** David T. Buente 120 Arch Ave., Pittsburgh, PA 15202. Phone (412) 766–7342.

Jolly Green Ass'n. May 5–6, 1995, at the Ramada Inn Beach Resort in Fort Walton Beach, Fla. **Contact:** Lt. Col. John F. Guilmartin, Jr., USAF (Ret.), P. O. Box 965, O'Fallon, IL 62269.

Scouting Force, 8th Air Force (1944–45). April 6–9, 1995, at the Park Hotel and Conference Center in Tucson, Ariz. Veterans of the 55th, 355th, and 364th Fighter Groups and veterans of all bomb groups served by the Scouting Force are also invited. **Contact:** E. Richard Atkins, 1304 Cochise Dr., Suite 222-A, Arlington, TX 76012. Phone: (817) 261-3307.

Suffolk County AFB, N. Y. October 5–8, 1995, at the Sheraton World in Orlando, Fla. All who served at Suffolk are invited. **Contact:** Edwin P. Hapgood, 9855 S. W. 203 Cir., Dunnellon, FL 34431. Phone: (904) 489-0725.

4th Fighter Group (World War II). June 14–18, 1995, in Dayton, Ohio. **Contact:** Richard J. Rinebolt, 624 E. Circle Dr., Findlay, OH 45840-8610. Phone: (419) 422-7363 or (419) 424-7832.

4th Fighter-Interceptor Wing (Korea). June 12–14, 1995, in Hampton, Va. **Contact:** Larry Davis, 4713 Cleveland Ave. N. W., Canton, OH 44709. Phone: (216) 493-4122

Mail unit reunion 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.

12th Bomb Group. September 27–30, 1995, at the Holiday Inn in Hampton, Va. **Contact:** Alex Adair, 22925 14th Pl. W., Bothell, WA 98021. Phone: (206) 486-1221.

29th Air Service Group, 13th Air Force, and attached units. July 9–14, 1995, at the Holiday Inn–Dayton Northwest in Englewood, Ohio. **Contact:** Frank Pace, 315 W. 15th St., Dover, OH 44622. Phone: (216) 343-7855.

41st Bomb Group, 7th Air Force, which included the 47th, 48th, 396th, and 820th Bomb Squadrons (World War II). October 17–20, 1995, at the Riviera Hotel in Las Vegas, Nev. **Contact:** Don Rossbach, P. O. Box 187, Marcell, MN 56657. Phone: (218) 832-3461.

Aviation Cadet Class 42-B. April 27–May 1, 1995, at the Marriott Hotel in Nashville, Tenn. **Contacts:** Leslie Mondelli, 1220 Shiloh Dr., Nashville, TN 37205. Phone: (615) 352-2079. Leo Bolster, 2235 Paseo Del Oro, Colorado Springs, CO 80904. Phone: (719) 473-9974.

USAF Pilot Training Class 49-B. September 3–7, 1995, at the Hyatt Regency Resort and Conference Center in Monterey, Calif. **Contact:** Lt. Col. John Stolly, USAF (Ret.), 11323 Cotil-

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NORTHROP GRUMMAN

Unit Reunions

lion Dr., Dallas, TX 75228-1910. Phone: (214) 681-8290.

69th Fighter Squadron (World War II). June 8–12, 1995, in Boise, Idaho. **Contact:** George E. Mayer, 7445 Thomas Ave. S., Richfield, MN 55423. Phone: (612) 866-6073.

99th Bomb Group. May 16–21, 1995, in St. Louis, Mo. **Contact:** Francis Grantz, 15655 Clayton Rd., Ballwin, MO 63011-2363. Phone: (314) 394-3314.

315th Fighter Squadron, 324th Fighter Group (World War II). May 31–June 3, 1995, at the Holiday Inn in Fairfax, Va. **Contact:** Eugene J. Orlandi, 311 Third St. E., Northport, NY 11731. Phone: (516) 368-9193.

354th Fighter Group (Pioneer Mustang Group/ World War II). Fiftieth-anniversary V-E Day reunion, April 29–May 8, 1995, in Ansbach, Germany. **Contact:** Clayton Kelly Gross, 7000 Merry Lane, S. W., Beaverton, OR 97008.

358th Fighter Group, including the 365th, 366th, and 367th Fighter Squadrons and support units. October 6–8, 1995, in Dayton, Ohio. **Contact:** Lt. Col. Robert Bowen, USAF (Ret.), 215 Mockingbird Ct., Pinehurst, NC 28374. Phone: (910) 295-5430.

364th Fighter Group, 8th Air Force (World War II), Honington, England. October 25–29, 1995, at the Doubletree Hotel in Houston, Tex. **Contact:** Dan Leftwich, 6630 Caldero Ct., Dayton, OH 45415. Phone: (513) 890-3641.

404th Fighter Group. September 7–10, 1995, at the University Plaza Hotel in Springfield, Mo. **Contact:** Warren Watters, Rte. 4, Box 2630, Marshfield, MO 65707. Phone: (417) 859-2432.

410th Bomb Group, ETO (World War II). May 24–28, 1995, at the US Grant Hotel in San Diego, Calif. **Contacts:** Linville Franklyn Young, 384 Third St., Atlantic Beach, FL 32233. Phone: (904) 246-2324. Howard B. Aines, 516 Rolling Hills Lane, Danville, CA 94526.

417th Bomb Group. September 14–16, 1995, in San Antonio, Tex. **Contact:** Matt Montee, Rte. 3, Box 310, Seguin, TX 78155. Phone: (210) 372-2269.

483d Bomb Group and 566th Air Engineers (World War II). October 9–15, 1995, in Hampton, Va. **Contact:** James Ashley, 312 Marshall St., Hampton, VA 23669-3524.

555th, 563d, 564th, 566th, and 573d Signal Aircraft Warning Battalions. October 5–7, 1995, in Kansas City, Mo. **Contact:** James D. Lynn, 3855 Utah Pl., St. Louis, MO 63116-4832. Phone: (314) 771-2928.

648th Aircraft Control and Warning Squadron. May 27–29, 1995, at the Holiday Inn in Wilkes-Barre, Pa. **Contact:** Bernie Wall, 528 Ridgewood Dr., Northfield, NJ 08225. Phone: (609) 646-1079.

7406th Support Squadron. May 4–7, 1995, in San Antonio, Tex. **Contact:** Maj. Charles V. Davis, USAF (Ret.), 11570 61st Ave. N., Seminole, FL 34642. Phone: (813) 392-5815.

433d Troop Carrier Ass'n. Seeking contact with former members for the purpose of planning a reunion. **Contact:** Col. Joe Bonner, USAF (Ret.), 9219 S. E. Pardee, Portland, OR 97266. Phone: (503) 777-5125. ■

Bulletin Board

In return for shipping cost reimbursement, offering complete collection of **Air Force Magazine** from 1944 to present. **Contact:** Lt. Col. Douglas D. Stewart, USAF (Ret.), 409 W. River Rd., Oscoda, MI 48750.

Seeking contact with anyone associated with World War II USAAF **floating aircraft repair and maintenance units** at Kelly Field, Tex. and trained on Mobile Bay in 1944. **Contact:** Col. George H. Pittman, Jr., USAF (Ret.), P. O. Box 1617, Melbourne, FL 32902.

Collector seeks USAF color **patches** from flying units in exchange for French Air Force patches. **Contact:** J. C. Cechetti, 53 rue du Cormier, 41200 Romorantin, France.

Seeking contact with **MSgt. Rauld (Harold) Ferandes,** who corresponded with Carolyn Ann Hyams in February 1944 while serving at Chelveston, England, with the 422d Bomb Squadron, 305th Bomb Group. **Contact:** Carolyn A. Howie, 2 Glenlorne, 31 Vause Rd., Durban 4001, South Africa.

Collector seeks patches and memorabilia from **manned spacecraft recovery** forces for Mercury, Gemini, and Apollo astronauts. Also seeking strategic missile and aerospace patches. **Contact:** John Bisney, 5803 Ryland Dr., Bethesda, MD 20817.

Seeking autographs of **Frank M. Andrews, John B. Brooks, Everett S. Davis, Lionel H. Dunlap, Westside T. Larson, and Millard Fillmore Harmon. Contact:** Steve Keyser, P. O. Box 1464, El Cajon, CA 92022.

Collector seeks **WASP wings**—ATC civilian pilot or class wings or either version of the official

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 reserve the right to condense them as necessary. We cannot acknowledge receipt of letters. Unsigned letters, items or services for sale or otherwise intended to bring in money, and photographs will not be used or returned.—THE EDITORS

WASP wing with WASP diamond in the center. **Contact:** Chuck Ackerman, 4224 S. W. 314th Pl., Federal Way, WA 98023.

Seeking information on **Col. Henry R. Spicer** while he was a POW in Barth, Germany. **Contact:** Col. C. V. Glines, USAF (Ret.), 1531 San Rafael Dr., Dallas, TX 75218.

Seeking information on the type of aircraft flown by World War II and Korean War ace **Col. John C. Meyer. Contact:** Bernard J. Murphy, 7 Bertha St., R. D. #1, Stanhope, NJ 07874.

Seeking the whereabouts of **A1C Jack May,** originally from Chandler Heights, Ariz., who was stationed in the UK around 1952. **Contact:** Christopher Thomas Laing, 19 The Hawthorns, Audenshaw, Manchester, Tameside M34 5LU, UK.

Seeking the whereabouts of **Sgt. Gerald Irving Walter,** who was stationed at RAF Upper Heyford, UK, until July 1977 and whose parents were from Metamora, Mich. **Contact:** Mark J. Walter, 6 Maidencroft Cottages, Kempsford, Gloucestershire, UK.

Seeking information on the **KC-135 *Miss Omaha*** that crashed at Offutt AFB, Neb., in 1959. **Contact:** Lt. Col. Angelo P. Marini, USAF (Ret.), 85 Ebling Ave., Tonawanda, NY 14150.

Seeking contact with **Capt. Scott D. Mattson,** whose last known address was Grand Forks AFB, N. D. **Contact:** Michael Kosman, 504 E. Exchange St., Geneseo, IL 61254-2100.

Seeking memorabilia, photos, and contact with students or permanent party who were at the **Stevens Hotel** (now the Chicago Hilton) radio operator/mechanics school, World War II, interested in a reunion in 1995. **Contact:** Lt. Col. Andy M. Kmetz, USAF (Ret.), 1715 W. Haven Dr., Champaign, IL 61820.

For a history of **Castle AFB, Calif.,** 1941–95, seeking information from Castle veterans on personnel, aircraft, activities, and TDY deployments. Also seeking photos of Castle. **Contact:** Lt. Col. Rick Rodrigues, USA (Ret.), 212 E. McHenry, Urbana, IL 61801.

Collector seeks **name tags** from aviators who were stationed at Bitburg AB or Ramstein AB, Germany, or with the 10th, 313th, and 496th Tactical Fighter Squadrons at Hahn AB, Germany, or the 23d, 81st, and 480th Tactical Fighter Squadrons at Spangdahlem AB, Germany. **Contact:** Martin Agüera, Goethestraße 2, 55491 Büchenbeuren, Germany.

Seeking contact with anyone who knew 8th Air Force pilot **Harvey Dater,** killed in action in September or October 1944 over Germany. **Contact:** Harvey Dater, 5320 Zelzah Ave., #110, Encino, CA 91316.

For a genealogy, seeking contact with **Lt. Col. Sidney J. Prejean. Contact:** Lt. Col. Edward J. Préjean, USAF (Ret.), 641R Cypress Creek Rd., Kerrville, TX 78028-9120.

Seeking the whereabouts of **Sgt. Steven B. Fisher** and **2d Lt. Wayne H. Wentz,** both from Wisconsin, who were stationed at Avon Park Bombing Range, Fla., 1979–82. **Contact:** Johnny L. McDonough, 980 Country Lane, Hayden, AL 35079-2968.

Seeking contact with **Sergeants Black, Lyle, Schwemmer, and Strasheim** and **Airmen McFayden and Candido,** who were with the 4th Fighter-Interceptor Wing, 4th M&S Group, Korea, 1951–52. **Contact:** Jack Casotti, 125 Santa Monica Ave., Channel Islands Harbor, CA 93035.

Seeking contact with five pilots downed behind enemy lines in **Ormac Valley,** western Leyte, the Philippines, in November or December 1944. A Japanese seaplane bombed them. **Contact:** Harry D. Weiland, 3272 School Rd., Murrysville, PA 15668.

Seeking contact with an American military member who parachuted into **Sallenelles, Normandy, France,** in July 1944. He hurt his foot, was rescued by Paul Sicot, and was taken away by an English ambulance. **Contact:** Louise Moulin, 48 route de Cabourg, La Musardière, 14810 Merville, France.

Collector seeks special issues of Air Defense Command ***Interceptor*** Magazine. **Contact:** Elmer Ross, P. O. Box 807, Everett, WA 98206-0807.

The 514th Air Mobility Wing is seeking historical material, newspaper articles, photos, patches, and uniforms from **514th Troop Carrier Wing/ Tactical Airlift Wing** veterans, 1949–73. **Contact:** TSgt. David Stroebel, 2217 W. Arnold Ave., McGuire AFB, NJ 08641-5218.

Seeking information on the **Air Force Data Communications** network (also called COMLOGNET and AUTODIN) from the 1950s to 1960s. Also seeking contact with 1958 COMLOG Phasing and Coordination Group participants. **Contact:** Defense Information Systems Agency, Attn: Code TEFFE (William Arey), 10701 Parkridge Blvd., Reston, VA 22091-4398.

Seeking Air Force patches, flight suits, flight gear, and photos from World War II to present, particularly from the **32d Fighter Day Squadron, 32d Fighter-Interceptor Squadron,** and **32d Tactical Fighter Squadron. Contact:** SSgt. Al Pritchard, 53d Fighter Squadron, PSC #9, Box 1469, APO AE 09123. ■

Pieces of History

Photography by Paul Kennedy

The Cops

Memorabilia courtesy US Air Force Security Police Museum, Lackland AFB, Tex.

On a routine day, they might direct traffic or guard the flight line. On the other hand, when an Air Force base is under attack, Security Police are expected to fend off the enemy—whether it's a single terrorist or an entire battalion. In Operation Desert Storm, the evacuation plan for US air bases in Saudi Arabia didn't even include the SPs; they were expected to stay in place and hold back an Iraqi attack until a response force arrived. SPs have been called "Air Police," LEs (for law enforcement), even "the Air Force's own infantry." By any name, they play an integral part in the fly-and-fight mission.

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