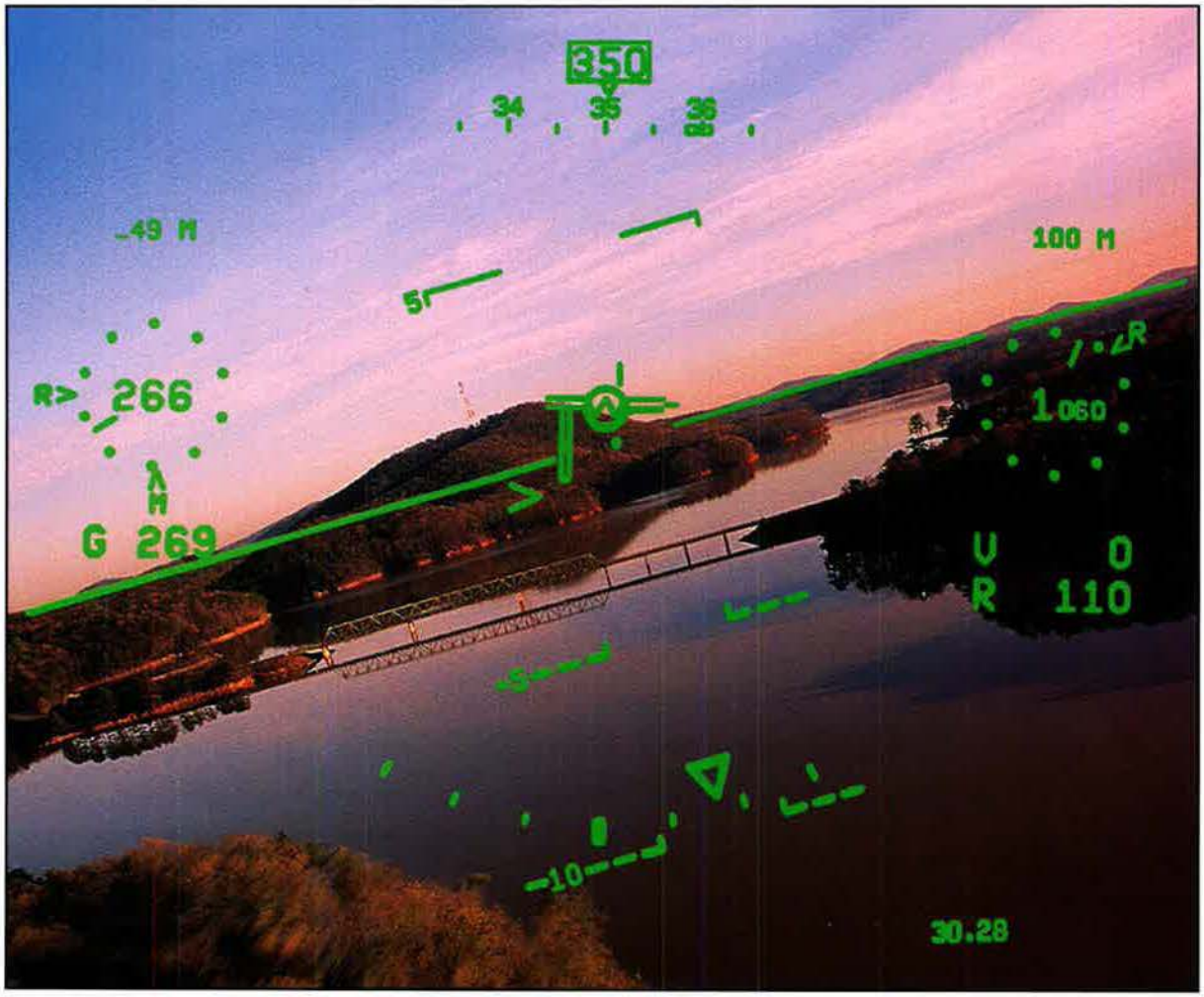
MARCH 1997/$3

AIR FORCE

PUBLISHED BY THE AIR FORCE ASSOCIATION MAGAZINE

The Air War in Korea

Pilots aboard the new C-130J can utilize a special low-altitude technique. We call it "looking out the window."



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Mission Success

March 1997, Vol. 80, No. 3

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

About the cover: Capt. Joseph C. McConnell, Jr., returns from the mission that made him USAF's leading ace of the Korean War. See "The Air War in Korea," p. 26. Photo by Gil Lowder, via Warren Thompson.

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Editorial

By John T. Correll, Editor in Chief

To Halt an Invasion

WHEN the Cold War ended, the US reduced its armed forces and recast its defense strategy into a regional conflict mold. Unfortunately, the main vehicle by which it did so was the Bottom-Up Review of 1993.

The BUR, as it came to be known, is often depicted as a thoughtful reevaluation of strategy. In fact, it was a fiscal exercise to find operational concepts that would fit the blind budget cuts made several months earlier by the Clinton Administration.

After several miscues, the BUR declared that US forces ought to be ready to fight and win two major regional conflicts, "almost simultaneously." ("Almost," we learned later, meant a separation of 45 days.) However, the BUR did not provide enough forces or enough funding to execute a two-MRC strategy.

Focused as it was on the budget, the BUR took insufficient note of the changing nature of warfare or of the nation's operational experience in the most recent regional conflict, the Persian Gulf War of 1991.

The two-MRC strategy is stiffly traditional. In the initial phase, US forces, chiefly airpower, seek to halt an invasion. That done, the air effort slackens during an extended buildup phase for US land, sea, and air forces. The final phase is a large-scale air-land counteroffensive to defeat the enemy.

The Gulf War followed a different pattern. The 43-day air campaign not only halted the Iraqis but also reduced their military effectiveness so much that the US ground offensive lasted only 100 hours. Moreover, the Gulf War provided an instructive set piece in the Battle of Khafji.

Two weeks into the war, Iraq was reeling from the constant air attacks and wanted to induce a fight on the ground. To provoke such an exchange, Iraqi armored divisions moved against the lightly defended border town of Khafji in Saudi Arabia. Their hope, apparently, was to lure coalition ground forces back into the strength of the Iraqi defenses.

It didn't work. A Joint STARS surveillance aircraft spotted an armored column moving through the night and vectored two A-10s and an AC-130 gunship onto it. Among them, they destroyed 58 of the 71 vehicles. Airpower continued to hammer the invaders and harried them relentlessly on the way out. One tank brigade, caught in the open, was practically destroyed from the air. A survivor said that all the brigade had endured during 10 years of the Iran-Iraq war did not equal what happened to it in 15 minutes in the desert north of Khafji.

Joint force planners undervalue airpower in the critical first stage of conflict.

An interesting footnote is that the summer before, a US Central Command exercise, Internal Look, predicted that airpower would not be very effective against Iraqi armored formations.

Prodded by the Air Force, the Pentagon is revisiting assumptions of the BUR and the two-MRC strategy in the course of the Deep Attack/Weapons Mix Study, the Joint Strategy Review, and the Quadrennial Defense Review.

A simulation model called "Tacwar" figures prominently in the argument. "Tacwar" has great influence on joint force planning, and its concepts tend to be reflected in theater war plans.

When the Air Force mounted its challenge to "Tacwar" last year, the model assumed that the enemy's military effectiveness would be reduced by about 20 percent in the first 15 days of the conflict. At that point, "Tacwar" curtailed the air effort until land forces had time to arrive and held back preferred aerial munitions to support the ground counteroffensive.

Part of the problem was that the model—and the joint force planning process—undervalued airpower. For example, "Tacwar" estimated sortie effectiveness at 15 percent, less than the Air Force achieved in Vietnam. Sortie effectiveness in the Gulf War was about 50 percent. In Bosnia-Hercegovina, it was 59 percent. By the model's logic, it took 16 sorties to destroy an armored personnel carrier. "Tacwar," since modified, now figures that three or four sorties will do the job. That's better than the previous estimate, but in reality, the Air Force says it can take out three to four APCs per sortie when using preferred munitions.

Another part of the problem is that joint strategy, geared to dominant surface maneuver, has not kept pace with change. The Napoleonic style of war, characterized by attrition, the clash of force on force, and high casualties, is giving way to new approaches made possible by the combination of information technology, stealth, and long-range precision strike.

The Air Force believes early arriving US forces can achieve more than is now expected of them in the halt phase of a conflict. The objective should be a decisive halt, in which we hold air dominance and in which the enemy no longer has the capability to advance and his strategic options are exhausted.

This, the Air Force says, will be a "culminating point" at which the theater commander has a number of options to further disable the enemy regime, ranging from a ground offensive to continuation of the air campaign.

The sooner US forces can render the enemy ineffective in one regional conflict, the faster they will be ready to swing over to a second conflict, putting new credibility into the national strategy and improving on the difference between "almost simultaneously" and the 45-day gap. ■

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Unfortunately, increased sensitivity can also lead to increased vulnerability. And our precision strike capabilities are susceptible to RF jamming and interference from a number of sources including intentional high-power jamming, intentional low-power jamming, friendly/mutual interference and benign sources like television transmissions.

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For more information and a copy of the White Paper on this subject presented at the Precision Strike Technology Symposium, contact our Precision Strike Team.

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Letters

Broken Promises

After spending 20 to 30 years defending a system, it is difficult to realize that the system has been lying to you and planned to cheat you. But that is exactly what happened with the Defense Department and Congress and medical care for retirees *["Over the Cliff," January 1997, p. 38].* Further, after that 20 to 30 years of always showing great respect for superiors, many retirees find it most difficult to speak up and defend themselves against those who would cheat them.

Let's face it: If it were General Motors or IBM who after three decades said to their employees, "You did your part, but we don't want to keep our part of the bargain—shove off and forget it," I hate to think what would happen to those corporations.

Maybe it is time to quit pussyfooting around and call a con a con and a cheat a cheat—and call it loudly. Since even Tricare and the proposed Medicare Subvention break the promises, that may be the only way to generate enough publicity to remedy what is happening. It is obvious that complaints from the retirees are going to be ignored unless the general public can be aroused.

Michael V. McGee
North Pole, Alaska

My family enjoyed "Over the Cliff," and I wish to point out that retirees are not the only ones being abandoned by loss of guaranteed health care. This past summer, I was reassigned from the Pentagon to Fairchild AFB, Wash. The timing was not ideal since my wife would be eight months pregnant at the time of the move, and we couldn't get relief on the reassignment timing. . . .

My wife was not given any guarantee of medical care when we arrived at Fairchild.

Not accepting the potential risk for our soon-to-be-born child, we obtained commercial insurance. When we contacted the local hospital, stating we had commercial insurance, my wife was given medical appointments prior to moving.

Your article rightly depicted a decline in medical benefits for retirees, especially on reaching age 65, but you don't have to reach 65 to be uncovered by the military health-care system.

Maj. Wayland H. Patterson, USAF
Fairchild AFB, Wash.

For a variety of reasons, we have long relied on CHAMPUS/Tricare and AFA's ChamPLUS supplement and obtained our medical care from civilian providers. Therefore, not being able to use on-base facilities is not a major issue for us. In that context, having to change from CHAMPUS to Medicare when my wife became disabled (we're both well under 65) would not have been all that big a shock, except that she had to enroll in Part B, at almost $50 per month, in order to retain CHAMPUS/Tricare as a secondary carrier.

Being tossed out of the system that promised me over and over again it would take care of my family and me is bad enough. Having to pay for the "privilege" surely compounds the insult as well as the injury.

Lt. Col. Michael Hansen, USAF (Ret.)
Alexander, Ark.

This is in response to "Over the Cliff" and its description of difficulties with the Social Security system.

In 1995, I became eligible for Social Security. I called in advance of the eligibility date to determine which documents I needed to apply for Social Security. In response to my call, I received a list of the necessary documents and information I would need to complete the application. After gathering the necessary materials, I called back for an appointment to make the application. I was scheduled for 2:00 p.m., May 10, 1995.

At 2:00:42 p.m. on the appointed day, my telephone rang, and it was the person I had expected to call me from Social Security. I had all of the required information. The woman I spoke to knew her business and was courteous and patient. The elapsed time for the call was 24 minutes. My first deposit was on time, to the right account, and in the correct amount.

It is surprising to me that the retired Air Force officer whose experiences were described in the article—a man whose military career must have been governed by orders, forms, and documents—should have been so ill-prepared for dealing with an application for Medicare. Are Social Security facilities in the Twin Cities area less accessible than in Atlanta? Are the Social Security workers not as well trained? Did he inquire about the information and documents he was required to have?

Aside from that, it does seem unfair that medical care—one of the benefits that has always been an inducement to a military career—is being taken away. It is another of the promises to our military that have been broken or subjected to a convenient interpretation that has denied the original intent.

Richard N. Beardslee
Clarkston, Ga.

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

The Quality of Quantity

The January 1997 *Air Force* Magazine contained some very important articles that have serious ramifications for our national security in the coming century. With a flat defense budget for the foreseeable future, we have a badly flawed method of developing military doctrine that is institutionalized along with buying the right mix of weapons to fight and win wars.

Individual service doctrinal development is analogous to three car-

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Letters

penters, each building a room for a house without getting a clear look at the overall blueprint. Trying to fit the rooms together seems to be the thankless task of the Joint Staff.

Turning to the Air Force, our doctrine puts too much of a premium on newly developed technology. Our current "Global Engagement" doctrine seems based solely on lessons learned from the Persian Gulf War—a very serious misjudgment. Lessons from previous wars all point to our mistakenly heavy reliance on attrition warfare and technology. Except for the defeat of Japan through nuclear attack, airpower has not been the decisive factor that won wars. The grunt on the ground was the bottom line. How quickly we forget.

Another flaw in our strategy is the current notion that war can be fought with little loss of American life. Allowing our civilian leadership to go unchallenged on this idea gives rise to a tendency to engage where we shouldn't. . . .

Last, Air Force doctrine seems to be supporting "silver bullet" weapon systems. It is hard to imagine how 21 B-2s or 200 to 300 F-22s will be very effective in two simultaneous wars early in the twenty-first century. How did we ever fall into this trap?

All of a sudden, the opposition's cheap, modernized MiG-21s, F-5s, or F-16s look pretty respectable against the pitifully few F-22s, F-15s, or F-16s in, say, 2015. Superior numbers count. "Quantity has a quality of its own," Lenin supposedly wrote.

To provide the military capability we will need to fight (and win) future wars, we need a modernized, robust Army, Navy, and Air Force with sufficient force structure. We need total coordination and direction from doctrine through strategy on down to tactical plans. There will never be some magic technology that will defeat the type of hard-core enemies we are likely to face in the future.

In this era of tight military budgets with a new national willingness to employ our military forces, we need to clean up our act (doctrine) and our weapons acquisition. This can only be done through detailed guidance from the top down.

Col. T. C. Skanchy,
USAF (Ret.)
Springfield, Va.

Invest in Doctrine

"Closing the Doctrine Gap" *[January 1997, p. 48]* was very encouraging. As an Air Force officer in a unified command (US Atlantic Command), I know how a well-thought-out and fully discussed doctrine prepares warfighters to win. As part of joint planning groups, I regularly hear succinct and useful doctrinal statements from my Army and Marine counterparts that make our operational plans better. At the same time, they are flexible enough to avoid slavishly following the printed word in all situations.

I believe it is time for the Air Force to invest the mental and physical resources in a cogent approach to doctrine. The resulting doctrine will equip our warfighters with the rationale and mental methods to address national security issues with airpower.

At a minimum, this will provide our national leadership with more and better options during a crisis. Solid USAF doctrine, applied intelligently, may allow our forces to win their most important future conflicts without risking thousands of American lives and spending millions of dollars.

Lt. Col. Michael G. Dziubinski,
USAF
Norfolk, Va.

Rebecca Grant, in "Closing the Doctrine Gap," elegantly illuminates many Air Force concerns about doctrine. She provides significant insights into Air Force thinking, including the perception that it may be restrained by the "Joint Vision 2010" concept of full-dimensional protection to a role of maintaining "what might be called freedom from attack" for the joint force.

There appears to be some misunderstanding of what is explicitly stated in Joint Vision 2010: "The primary prerequisite for full-dimensional protection will be control of the battlespace to ensure our forces can *maintain freedom of action* [emphasis mine] during deployment, maneuver, and engagement, while providing multilayered defenses for our forces and facilities at all levels." No specific component is chartered for such a role.

Given the result as freedom of action, there seems to be ample room in this concept for the notion that "air superiority provides positional advantage, with 'supporting' firepower aboard the aircraft." Moreover, as Ms. Grant suggests, there is a close relationship in that notion to the definition of dominant maneuver.

This is because all the concepts of Joint Vision 2010 relate closely to one another. As a corollary, all of the components of the joint force should relate to one another synergistically to create desired effects.

For example, Joint Vision 2010 tells us, "Even from extended ranges, pre-

cision engagement will allow us to shape the battlespace, enhancing the *protection* [again my emphasis] of our forces." Joint Vision 2010 also discusses self-protection as another key element of "successfully achieving dominant maneuver." The right balance of capabilities will be key.

Protection, maneuver, engagement, and focused logistics capabilities are imperatives for all components of the joint force. . . .

Lt. Col. Richard J. Rinaldo,
USA (Ret.)
Newport News, Va.

Avoiding Parochialism

In "Future Engagement" *[January 1997, p. 18],* the author's restatement of the phrase "first among equals" is divisive, argumentative, and an echo from the parochial past in an era of increasing jointness. Air Force Secretary Sheila E. Widnall's white paper, "Global Engagement: A Vision for the Twenty-First-Century Air Force," continues the "us vs. them" parochialism by calling for the creation of a new USAF indoctrination course for all new personnel.

While airmen should be both knowledgeable and proud of the accomplishments, capabilities, history, and vision for the future of their service, they should not be brainwashed into believing that any and every conflict can be solved by airpower alone. These same airmen should also be knowledgeable and equally proud of the other services.

The Air Force possesses unique capabilities that the Army and Navy do not. These capabilities provide the joint commander unparalleled flexibility whether he or she is engaged in warfare, contingency operations, or Military Operations Other Than War. However, these capabilities can only be fully realized in the joint arena where each service's unique capability enhances its sister service's.

Gen. Ronald R. Fogleman said that USAF has the capability to "find, fix, or track and target anything . . . on the surface of the Earth." It is another thing to actually kill it. I haven't heard of any military technical revolutions in offensive operations since our "success" in eliminating Iraqi Scuds. What occurred was the retirement of many of the A/OA-10s that had ample loiter time in the target area. While kill rates against Iraqi "dug in" armor were exceptional, they do not reflect our potential performance against an experienced and determined aggressor using armor as a mobile force.

USAF has a long way to go—Global Engagement is a goal. Maybe at some point, USAF will be able to kill the targets essential to the prosecution of the conflict—we are not there yet. Most important, each service must learn to augment the other services to conduct highly efficient, synergistic, joint operations. In 1947, the Department of Defense was established to unify our military forces—not just to establish the Air Force as a separate service.

Maj. David J. Wallace,
USAF
Fayetteville, N. C.

ANG's Contribution

I enjoyed "Total Force Never Stops" *[November 1996, p. 34]. Air Force* Magazine is to be commended for its consistent efforts to publicize the contributions of the Air Force Reserve and Air National Guard. However, the table showing the breakdown of Total Force contribution contained a glaring error. The 92 percent contribution of aeromedical evacuation crews for AFRES is, rather, the contribution of the air reserve components as a whole. You have apparently overlooked the 10 squadrons of the ANG that contribute to the Air Force's assets in this area.

It is also important to note that, rather than simply existing to fill wartime needs, these air evac units fly a sizable percentage of the peacetime missions that support the worldwide operations not just of the Air Force but of all the other services. . . .

Bob Mebane
142d Air Evacuation Squadron,
Delaware ANG
Alexandria, Va.

■ *Reader Mebane is correct. ANG contributes 27 percent of USAF's medical flight crew capability. The AFRES contribution is 67 percent.*—THE EDITORS

Other Enlisted Pilots

I was astounded at the number of errors you were able to crowd onto one page of the October 1996 issue—"Pieces of History," on p. 88, under the title "Stripes and Wings."

To start with, there were two enlisted pilot programs in the Army Air Corps and the Army Air Forces. In the first one, 3,000 US enlisted men earned their wings, as you state. You state that this program ended in 1942. Not so: In this group, the last class of aviation students to be rated as sergeant pilots was Class 43-B, February 1943. The aviation students in Class 43-C, on graduation day, March 10, 1943, received the new rank of flight officer or were commissioned, as were those who had previously been rated sergeant pilots and were on active duty. . . .

At the same time this program was going on, early in World War II, a second group of enlisted pilots (1,155) was being trained as liaison pilots. Air Force Headquarters and DoD continually try to ignore the existence of this group. In the June 1995 issue of *Air Force* Magazine, p. 36, in "The US Army Air Forces at War," under the summary, "Flying Training Graduates, July 1939 to August 1945," you have a listing of pilots. You show "Advanced Liaison 1,155"—but fail to mention these 1,155 were staff sergeant, technical sergeant, and master sergeant pilots. The only difference in their rating papers and the group of 3,000 was the addition of one word, "liaison," before "pilot." . . .

Last but not least in your article, you state that USAF's last sergeant pilot, MSgt. George Holmes, retired in 1957. I don't want to detract one bit from the career of Sergeant Holmes; however, my World War II flight chief, CMSgt. Maurice Menge (deceased), retired in the late 1960s. SMSgt. Robert Doty (deceased), 125th Liaison Squadron, retired in the early 1970s. I retired as chief of Maintenance Engineering, Alaskan Air Command, on July 1, 1975. For all I know, other former sergeant pilots may have retired after I did.

Lt. Col. John H. Miller,
USAF (Ret.)
Coeur d'Alene, Idaho

■ *There is some disagreement on reader Miller's point. According to Air University, liaison pilots do belong in a category separate from enlisted pilots, which would make the statements in "Stripes and Wings" correct.*—THE EDITORS

Tribute to a Paratrooper

A photograph in your splendid "History on the Wing" *[November 1996, p. 40]* caught my attention. The photograph of the World War II paratrooper appearing on p. 42 is of my longtime friend, Samuel C. Rowland II, of Little Rock, Ark., who died in 1995.

Sam left college to join the paratroops and served with the 508th Infantry Parachute Regiment of the 82d Airborne Division. He was dropped into Normandy behind Utah Beach the night of June 5, 1944, and served in the Normandy campaign and also the Battle of the Bulge. A native of Baltimore, Md., he lived in Little Rock after the war and was a leading church, civic, and business leader. He is missed. . . .

William L. Terry
Little Rock, Ark.

Verbatim

Seek Modernization . . .

"I worry that the Department [of Defense] has maintained force structure and readiness but has deferred modernization to near the breaking point."
William S. Cohen, the new Secretary of Defense, at a January 22, 1997, hearing of the Senate Armed Services Committee.

. . . But Don't Cut Forces

"I do believe we've reached a limit. Over the last 10 years, we've reduced military forces by about one-third, from 2.1 million personnel to just under 1.5 million. That's a pretty damn big reduction. . . . The force levels we're at now, however, are about the minimum required to allow the US to maintain its role as a global superpower. . . . If we cut force structure, . . . we can no longer meet our present requirement to be able to fight two major regional conflicts nearly simultaneously. To me, that means we would no longer be able to carry out our role as a global military power."
Retiring Defense Secretary William J. Perry, during his last interview in office on January 15, 1997, in which he argued for keeping current force levels intact.

The Big One, and Then . . . ?

"The [US] can never afford to lose 'the big one.' . . . We've always got to have the forces, the capabilities, to go win a major regional [conflict]. The issue that needs to be debated, then, is: How much do you need for whatever comes next? Clearly, the possibility exists that, while you're engaged somewhere in the world, some other adversary can decide to take advantage of that. So the issue in my mind is: Do you try to attain an entire second MRC's worth of forces and capabilities? Do you do that, say, only in the active force? Do you do it with active and Guard-type forces? . . . The issue becomes: How much can the nation afford to carry in . . . force structure, modernization, all those other things that go down the road?"
Gen. Ronald R. Fogleman, USAF Chief of Staff, in a January 7, 1997, meeting with the Defense Writers Group in Washington, D. C.

IOC in 2003

"It is the policy of the United States to deploy by the end of 2003 a national missile defense system that . . . is capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized, or deliberate) and . . . could be augmented over time to provide a layered defense against larger and more sophisticated ballistic missile threats, if they emerge. . . . To implement the policy, . . . the Secretary of Defense shall develop for deployment a national missile defense system, which shall achieve an initial operational capability by the end of 2003."
The National Missile Defense Act of 1997, a bill introduced on January 21, 1997, by Senate Republican leaders.

We're All Prisoners

"The harsh truth is that, six years after the end of the Cold War, we are still prisoner to its psychology of distrust, still enmeshed in the vocabulary of mutual assured destruction, still in the thrall of the nuclear era. Worse, strategists persist in conjuring worlds that spiral toward chaos and concocting threats that they assert can only be discouraged or expunged by the existence or employment of nuclear weapons."
Gen. George Lee Butler, USAF (Ret.), Strategic Air Command's final commander in chief and now a ban-the-bomb activist, in a January 8, 1997, address to the Henry L. Stimson Center in Washington, D. C.

A Dissenting View

"I disagree with Gen. George Lee Butler's conclusion. . . . I did not endorse the statement he coauthored on banning the bomb, nor have I been persuaded by his eloquence since then. . . . The net effect of General Butler's proposal places the abolition of nuclear weapons ahead of the security of the United States. I disagree that 'the risks posed by nuclear weapons far outweigh their presumed benefits.' General Butler pits his intellect and judgment against all 20 . . . Secretaries of Defense, among them James Schlesinger, who has publicly disagreed with General Butler. . . .

"The end of the Cold War does not mark the end of history. Who can predict with certainty that China, a resurgent Russia, or some rogue state, such as Iraq or North Korea, might not threaten us with nuclear weapons? Let us not risk our national survival by prematurely calling for the abolition of all nuclear weapons."
***Ambassador Edward L. Rowny (Lt. Gen., USA, Ret.), former chief Strategic Arms Reduction Talks negotiator, in a January 17, 1997, letter to the Washington* Post.**

Lunar Filling Station

"Water . . . is . . . a very good rocket propellant. When you electrolyze water into hydrogen and oxygen and you liquefy them, you produce basically the same fuel that the space shuttle uses in its main engines—liquid oxygen and liquid hydrogen. So for the first time, we now know that there are deposits of water at the south pole of the moon, . . . apparently accessible and ready to use for this purpose. . . .

"If we were to recover [lunar water] and electrolyze it—disassociate it into hydrogen and oxygen—we would actually be able to build a filling station on the moon. One of the reasons space travel is so expensive is that we have to lug everything we need up with us from Earth's orbit, this huge gravity well. By having materials that we can use on the moon to refuel, that's already in Earth orbit, we save an enormous amount of weight and an enormous amount of cost. So the significance of this to the future exploration of the solar system is very profound."
Dr. Paul Spudis, of the Lunar and Planetary Institute, Rice University, Houston, Tex., at a December 3, 1996, Pentagon press conference on the discovery of a large deposit of ice on the moon. ■

We got it off the ground.

We not only had a great idea.

What once was only a vision of a revolutionary new military aircraft has now become a reality. The first production representative Bell Boeing V-22 Osprey Tiltrotor has successfully completed its inaugural flight, and much of the credit for this remarkable achievement belongs to you, the men and women of the Marines, SOCOM, the Navy and the Air Force. Your unswerving support was invaluable in the initial stages of its development, and your unwavering belief in the project's inevitable success resulted in an outstanding "mission accomplished." From all of us at Bell Boeing, we salute you. The Tiltrotor Team

The Chart Page

By Tamar A. Mehuron, Associate Editor

The Safest Year

Despite an unusually high operations tempo, many worldwide deployments, and continued turmoil from restructuring, US armed forces in Fiscal 1996 set new records in aviation safety. The DoD-wide rate of Class A accidents (Figure 1) dropped for the fifth consecutive year and hit a record low of 1.50 per 100,000 flying hours for the most recent fiscal year, which ended September 30. Figure 2 demonstrates even more sharply how the major accident rate has been plummeting for nearly four decades (except for a brief uptick in the mid-1960s). DoD aircraft losses also continued to decline; in FY 1996, it fell to a low of 67 destroyed aircraft (Figure 3). DoD defines a Class A accident as one that results in a fatality or at least $1 million in damage.

Figure 1: **DoD Class A Accident Rate: FY 1984–96**

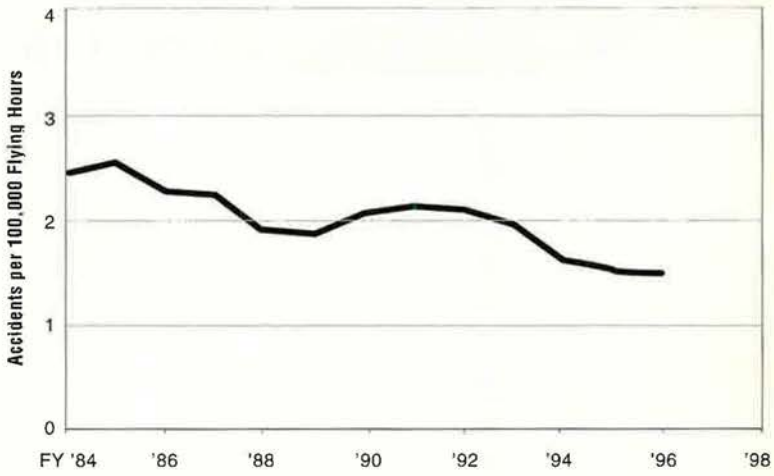


Figure 2:
Class A Accident Rate: The Long-Term Record

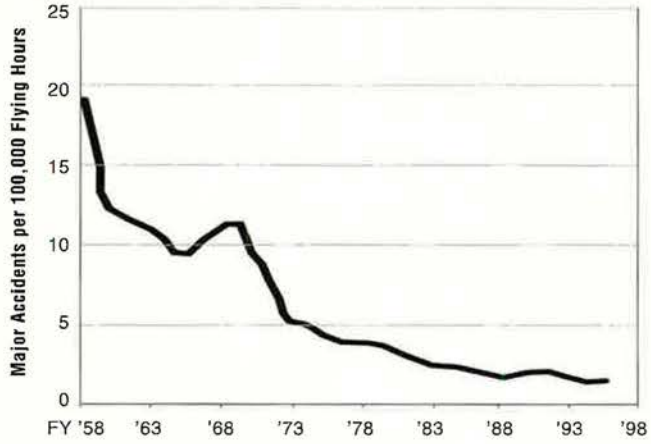
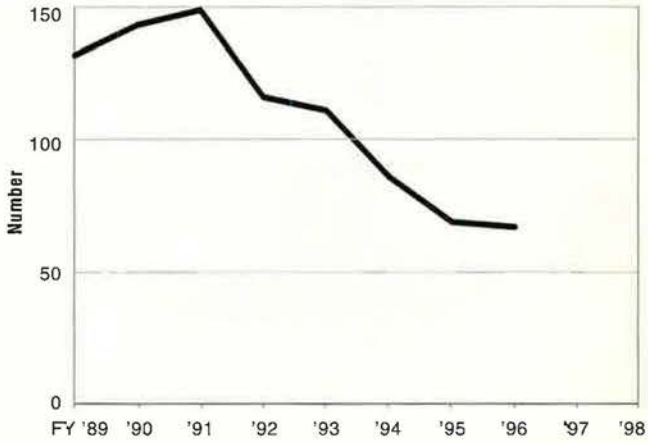


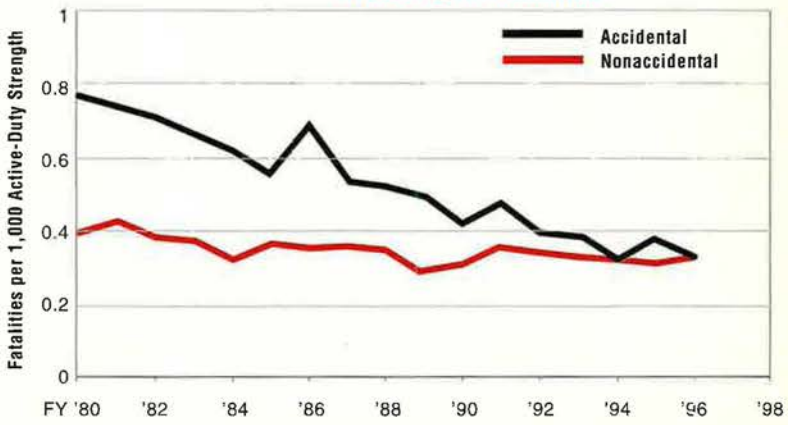
Figure 3: **Decline in DoD Aircraft Losses**



The on- and off-duty military fatality rate (from an aviation or any other kind of accident) fell in Fiscal 1996 to under .4 per 1,000 active-duty personnel (Figure 4).

Source: Department of Defense

Figure 4: **The Drop in Fatalities***



* Does not include deaths due to hostile action. Non-accidental includes natural causes, homicides, diseases, and suicides. Does include friendly fire accidents.

Aerospace World

By Suzann Chapman, Associate Editor

Cohen Confirmed as Defense Secretary

On January 22, the Senate unanimously confirmed William S. Cohen to be the nation's twentieth Secretary of Defense. He was sworn in January 24. He is the only Republican in President Bill Clinton's new Cabinet.

The former Senator from Maine told the Senate Armed Services Committee that he was certain he would occasionally disagree with the President. However, he noted that he had a long record of creating "reasonable and responsible compromises," citing this as evidence that he could effectively serve a Democratic administration.

Though he praised many Clinton Administration defense efforts, he did not hesitate to point out what he viewed as deficiencies. He contended that there is an urgent need to increase procurement budgets and to stop pushing modernization into the outyears. Decreased funding, he said, had placed the services at the limit of their ability to respond to two major regional conflicts at the same time.

He emphasized the importance of the Quadrennial Defense Review, due to Congress in May, and the need to withhold judgment on force structure, force readiness, and modernization until it is complete. He also emphasized that, though the Pentagon was achieving some savings with various reforms, he was skeptical about predictions of big savings in budget development because they might not materialize.

According to Secretary Cohen, continued erosion of research and development funding will jeopardize DoD's ability to pursue the Joint Vision 2010 approach to warfare, which relies on the acquisition of advanced-technology systems. Unless the armed forces can increase their funding of those technologies, they won't be available in time, he said.

Raytheon Opts for Electronics

Ending months of speculation, Raytheon announced on January 16 that it will buy Hughes Electronics Corp.'s

Although two million African-Americans served during World War II, none received the Medal of Honor until January 13, when Vernon Baker (seated, far right) accepted his from President Clinton. Survivors of five other recipients (from left), Valencie James, Grace Woodfork, Edward Carter III, Arlene Fox, and Sandra Johnson, also accepted medals. No survivors could be located for the seventh honoree, George Watson.

Raytheon and Hughes: Major Defense Programs

Hughes Aircraft is a leading supplier of advanced defense electronics systems and services, including naval systems; airborne and groundbased radars; ground-, air-, and ship-launched missiles; tactical communications; and training simulators and services. It is also active in the fields of Global Positioning System technology, infrared/electro-optics, and monolithic microwave integrated circuits (MMICs). Hughes missile programs include Maverick, TOW, Medium Extended Air Defense System, Tomahawk, Stinger, Rolling Airframe Missile, AMRAAM, Sparrow, Evolved Seasparrow, and the new AIM-9X Sidewinder

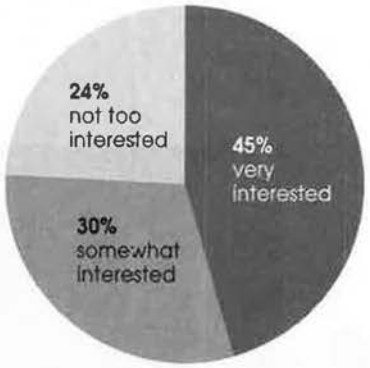
Raytheon Electronics Systems is a major provider of groundbased and shipboard radars, military communication systems, and naval combat control, sonar, and mine-hunting systems. It is one of three teams selected for Phase II of the Navy–Defense Advanced Research Projects Agency Arsenal Ship program. Raytheon Electronics Systems missile systems include Patriot, Hawk, Advanced Medium-Range Air-to-Air Missile, Sidewinder, Standard, and Sparrow.

Raytheon E-Systems is a leader in defense systems integration and provides reconnaissance and surveillance and C^3I systems, mass data collection, interpretation and dissemination, specialized aircraft modification services, and shipboard and airborne countermeasures systems.

Raytheon TI Systems joins Raytheon as a major supplier of precision guided munitions, including the Paveway laser-guided weapon system, the USAF-Navy Joint Standoff Weapon, the Army's Javelin antitank system, and the High-Speed Antiradiation Missile. It also contributes to P-3 and S-3 ocean surveillance systems, F-22 airborne radars, and Low-Altitude Navigation and Targeting Infrared for Night. It produces electro-optics products, such as sensors for the Bradley Fighting Vehicle, M1 Abrams tank, F-117, and F-18.

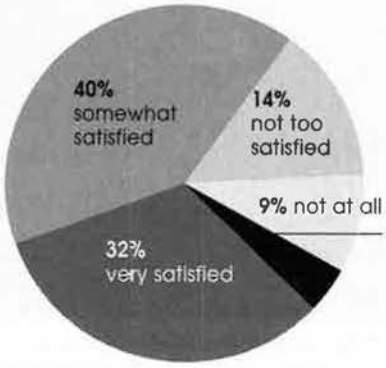
Defense in the Polls

(numbers may not sum to 100 because of rounding)



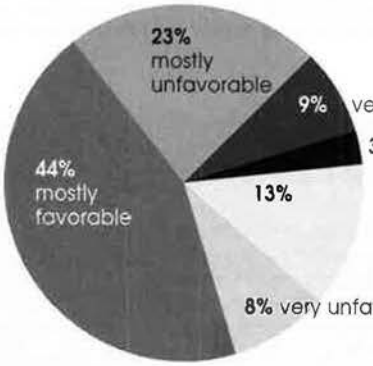
1 ***Regarding potential topics for future polls, would you be interested in what Americans think about . . . sending American troops to foreign countries and giving financial aid to foreign countries?***

0%
don't know/refused

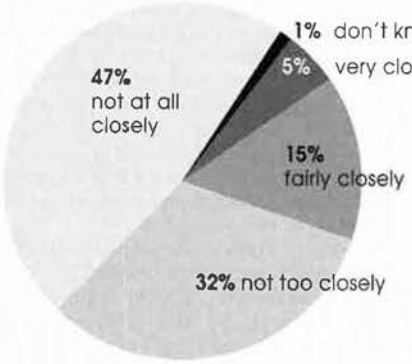


2 ***How satisfied are you with . . . the nation's military security?***

Survey Organization: Gallup Organization
Research Sponsor: Cable News Network, *USA Today*
Population: National adult
Population Size: 1,005
Date: January 10–13, 1997



3 ***How would you (characterize) your overall opinion of . . . NATO (North Atlantic Treaty Organization) . . . ?***



4 ***Have you happened to follow . . . the discussion and debate about expanding NATO into eastern Europe?***

Survey Organization: Princeton Survey Research Associates
Research Sponsor: Pew Research Center
Population: National adult
Population Size: 1,503
Date: January 9–12, 1997

defense operations (Hughes Aircraft) from General Motors for $9.5 billion in stock and debt. GM accepted the Raytheon offer over rival bidder Northrop Grumman.

A little more than a week earlier, on January 6, Raytheon also announced its buyout of Texas Instruments' Defense Systems and Electronics Group for $2.95 billion in cash.

The combined total annual 1996 revenue will be about $21 billion, including more than $13 billion in defense electronics. Coupled with its 1995 acquisition of E-Systems Inc., Raytheon's acquisition of Hughes Aircraft and the TI defense unit gives the Massachusetts-based company a dominant position in defense electronics. The other major stakeholder in the defense electronics market is Lockheed Martin.

With the Hughes Aircraft take-over, slated to conclude by midyear (pending government approval), and Raytheon TI Systems, Raytheon will have a total of 127,000 employees, up from about 75,000. It has four business sectors: commercial and defense electronics, engineering and construction, aircraft, and major appliances.

Chairman and Chief Executive Officer of Raytheon Dennis J. Picard said that the strategic combination of Raytheon, TI Defense, and Hughes Defense enables the expanded company to "grow in the best segment of the defense business—defense electronics."

The primary name will remain Raytheon Co. Hughes Aircraft will become a division titled Raytheon Hughes Systems, with current President John C. Weaver at the helm. C. Michael Armstrong, chairman and CEO of Hughes Electronics, will be a member of the Raytheon board of directors. GM plans to retain the remainder of Hughes Electronics, the telecommunications and space operations businesses.

Northrop Grumman Closes Plants

The day before the public announcement of Raytheon's purchase of Hughes Aircraft, Northrop Grumman announced that it would close four plants, transferring their work to other locations. The closures will eliminate 755 jobs and 2.5 million square feet of excess plant capacity.

A January 15 press release stated that the moves were part of a "continuing effort to consolidate facilities, streamline operations, and enhance its competitive position." Industry

analysts believe that position will be a limited one unless Northrop Grumman, the product of a 1994 merger, finds a new partner.

The Los Angeles–based company plans to close a defense electronics facility in Hawthorne, Calif., cutting 530 jobs by the end of the year. It expects to offer transfers to 240 employees and will move most of the work to its facilities in Rolling Meadows, Ill., and Benton Park, Pa.

By the middle of the year, it will also close a defense electronics unit in Great River, N. Y. Of the Great River plant's 450 employees, the company plans to offer transfers for 120 to Rolling Meadows, Benton Park, and Bethpage, N. Y.

The other two plants slated to close, one in Stuart, Fla., and one in Perry, Ga., produce aerostructures and nacelles for commercial and military aircraft. The Stuart facility, which will close at the end of 1998, employs 500; approximately half may transfer to the company's commercial aircraft facilities in Dallas, Tex., and Milledgeville, Ga.

The Perry plant will close within two years, but its 450 employees may relocate to a smaller plant Northrop Grumman plans to lease in middle Georgia. The Perry facility was originally built to manufacture the Triservice Standoff Attack Missile, which the Pentagon canceled in 1995.

Northrop Grumman had previously announced plans to close its B-2 plant in Pico Rivera, Calif., by the end of 1999.

Reserve Force Drawdown Continues

As part of a five-year effort that began in Fiscal Year 1994 to reduce force and infrastructure, the Guard and Reserve will again cut force structure and end strength in Fiscal 1997.

According to the Pentagon's Fiscal 1997 Reserve Component Reduction Plan, released January 14, the number of force-structure positions will drop two percent—or 19,046 positions—from the Fiscal 1996 level. The end strength, or the number of positions authorized and funded by Congress, will fall by 3.1 percent—or 28,114 positions—from the previous year's level.

The Air National Guard actually will post a gain of 289 force-structure positions in Fiscal 1997—rising from 113,344 last year to 113,633. However, ANG end strength will drop by 3,529, from 112,707 in Fiscal 1996 to 109,178.

The Air Force Reserve will lose 1,213 force-structure positions in Fiscal 1997, dropping from 76,073 to 74,860. The AFRES end strength will drop by 658—from 73,969 to 73,311.

Defense officials pointed out that the force-structure number does not reflect the actual number of personnel who will leave the service. They said that many of the personnel assigned to inactivated units will have the opportunity to join other units. Openings arise as the components shift positions from inactivated units to units in other locations as part of the ongoing force-structure activations, realignments, and unit relocations caused mainly by base closures.

Additionally, officials termed the 1997 cuts modest in comparison to the first three years, which incurred more than 80 percent of the reduction goals. They predicted that the next cuts, in Fiscal 1998, will be even smaller. The reductions are based on Fiscal 1999 force-structure levels—targeted at approximately 950,000 (891,000 for end strength)—established by the Bottom-Up Review.

B-2 Ready for Conventional Role

Gen. Richard E. Hawley, commander of Air Combat Command, declared January 1 to be the day operational B-2 stealth bombers became ready to undertake a conventional bombing role.

The announcement established a limited operational capability (LOC) to permit their use in a conventional mode several months before the B-2's planned initial operational capability, when the bombers officially will achieve their full warfighting capability.

General Hawley based the LOC status on last October's highly successful bombing tests. During the test, three B-2s destroyed 16 targets using the Global Positioning System–Aided Targeting System with GPS-Aided Munitions from an altitude greater than 35,000 feet. Each B-2 can carry up to 16 2,000-pound GAMs, which can strike within 20 feet of a target.

Announcing the LOC at the naming ceremony for the B-2 *Spirit of Kitty Hawk,* held at Seymour Johnson AFB, N. C., in mid-December, the General said the B-2's combination of low observability, large payload, near-precision munitions, and long range give the US a unique, unprecedented conventional military capability.

USAF Chief of Staff Gen. Ronald R. Fogleman added that past measurements calculated how many aircraft were needed to destroy a single target. Now the Air Force can think in terms of how many targets a single aircraft can destroy.

CALCM Scores Precision Strike

On December 12, an AGM-86C Conventional Air-Launched Cruise Missile, launched from a B-52H and guided by GPS navigation satellites, successfully struck its target after a 4.5-hour test flight.

The test demonstrated that the CALCM can make precision strikes over great distances. It also proved that the conventional cruise missile could undertake a "steep-terminal-dive maneuver" designed to deliver a penetrator warhead on target. The Air Force stated that this was "the first time such a maneuver has been performed by a CALCM."

The CALCM had been modified with a new, more accurate GPS receiver and included use of both Phase I and Phase II Wide-Area GPS Enhancement. The GPS constellation of satellites currently operates with Phase I of the enhancement program, but the Air Force integrated Phase II specifically for the December test. WAGE is a prototype system designed to boost GPS constellation performance.

CALCMs used in the September 3–4 strike against Iraq featured an earlier generation, single-channel GPS receiver and a blast fragmentation warhead. The version tested in December doubled the accuracy and warhead effectiveness of the earlier CALCMs, according to program officials.

Boeing Air-Launched Missiles program manager Carl Avila said that the improvements provide a baseline for future CALCM models but also can be easily incorporated into missiles now in the field. The missiles are being converted for the conventional role at Boeing facilities in Oak Ridge, Tenn., from surplus AGM-86B ALCMs for about $150,000 per missile.

JDAM Marks Successes

The McDonnell Douglas Joint Direct Attack Munition scored successful flights in tests conducted at Eglin AFB, Fla., in November and December.

The JDAM is a kit designed to guide weapons in all weather from any launch altitude by using GPS along with a weapon inertial navigation system. The combined USAF-industry flight-test program uses an F-16C as the primary test-bed.

In late November, a JDAM-equipped Mk. 84 2,000-pound bomb guided by GPS successfully hit within six meters of its ground target. The circular-error-probable distance was 9.3 meters. Another November flight tested the JDAM-equipped bomb's maneuverability and its autopilot sys-

tem response to high-angle-of-attack guidance commands. Performance matched expectations, stated company officials.

The JDAM test program scored three successes on December 6. Two were GPS-aided JDAM-equipped Mk. 84 drops demonstrating impact angles of 65° at 4.9 nautical miles downrange and 75° at 3.8 nm. The first struck the ground within six meters of the target and the second within three meters.

For the third test, a JDAM-equipped BLU-109 bomb demonstrated aerodynamic and autopilot characteristics and performed as predicted.

The JDAM program will begin low-rate initial production of 937 units this spring. The program is also slated to enter combined developmental testing and operational testing for the B-1B, B-2, B-52, and F/A-18 this year.

Return-to-Fly Boards Dropped

For the past six years, special boards met semiannually to select the few rated officers serving in staff jobs who would get to return to flying jobs. Not anymore.

The program established to select which field-grade pilots and navigators would return to bomber and fighter cockpits has ended. General Fogleman ended the "return-to-fly" board process last year, placing cockpit reassignments back into the mainstream.

The boards were set up during the drawdown, according to Air Force Personnel Center officials, because the number of retraining opportunities for field-grade pilots and navigators was extremely limited. Now the situation has stabilized—the number of training slots nearly equals the number of qualified officers.

"Flying assignments for field-grade officers should not be any different" from assignments for other officers, said Lt. Col. Chris Tope, AFPC's Fighter and Bomber Assignments branch chief. "We've added field-grade fighter and bomber assignments to our Electronic Bulletin Board System showing cockpit availability based on training slots."

He added that final assignment selection is "based on major command requirements, unit manning, and experience levels." Officials also consider time-on-station and currency (time out of cockpit) requirements and career timing.

A big plus for flyers now holding staff jobs is that they can apply for return-to-fly training throughout the year. Once they become eligible, they do not have to wait for a semiannual board.

AFPC officials noted the high selection rate for the first Officer Assignment System electronic bulletin board advertisements for pilot training slots for March through June 1997. They chose 31 of the 34 eligible fighter pilot applicants and two of four eligible bomber pilots.

First C-141s To Retire

The Air Force announced December 20 that Travis AFB, Calif., will retire seven C-141 Starlifters in Fiscal Year 1997. The service plans to retire the entire fleet of 154 C-141 cargo aircraft by 2006.

A 1994 Scientific Advisory Board, convened by the Air Force in response to Congressional concern, recommended retirement of the fleet. After examining the service life of the C-141, the board determined that flight beyond 45,000 equivalent hours might not be viable. It found that widespread fatigue damage experienced by the aircraft could jeopardize the fail-safe features of the basic C-141 design.

The C-141 first entered the Air Force inventory in 1965, with Military Airlift Command.

New Office Tackles TAMD

Pentagon officials announced in January the creation of the Joint Theater Air Missile Defense Organization (JTAMDO), naming USAF Maj. Gen. Stephen B. Plummer as the first director.

The new agency will integrate DoD requirements and acquisition activities for theater air and missile defense (TAMD) to provide theater commanders with "an improved capability to defend against air and missile threats." It will develop operational architectures, define system interoperabilities, and validate new capabilities through simulation and technology demonstrations.

Under the new management structure, the Ballistic Missile Defense Organization (BMDO) will translate the JTAMDO-developed operational architecture into system architectures and lead program acquisition activities.

The JTAMDO will work with theater commanders and the services to develop a joint roadmap for mission requirements, architecture, and capabilities. The JTAMDO requirements roadmap, coupled with a BMDO-developed acquisition roadmap, will form a TAMD master plan for validation by the Joint Requirements Oversight Council.

Battle Labs Seek Innovation

The Air Force plans to set up six small, focused "battle labs" this year to take aim at its newly defined six core competencies outlined in "Global Engagement: A Vision for the Twenty-First-Century Air Force."

Despite use of the term "lab," these battle labs will not operate as traditional research facilities. Instead, these new units, with 15 to 25 workers each, will focus on identifying innovative operational concepts that take advantage of mature technologies, rather than developing new technologies.

Air Combat Command will oversee three battle labs: Air Expeditionary Force Battle Lab, Mountain Home AFB, Idaho; Battle Management Battle Lab, Hurlburt Field, Fla.; and Unmanned Air Vehicle Battle Lab, Eglin AFB, Fla.

Air Force Space Command will direct the Space Battle Lab at Falcon AFB, Colo. The newly established Air Force Security Forces Center will oversee the Force Protection Battle Lab at Lackland AFB, Tex. The Air Intelligence Agency will direct the Information Warfare Battle Lab at Kelly AFB, Tex.

According to a USAF statement, the battle labs will sustain their work and any initiatives primarily from within existing Air Force resources. The service plans to reorder priorities and allocate assets and capabilities temporarily as necessary.

An air force–level board of directors will assess concepts demonstrated by the battle labs for integration into ongoing programs.

First Waverider Powered Flight

An 80-pound, remotely piloted model of a hypersonic flight vehicle took off under its own power on December 16 to make its maiden flight. The 100-inch-long, wedge-shaped Low-Observable Flight Test Experiment (Loflyte) flew for 34 seconds and reached an altitude of 150 feet over Mojave Airfield, Calif.

Loflyte, a model of a vehicle that might fly at Mach 5.5, is a waverider concept based on research from the X-30 National Aerospace Plane program. Waverider vehicles are triangular platforms designed to surf on the high-pressure field created by the vehicles' bow shock as they exceed the speed of sound. The December flight marked the first time a waverider vehicle had taken off under its own power, according to Air Force officials.

USAF's Wright Laboratory, Wright-Patterson AFB, Ohio, manages the

Loflyte program in partnership with NASA. Both agencies expect to derive vehicles that might serve as low-cost hypersonic transports or small satellite launchers.

In particular, NASA wants to use the Loflyte neural-network flight-control system (FCS) for its research program for Hyper X, a Mach 10 lifting body. The Hyper X research program, scheduled to begin flight tests this year, could lead to an ultrafast atmospheric transport or the first stage of a two-stage launch vehicle.

Following additional flight tests to determine airworthiness at its high takeoff and landing speeds, Wright Lab engineers will install the neural-network FCS in Loflyte vehicle number one. Neural networks allow computers to learn—similar to the human thought process—and, in this case, would help keep the vehicle stable.

Current plans call for a second Loflyte vehicle to follow later this year. It will include GPS features and fly-by-light controls, which use optical cables to signal the vehicle's control surfaces, as well as a neural network. The neural network from vehicle number one would go into the Hyper X.

Funding for the program comes from the Air Force, NASA, the Navy, and the National Science Foundation. It involves a number of Small Business Innovative Research contracts. According to Wright Lab officials, SBIR-funded research of neural networks is already in use in B-2 stealth bombers.

Statistically Speaking

USAF statistics for the first quarter of Fiscal 1997 reported that the service had 530,085 members: 305,924 enlisted troops, 75,794 officers, and 148,367 civilians.

According to the Air Force's statistical report, the Reserve Officers Training Corps still provides the greatest proportion of officers—41.63 percent. Officer Training School provides 20.95 percent and the US Air Force Academy 19.1 percent. Another 18.32 percent received commissions from other sources, such as direct appointment.

The service has 14,762 pilots, 5,535 navigators, and 36,400 nonrated line officers below the grade of colonel. There are 320 female pilots, or 2.17 percent, and 100 female navigators, or 1.81 percent.

In 1975, women represented just 5.4 percent (33,000) of USAF's active-duty force. Today their numbers have not quite doubled at 64,111, but they constitute nearly 17 percent of USAF active-duty personnel.

The percentage of minorities based on race has risen. In 1975, racial minorities made up only 14 percent of the force, compared to almost 23 percent today.

Air Force members who are married make up 67.09 percent of the force. There are 18,378 military couples, with 1,050 of them married to members of other services.

Dog Tags Identify World War II Aircrew

An Air Force Reserve C-141 aircrew flew to Beijing, China, January 15 to recover the remains of 10 airmen presumed killed when their World War II B-24J Liberator crashed August 13, 1944, after completing a bombing mission against Japanese shipping near what is now Taiwan.

According to the Associated Press news service, an official Chinese news report stated that the wreckage was found by farmers searching for herbs on October 2. The B-24 had crashed in an extremely remote location and lay at the bottom of a ravine 62 miles south of Guilin in the Guangxi Province on China's southern coast.

Chinese President Jiang Zemin turned over photographs of five military dog tags and a videotape of the crash site to President Bill Clinton when they met in the Philippines in

Senior Staff Changes

RETIREMENT: M/G Marcelite Jordan **Harris.**

PROMOTION: To be **General:** Lloyd W. **Newton.**

CHANGES: M/G Kurt B. Anderson, from Cmdr., Jt. Task Force Southwest Asia, USCENTCOM, Riyadh, Saudi Arabia, to Cmdr., 19th AF, Hq. AETC, Randolph AFB, Tex., replacing retiring M/G W. Thomas West . . . **B/G (M/G selectee) Maxwell C. Bailey,** from Dep. Commanding Gen., Jt. Spec. Ops. Command, USSOCOM, Fort Bragg, N. C., to Dir., Ops., J-3, Hq. USSOCOM, MacDill AFB, Fla., replacing M/G Clinton V. Horn . . . **Col. (B/G selectee) Leroy Barnidge, Jr.,** from Cmdr., 28th BW, ACC, Ellsworth AFB, S. D., to Vice Cmdr., San Antonio ALC, AFMC, Kelly AFB, Tex., replacing B/G Scott C. Bergren . . . **B/G Scott C. Bergren,** from Vice Cmdr., San Antonio ALC, AFMC, Kelly AFB, Tex., to Cmdr., 82d Training Wing, AETC, Sheppard AFB, Tex., replacing B/G Michael E. Zettler.

B/G (M/G selectee) William J. Dendinger, from Dep. Chief of the Chaplain Service, Hq. USAF, Bolling AFB, D. C., to Chief of the Chaplain Service, Hq. USAF, Bolling AFB, D. C., replacing retiring M/G Arthur S. Thomas . . . **Col. (B/G selectee) Michael N. Farage,** from Cmdr., 58th SOW, AETC, Kirtland AFB, N. M., to Dep. Commanding Gen., Jt. Spec. Ops. Command, USSOCOM, Fort Bragg, N. C., replacing B/G (M/G selectee) Maxwell C. Bailey . . . **Col. (B/G selectee) Gary W. Heckman,** from Chief, Engagement Assessment Div., Plans, Policy, and Strategic Assessment, J-5, Hq. USSOCOM, MacDill AFB, Fla., to Dir. for Resources, J-8, Hq. USSOCOM, MacDill AFB, Fla. . . . **B/G Paul V. Hester,** from Cmdr., 35th FW, PACAF, Misawa AB, Japan, to Cmdr., 53d Wing, Air Warfare Ctr., ACC, Eglin AFB, Fla., replacing B/G (M/G selectee) Ronald E. Keys.

M/G Clinton V. Horn, from Dir. of Ops., J-3, Hq. USSOCOM, MacDill AFB, Fla., to Principal Ass't Dep. Under Sec'y of the AF (Int'l Affairs), Office of the Under Sec'y of the AF, OSAF, Washington, D. C., replacing retired M/G Hiram H. Burr, Jr. . . . **Col. (B/G selectee) Hiram L. Jones,** from Command Chaplain, Hq. ACC, Langley AFB, Va., to Dep. Chief of the Chaplain Service, Hq. USAF, Bolling AFB, D. C., replacing B/G (M/G selectee) William J. Dendinger . . . **B/G (M/G selectee) Ronald E. Keys,** from Cmdr., 53d Wing, Air Warfare Ctr., ACC, Eglin AFB, Fla., to Cmdr., AFDC, Maxwell AFB, Ala., replacing Col. Robert D. Coffman . . . **L/G (Gen. selectee) Lloyd W. Newton,** from Ass't Vice C/S, Hq. USAF, Washington, D. C., to Cmdr., Hq. AETC, Randolph AFB, Tex., replacing retiring Gen. Billy J. Boles.

M/G Stephen B. Plummer, from Dir., Ops. (Current Readiness and Capabilities), J-38, Jt. Staff, Washington, D. C., to Dir., Jt. Theater Air Missile Defense Organization, J-8, Jt. Staff, Washington, D. C. . . . **Col. (B/G selectee) Andrew W. Smoak,** Dep. Dir., P&P, Hq. ACC, Langley AFB, Va., to Cmdr., 2d BW, ACC, Barksdale AFB, La., replacing retiring B/G David L. Young. . . **Col. (B/G selectee) Bruce A. Wright,** from Dir., Ops., J-3, US Forces Japan, PACOM, Yokota AB, Japan, to Cmdr., 35th FW, PACAF, Misawa AB, Japan, replacing B/G Paul V. Hester . . . **B/G Michael E. Zettler,** from Cmdr., 82d Training Wing, AETC, Sheppard AFB, Tex., to Dir., Maintenance, DCS/Installations and Log., Hq. USAF, Washington, D. C., replacing retired M/G Marcelite Jordan Harris.

SENIOR EXECUTIVE SERVICE (SES) RETIREMENTS: Samuel L. **Croucher,** Maurice R. **Himmelberg,** Olin A. **Howard,** Ira L. **Kemp,** Merrill L. **Minges,** Philip **Panzarella,** Jesse **Ryles.**

SES CHANGES: David G. Ardis, to Technical Advisor, Avionics Sys. Architecture, ASC, AFMC, Wright-Patterson AFB, Ohio . . . **Phillip S. Babel,** to Technical Advisor, Embedded Computer Sys. Software, ASC, AFMC, Wright-Patterson AFB, Ohio . . . **William L. Baker,** to Chief Scientist, High-Power Microwaves, Phillips Lab, AFMC, Kirtland AFB, N. M., replacing Brendan Godfrey . . . **Joseph K. Black,** to Assoc. Dir. of Maintenance, DCS/Installations and Log., Hq. USAF, Washington, D. C.

Christopher Blake, to Dir. of Engineering, C-17, ASC, AFMC, Wright-Patterson AFB, Ohio, replacing Eric E. Abell . . . **Roger M. Blanchard,** to Ass't DCS/Personnel, Hq. USAF, Washington, D. C. . . . **Otha B. Davenport,** to Dir., Engineering and Propulsion, ASC, AFMC, Wright-Patterson AFB, Ohio . . . **Timothy L. Dues,** to Dir., P&P, Wright Lab, AFMC, Wright-Patterson AFB, Ohio, replacing Keith Richey.

Charles B. Hogge, to Chief Scientist, Space and Missile Technology, Phillips Lab, AFMC, Kirtland AFB, N. M. . . . **Gerald B. Kauvar,** to Dep. Dir. for Prgms. & Eval., Hq. USAF, Washington, D. C. . . . **Horst R. Kelly,** to Exec. Dir., Hq. AFPC, Randolph AFB, Tex., replacing Roger M. Blanchard . . . **Terry R. Little,** to Prgm. Dir., JASSM, ASC, Eglin AFB, Fla.

Lester McFawn, to Dir., Avionics, Wright Lab, AFMC, Wright-Patterson AFB, Ohio, replacing retired Jesse Ryles . . . **Robert E. Mulcahy, Jr.,** to Dir., Sys. Mgmt., ASC, AFMC, Wright-Patterson AFB, Ohio . . . **Susan A. O'Neal,** to Chief, AFPOA, Washington, D. C., replacing Horst Kelly . . . **Ronald L. Orr,** to Ass't DCS/Installations and Log., Hq. USAF, Washington, D. C.

Vincent J. Russo, to Dep. Dir., Wright Lab, AFMC, Wright-Patterson AFB, Ohio, replacing O. Lester Smithers . . . **S. Lee Semiatin,** to Sr. Scientist, Materials Processing/Processing Service, Wright Lab, AFMC, Wright-Patterson AFB, Ohio . . . **O. Lester Smithers,** to Dir., Engineering and Technical Mgmt., ASC, AFMC, Wright-Patterson AFB, Ohio, replacing retired Maurice Himmelberg . . . **James R. Speer,** to Ass't Auditor Gen., Field Activities, AFAA, Arlington, Va., replacing Karla W. Corcoran . . . **Robert D. Wolff,** to Dir., Plans and Integration, DCS/Installations and Log., Hq. USAF, Washington, D. C., replacing Ronald L. Orr. ■

November. Then–Defense Secretary William J. Perry received two of the dog tags from his Chinese counterpart, at the Pentagon in December.

The AFRES crew from the 446th Airlift Wing, McChord AFB, Wash., returned the remains to the Army's Central Identification Laboratory in Hawaii. A US search team visited the site to search for more remains and equipment.

The B-24J crew belonged to the 375th Bomb Squadron, 308th Bomb Group, Fourteenth Air Force.

Enlisted Promotions Rise

Air Force officials announced in December that promotion rates to staff, technical, and master sergeants will increase this year to the highest levels seen in the past decade.

The drawdown forced the service to stick with the minimum promotion rates set forth in the Total Objective Plan for Career Airman Personnel to ensure it would not have too many noncommissioned officers, according to Lt. Gen. Michael D. McGinty, USAF's deputy chief of staff for Personnel. "However, as end strength and requirements stabilize, we now have the opportunity to raise our promotion rates," he added.

Staff sergeant promotion rates will increase by about one percentage point, to 17.6 percent, the highest since 1987 with the exception of 1995. At one time during the last 10 years, the rate went as low as 5.5 percent.

The greatest increase—more than three percentage points higher than last year—will be in promotions to technical sergeant. The 1997 rate will be 14.7 percent, which also has not happened since 1987. The lowest promotion rate for technical sergeants was 11.1 percent in 1988.

The rate to master sergeant will increase by 1.7, reaching 21.2 percent. The lowest percentage for promotion to the top three enlisted levels was 18.9 percent in 1990.

General McGinty said that increasing the rates for 1997 "is the right thing to do for our people and the Air Force. This will balance our grades and continue to provide a good opportunity for career progression."

Region VI Takes Specialists to Patients

For the past two years, teams of Wilford Hall USAF Medical Center specialists from Lackland AFB, Tex., have made day-trips to each military medical facility within Tricare Region VI, covering parts of Texas, Oklahoma, and Louisiana. Tricare is

the Pentagon's managed health-care program.

In Fiscal 1996 alone, they conducted 179 medical outreach missions, not only saving patients time and money but also saving more than $286,000 for Region VI, according to the American Forces Press Service.

Visiting Army, Navy, and Air Force bases every other month via a USAF C-21 are specialists in cardiology, dermatology, obstetrics and gynecology, orthopedics, pediatrics, pediatric neurology, and podiatry. Other subspecialists participate as needed. They usually see patients most of the day, discuss treatment regimens with local doctors, and may even lecture to the medical staffs.

They extend the kind of care no longer available at most bases because of reductions in hospitals, clinics, and medical staffs. The program especially benefits older retirees, who had to make trips to Wilford Hall for all their care when smaller base facilities could no longer treat them. Although some patients still must travel to Wilford Hall, follow-up appointments can be done at their nearest base by a traveling doctor.

World War II Memorial Design Selected

On January 17, President Clinton unveiled the winning design for the national World War II Memorial.

The American Battle Monuments Commission chose the design for the memorial, which will stand on the National Mall between the Washington Monument and Lincoln Memorial, from 400 entries. It will be at the eastern end of the Reflecting Pool.

The Secretary of the Interior, the National Capital Planning Commission, and the Fine Arts Commission had not yet approved the design at press time.

Created by architect Friedrich St. Florian, the design features a sunken plaza framed by high stone walls and 50 fluted 40-foot columns. Born in Austria, Mr. St. Florian has been associated with the Rhode Island School of Design for more than 30 years.

Congress authorized the memorial in 1993. It will cost approximately $100 million, which the commission must raise before it breaks ground. If successful, they plan to open on Veterans Day, 2000.

News Notes

■ Lt. Gen. Lloyd W. Newton, USAF's assistant vice chief of staff, will replace Gen. Billy J. Boles, as commander of Air Education and Training Command on April 1, when General Boles retires.

■ Gone, but not forgotten—a Dyess AFB, Tex., spokesperson confirmed in December that before Lt. Col. Ralph Mollet, a weapon systems officer, retired, he became the first crew member to fly more than 2,500 hours in the B-1B. He bested the milestone by 2.2 hours on his last flight on October 26, 1996.

■ The Pentagon announced December 23 that officials had approved a revised DarkStar High-Altitude Endurance Unmanned Aerial Vehicle program plan, in which vehicle number two should begin flight tests this summer. It also includes production of two additional DarkStar systems, with delivery in summer 1998. Approval came after an independent review of the program following the crash of the first DarkStar vehicle in April 1996.

■ Air Combat Command received the second production Joint Surveil-

50 Years Ago in Air Force Magazine

March 1947

On the cover: A Republic Seabee passes the Statue of Liberty in New York Harbor. The aircraft was painted red for this shot because the stock silver finish did not photograph well in color.

■ AFA National President James H. Doolittle alerts members that the Army Air Forces had been "relegated to a secondary role" in 1946, receiving less than $1.25 billion out of the $12 billion appropriated by Congress for national defense. He quotes the assessment of Lt. Gen. George E. Stratemeyer of Air Defense Command that "the present AAF couldn't punch its way out of a paper bag."

■ The AFA Board of Directors issues a formal statement supporting unification of the armed forces under a "Secretary of National Defense" and with co-equal Army, Navy, and Air Force branches.

■ Members of Glenn Miller's fabled wartime Air Force band have regrouped under the leadership of Tex Beneke, who had been with the Miller band since its beginning in 1938. The Beneke group is recognized as the official band of the Air Force Association and is "drawing record-breaking crowds in theaters and night spots from coast to coast."

■ Wright Field announces that during 1946, the Army Air Forces "took delivery of only 1,010 military aircraft of all types."

AFA news: AFA "wing group" organizations have now been formed in all states. . . . This issue reports a "considerable sprinkling" of AFA members in Congress and pictures five more—Rep. William Jennings Bryan Dorn of South Carolina, Rep. John Bell Williams of Mississippi, Sen. W. E. Jenner of Indiana, Rep. W. J. Miller of Connecticut, and Rep. Carl Albert of Oklahoma—receiving their AFA pins.

Coming Events

Shell Air and Sea Show at Fort Lauderdale, Fla., May 3–4, will honor USAF's fiftieth anniversary this year.

Indy 500 Salute to the fiftieth anniversary of the Air Force, May 23–26, features the USAF band and a flyover on May 25 at the Indianapolis Motor Speedway, Ind.

Air Fete '97, the largest military airshow and static display in Europe and its only official commemoration of USAF's fiftieth anniversary, will be held May 24–25 at RAF Mildenhall, UK.

The Memorial Day Concert at the US Capitol, Washington D. C., features a salute to the Air Force.

USAF is sponsoring a historical symposium on the Air Force, 1947–97, in Arlington, Va., May 28–29.

New York city's salute to the Air Force includes a USAF musical event at the World Financial Center and static displays at Floyd Bennett Field, June 20–22.

The Quad City Airshow in Davenport, Iowa, June 20–23, features a Midwest Golden Salute to the Air Force.

The San Diego Aerospace Museum has set up special Air Force exhibits, including a history from 1909 to the present, which may become a permanent display, and one focusing on the last 50 years. Both will run until at least December 31.

NASA has offered to carry USAF memorabilia from each major command aboard space shuttle flights throughout 1997. The *Atlantis* flight on January 12 carried cloth patches of each wing and numbered air force within Air Education and Training Command, a pewter AETC medallion, and six commemorative coins from the Air Force Personnel Center.

lance and Target Attack Radar System (Joint STARS) E-8C on December 22 at Rhein-Main AB, Germany, and began flying operational missions three days later. System Program Director Col. Robert H. Latiff returned the last E-8C test aircraft from Rhein-Main on December 25, for the first time leaving only production versions in Europe. Northrop Grumman is working on the third production aircraft now and expects to deliver it to the 93d Air Control Wing, Robins AFB, Ga., this fall.

■ An Electronic Systems Center concept, the prototyping and demonstration location, is at work at the Logicon Geodynamics facility in Tampa, Fla., analyzing imagery exploitation techniques for coastal mine detection for US Special Operations Command. The PADL customizes computerized research and development facilities collocated with a client, in this case USSOCOM, to meet the client's special needs. It enables ESC to deliver a quick "80 percent" fix, then complete their work while the product is in use, said an ESC official.

■ USAF's Rome Laboratory, N. Y., officially extended its long-running cooperation in voice-recognition and radar-testing technologies with the Federal Aviation Administration in December through a memorandum of understanding. The lab and the FAA are currently working on three projects: affordable, dual-use digital signal path technology for multiband, multimode radios; a millimeter-wave focal plane array radar to detect concealed weapons; and an interoperable tactical radio.

■ The Air Force has increased its limit for the Fiscal 1997 officer drawdown from 430 to 600 for lieutenant colonels and below. Additionally, it has expanded eligibility to include limited active-duty service commitment waivers for permanent change of station moves, Air Force Institute of Technology master's degrees, and below-the-zone promotees. It will also offer extended ADSC waivers for ROTC, US Air Force Academy, Officer Training School, and all other commissioning sources.

■ Following a two-year study to review the impacts generated by a smaller noncommissioned officer population and base closures, USAF decided to cut the number of Stateside NCO academy classes from seven to six this year, then resume a schedule of seven in 1998. It will also permanently close the academy at Barksdale AFB, La., this month and

Retired Army Gen. Fred F. Woerner, chairman of the American Battle Monuments Commission, said that the planned World War II Memorial "will educate future generations on the spirit, sacrifice, and commitment of the American people united in a just and common cause."

close others over the next few years as it moves to a system of regional academies.

■ USAF airfield operators at Prince Sultan AB, Saudi Arabia, began work with the first mobile control tower of its kind—Tactical Systems Weather–14—on December 25. A cramped work area and old equipment shared by American, French, and Saudi controllers led a team from the 3d Combat Communications Mobility Squadron, Tinker AFB, Okla., to weld together two TSW-7 units. Once in place, members of the 4404th Communications Squadron, Prince Sultan AB, and 5th Combat Communications Group, Robins AFB, Ga., upgraded the equipment.

■ More than 30,000 USAF members became eligible last month to switch from the Veterans' Educational Assistance Program (VEAP), which applied to airmen who entered the service between 1977 and 1985, to the higher-return Montgomery GI Bill, which replaced VEAP in 1985. Airmen enrolled in VEAP will receive full refunds if they enroll in the GI Bill, but the conversion offer is only open until October 8, 1997.

■ The Army and Air Force Exchange Service is now an approved provider for merchandise covered by Tricare/CHAMPUS. AAFES customers may purchase durable medical equipment and other prescribed goods from an exchange store or the AAFES mail-order catalog. They must submit a proof of payment, generally a cash register receipt, and file their claim through their Tricare regional provider as with other Tricare/CHAMPUS claims.

■ The 175th Wing's 135th Airlift Squadron of the Maryland ANG will receive the first of the new C-130J transport aircraft in 1998. According to Maryland's Congressional delegation, who wrote to then–Defense Secretary Perry last summer to urge that Maryland be first in line, the state's ANG unit currently has the C-130s "with the greatest amount of flying time and highest degree of corrosion."

■ Officials at the Lone Star Flight Museum in Galveston, Tex., announced that they have the North American P-51D Mustang, *SuSu,* on display through May 4, 1997.

■ Queen Elizabeth II will perform the opening ceremony for the American Air Museum in Britain on August 1, at Duxford Airfield, UK. The museum campaign began in 1985 and has raised $15.5 million toward a total project cost of $17 million. The campaign was supported by Gen. Jimmy Doolittle and actor James Stewart. The current chairmen are Charlton Heston and Field Marshal Lord Bramall.

■ SrA. Ed Quirk, 357th Fighter Squadron, Davis-Monthan AFB, Ariz., received an inaugural Citizen Certificate of Appreciation December 13 from the Tucson police chief for helping apprehend two suspected robbers. Airman Quirk tailed the getaway car to a house and provided the location and license plate number to the police.

■ Maj. Gen. Eugene L. Eubank, USAF (Ret.), who began his aviation career in 1918, celebrated his 104th birthday on December 2. Helen, his wife of 76 years, is 96 years old. The General learned flying from the Wright brothers and had Brig. Gen. William "Billy" Mitchell and Gen. H. H. "Hap" Arnold as his mentors.

Obituary

Viewed as the architect of the modern Ready Reserve, **Maj. Gen. Winston P. Wilson,** USAF (Ret.), died December 31 after a stroke. He was 85. Beginning his military career as an aircraft mechanic in the Arkansas ANG in 1929, he earned a pilot's license in 1936 and served in World War II and the Korean War. Between wars, he revamped the Arkansas ANG with innovative flying training programs. In the 1950s as deputy chief of the National Guard Bureau, he headed the Air National Guard, creating a strengthened force that proved its worth during the 1961 Berlin crisis. In 1963, he became NGB chief, overseeing Army and ANG units nationwide. ■

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Information warfare is no longer the stuff of futuristic role-playing exercises. It's already here.

At War With Sweepers, Sniffers, Trapdoors, and Worms

By Peter Grier

IN SPRING 1994, Air Force security officers tracking a computer intrusion suddenly found themselves face-to-face with a horrifying prospect: inadvertent cyberwar—and perhaps worse—between the United States and North Korea.

The Air Force had for weeks been trying to catch a hacker they knew only as "Datastream Cowboy." From a base that appeared to be located in Britain, Datastream was rampaging through the computers of Rome Laboratory, N. Y., and other defense installations.

He was downloading files and leaving behind "sniffer" programs capable of eavesdropping on sensitive electronic communications. Worse, he was using these same Air Force systems as launching pads for false-flag Internet attacks on other computers—including those of other nations.

On April 15, as Air Force investigators covertly watched, Datastream came online at the Rome Lab system and then quickly gained access to a third computer. On-screen file data identified this other computer as belonging to a "Korean Atomic Research Institute." The hacker filched all the data on the Korean system, pulling it back and storing it in a corner of Rome's memory.

Photo by Michael J. N. Bowles

The Air Force investigators were shocked. They couldn't tell if the computer that Datastream had just penetrated belonged to South Korea or North Korea. Had this vandal just stolen the most sensitive secrets of the unpredictable "Hermit Kingdom"? If so, how would the often paranoid and always dangerous North Koreans react?

"Act of War"?

The Air Force conducted a full study, results of which were released this year. The report stated, in part, "The concern was that . . . the North Koreans would think the . . . transfer . . . was an intrusion by the US Air Force, which could be perceived as an aggressive act of war."

As it turned out, there was no actual cause for worry that an enraged Pyongyang would hurl missiles or troops south to retaliate against US forces; the computer in question belonged to South Korea. Datastream himself was no terrorist or foreign military operative but a London teenager named Richard Pryce, who curled up on the floor and cried when police arrived to arrest him.

Still, American officials viewed the incident as a clear wake-up call for the entire Department of Defense. In his brief rampage, one youthful hacker had compromised 30 Rome Lab computer systems. The specter of an international incident and perhaps open conflict flashed before Washington officials. Surely some of America's adversaries had, or would soon have, the capability to do far worse.

Such incidents have convinced the US government that information warfare is no longer just the stuff of role-playing exercises set safely in the next century. As far as many experts in the US government are concerned, it is already here—and it is time to start planning serious defenses.

"Just as we prepare for a conventional weapons attack, we must be ready for attacks on our computer networks," said Sen. Sam Nunn, the now-retired Georgia Democrat, during wide-ranging Congressional hearings on the issue last summer.

Today, the Pentagon, the White House, the intelligence community, and many private businesses are spending lots of time considering the implications of a broad subject they have dubbed "IW," for information warfare.

"Information warfare has become central to the way nations fight wars, and it is critical to Air Force operations in the twenty-first century," says service guidance issued by Air Force Chief of Staff Gen. Ronald R. Fogleman.

For the military, "information warfare" means much more than providing physical security for defense-related computers. Info war has an offensive component, too, comprising various capabilities for attacking an adversary's computers, communications, and information sources. It can even cover a time-honored military means of achieving victory: the timely use of superior information about terrain or opposing forces for tactical purposes.

Maj. Gen. John P. Casciano, the assistant chief of staff for Intelligence, spelled out the breadth of IW at AFA's Los Angeles symposium, held in October. The definition of IW used by the Air Force, he explained, was "any action to deny, exploit, corrupt, or destroy the enemy's information and its functions; protecting ourselves against those actions; and exploiting our own military information functions."

It is not a purely modern phenomenon, USAF officials said, but the concept has become much more important in the information age. Satellites, computers, faxes, video cameras, and modems have given today's military forces a startling capability to create and disseminate information. This flood of data changes battlefield realities, alters conclusions, and redirects actions.

Information technologies have proven to be tremendous military force-multipliers. Their very usefulness creates a defensive problem, however.

Weakness in Strength

"We must recognize . . . that the same qualities making modern information functions so indispensable, make them alarmingly vulnerable," said Col. Frank Morgan, commander of the Air Force Information Warfare Center, Kelly AFB, Tex.

By itself, the military cannot hope to address every one of these vulnerabilities. The dependence of US armed forces on commercial technologies and communications may represent a weak link in America's info war armor.

Not too long ago, almost all of the information critical to Air Force planning and execution was transmitted over secure links. Now, 90 percent of it travels through commercial systems, according to service estimates. For instance, service officials point out that fuel orders and logistics data—information essential to the success of a sudden deployment—usually travels over essentially unprotected commercial lines. Blood and medical supplies are ordered the same way. Telemedicine capabilities are becoming increasingly important in the military for long-distance health diagnostics; these capabilities, based on rapid electronic transmissions, are also at risk.

Even something as common as an automatic teller machine might represent a military vulnerability. A sophisticated adversary might be able to track the movements of key military personnel via ATM withdrawal data, for instance. Alternatively, the simple electronic looting of a soldier's financial accounts could profoundly affect his or her morale.

"We have to streamline our support functions to take advantage of technology and cut down costs, but it means we are more at risk," said General Casciano.

Furthermore, vulnerabilities of commercial systems could cause problems at a strategic level. IW attacks might play havoc with the US electrical grid, for instance, or decimate commercial banking systems. Clever hackers could redirect speeding trains onto the same track or cause air traffic controllers to misdirect airliners.

Wary of the emerging dangers, the White House last July established a Commission on Critical Infrastructure Protection to weigh the implications of the threat. Members are considering whether it is a truly imminent danger or possibly an overhyped annoyance. "Is [the IW problem] a Sherman tank coming at us, or is it just a kid carrying a Ping-Pong paddle?" asks Roger Molander, a RAND Corp. analyst and one of the country's foremost experts on IW. "No one really knows."

Most of the weapons of IW are themselves composed of electrons and focus on software.

Worms on the March

For years, hackers have been using the simple technique of guessing the passwords needed to enter remote computing systems. (The word "password," for instance, is a more common password than one might think.) Once inside a computer's cyberspace, vandalism can be easy. More sophisticated users can then insert a self-replicating program, often known as a "worm." Churning worms keep growing and growing, taking up more and more memory, and eventually jam system software.

The spread of powerful personal computers has made it possible for hackers to crack password defenses simply by trying many possible combinations of letters. Once inside, the covert insertion of a software "backdoor" allows adversaries to reenter a system at will. Another hacker tool—the "sweeper"—will do just what its name suggests: sweep all data banks clean of their information. "Sniffers" are eavesdropping programs that monitor electronic communications, providing useful intelligence analogous to that achieved by wiretapping telephones.

Today, however, the highest form of software attack may be what is called "packet forge spoofing." This activity results in the subtle—and secret—alteration of data. A file containing an adversary's order of battle, for instance, may suddenly show a fighter squadron where none existed before. The idea, explained one defense contractor whose firm works on the offensive side of cyberwar, is simple. "It's much better to get a guy's system to give him wrong information than no information at all," he said.

Moreover, powerful workstations are not necessary to create these weapons. The attacks on Rome Lab were launched from the computer equivalent of a Cessna prop plane; it was a slow, 25-megahertz, 486 SX desktop computer whose hard drive contained only 170 megabytes of space. After all, a whole arsenal of IW software is openly posted at various sites on the Internet. Log in, point and click, and—presto!—you're an electron warrior.

Other tools could directly target the embedded computers in aircraft and other high-tech weapon systems. Directed energy bursts, for example, might fry an aircraft's avionics, and the alteration of Global Positioning System navigation data could put a long-range bomber far off course. Flight controls might be disabled through radio-frequency insertion of corrupt computer codes.

Defense planners also maintain that the physical destruction of crucial computer assets qualifies as an act of information war. Such activity might be as simple as attachment of a powerful magnet to a hard drive by special operations forces or as blunt as an old-fashioned laser-guided bomb down the air vent of an underground computer center.

USAF leaders say that all major commands must be ready to conduct defensive info war functions.

Air Force officials separate the IW threat into three categories, of varying degrees of danger.

- The thrill-seeking hackers—or "ankle biters," in General Casciano's phrase—who pose the most limited challenge. Datastream Cowboy was an archetype of this threat.
- Freelancers with a purpose. These can range from a lone individual with an antinuclear agenda to subnational groups, such as the Strano Leftist Network, a loose Internet-oriented Italian agglomeration that recently launched politically oriented attacks on computers in France and Mexico.
- Nation-states. US officials worry that info war might take place on something of a level battlefield. For example, production of stealth aircraft takes a huge national investment, but the production of a truly deadly computer virus might be cheap enough for even the poorest government to afford.

250,000 Hacks

The threat no longer is theoretical. A recent General Accounting Office study estimated that Pentagon computers absorb some 250,000 hacker attacks per year—and that 65 percent of these attacks are at least partially successful. In late 1996, most DoD information on the Internet had to be temporarily shut down after a hacker damaged an Air Force home page on the World Wide Web.

Most hackers tend to scoff at the notion that they represent a national security threat. The overwhelming majority of them, they point out, target military computers that handle unclassified information. Even so, their actions can be costly and exasperating. Some hackers do gain access to sensitive areas: Datastream Cowboy managed to make off with communications that had been classified "secret." In the late 1980s, the so-called "Hannover Hacker" attacked US systems, searching for data to sell to the East German government.

As for other nations, about 18 have active defensive or offensive IW programs, according to Air Force documents.

To date, it is not clear whether and to what extent this activity constitutes a direct threat to the US. The US National Intelligence Council has produced a classified report on known foreign efforts or plans to attack crucial national data networks, such as the Defense Switched Network telephone system. Officials have not revealed its conclusions publicly, though they acknowledge that computer-assisted intrusions into the systems used by banks and other financial institutions have so far been isolated, with the goal limited to theft.

John M. Deutch, then CIA director, told Congress last summer that such incidents may begin to threaten the nation's economic well-being if they increase. "In addition, we do not fully understand the real source and purpose of these events," he said. "Some may be sponsored by foreign adversaries in support of broader political, economic, or military goals."

Three Thrusts

Information warfare is currently the focus of three general, overlapping efforts within the US defense-industrial structure. One of these efforts centers on activity in think tanks. Science Applications International Corp., for instance, recently launched a Center for Information Strategy and Policy to run seminars and produce papers on the subject, as well as systems planning and crisis simulations. RAND Corp. has carried out groundbreaking IW work, including several well-attended game-playing exercises

for government officials. A 1995 game focused on a Persian Gulf War scenario, with Iran attempting to destabilize Saudi Arabia. The game setup called for Iran to use such methods as destruction of a Dhahran refinery by meddling with its computerized controls. In 1996, the RAND story line was tension between China and Taiwan. Sixty mid- to upper-level US officials attended.

The other hotbeds of IW thinking are, first, the Pentagon and the armed services and, second, the White House and the intelligence community.

Within the US military, all evidence is that the services take IW seriously. All branches, for instance, have headquarters staff position papers on the subject that are in various stages of development. The Air Force seems clearly out in front when it comes to IW planning. That's not just the opinion of USAF leaders, either.

"The Air Force is furthest along," says RAND's Mr. Molander. "They've got some good training programs going."

USAF leaders have rejected any notion of a separate IW command and say, instead, that all major commands must be ready to conduct defensive info war functions.

Specialized organizations established so far include the 609th Information Warfare Squadron, a prototype unit located at Shaw AFB, S. C., that studies the use of offensive and defensive IW tactics and techniques, and the Air Force Information Warfare Center, charged with developing and maintaining general IW capabilities.

AFIWC has been up and running since 1993 at Kelly AFB. Its experts were crucial in cracking the Datastream case. AFIWC hacker teams travel throughout the Air Force to assess computer security at individual Air Force bases. For instance, a recent AFIWC simulated attack on Charleston AFB, S. C., breached six computer systems—with two of these taken over completely. These attack techniques range from sophisticated cracking efforts to such simple acts as flipping over user mouse pads and keyboards in search of passwords written down by forgetful users.

Under the Base Network Control Center initiative, the Air Force is building electronic "fences" around all of its installations. This $68 million effort will erect data fire walls between base local networks and the Internet and other commercial communications providers, while providing network monitoring equipment to detect any hacker intrusions.

For the near future, the most significant Air Force IW item concerns education, according to officials. Air University has produced a video on the subject, called "Cyberstrike," and is now circulating it around the Air Force. Maxwell AFB, Ala., home of Air University, is offering two IW courses—a three-day version for general officers and senior civilians and a five-day version for others. USAF's first Information Warfare Training Lab is now open for business at Goodfellow AFB, Tex.

Surprise Attack

Not everyone believes the Pentagon is taking information warfare seriously enough or is putting enough resources into its efforts. In January, the Defense Science Board, issuing a report on defenses against IW, warned that the nation faced a possible electronic Pearl Harbor in the near future. DSB members are recommending that DoD spend at least $3 billion more than planned on IW over the next five years.

The study concluded that the Defense Department needs to designate a focal point for IW in the Pentagon. It recommends establishment of a Pentagon-wide electronic "aggressor" team to help assess vulnerability. And it says that R&D spending in the area needs to be expanded.

Though today's commercial products can provide some quick protection for the military's 2.1 million computers, they generally aren't able to handle the sheer scale of the Pentagon's distributed computer environment, according to the DSB. One particular need: a system that can automatically track an attack to its source. In addition, said the DSB report, the US needs to be prepared for the aftermath of a determined IW attack. That means identifying and hardening a minimum essential information infrastructure—a limited fail-safe system capable of surviving large outages and performing critical defense functions.

"The infrastructure must be designed to function in the presence of failed components, systems, and networks," concluded the study. "The risk . . . must be managed since it cannot be avoided."

The DSB is not the only high-level government group working on the overall IW problem. The President's Commission on Critical Infrastructure Protection is charged with looking at vulnerabilities in broad commercial systems, including telecommunications nets, electrical power systems, supply systems, banking, and transportation. The panel expects to issue its own report in early summer.

Protection of these high-level strategic targets may be the most challenging—and important—aspect of IW as the twenty-first century approaches. That is because the Pentagon needs to maintain its access to such systems, yet it cannot exert much control over how they defend themselves.

Mr. Molander, the RAND analyst, warned, "The services are in no position to foster protection for these elements of the infrastructure, which they're going to depend upon."

Defense officials point out that big commercial systems, by their very nature, foster interaction with the outside world and with potential problems. Banks judge themselves successful if they can convince more people to use their ATM networks. Cellular phones are spreading around the world faster than any electronic technology since television, yet in some markets they're already losing up to 30 percent of their revenue via fraud.

"Information warfare has no front line," says a comprehensive RAND study of the subject. "In addition, the means of deterrence and retaliation are uncertain and may rely on traditional military instruments in addition to IW threats. In sum, the US homeland may no longer provide a sanctuary from outside attack." ■

Peter Grier, the Washington bureau chief of the Christian Science Monitor, *is a longtime defense correspondent and regular contributor to* Air Force Magazine. *His most recent article, "The Jet Age in Review," appeared in the February 1997 issue.*

Presenting

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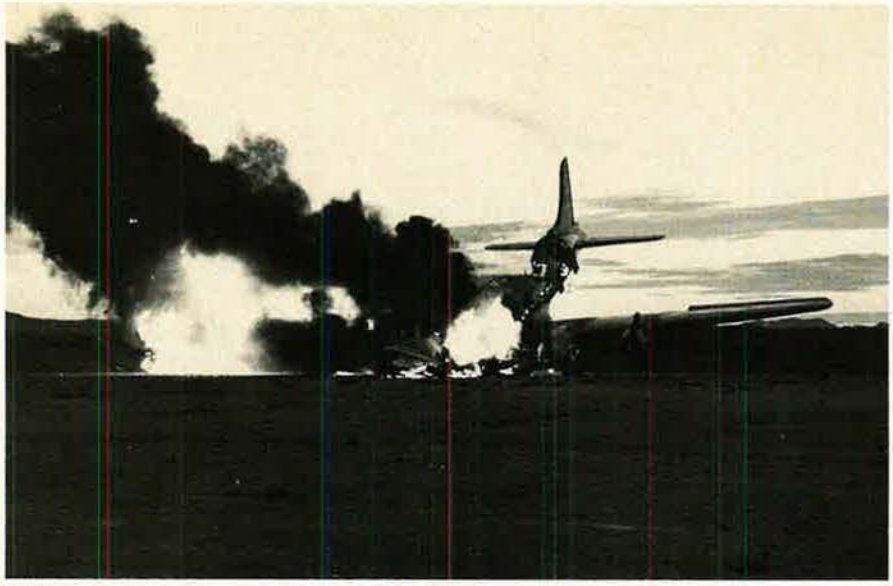
S151

The first hot conflict in the Cold War was a turning point in the Air Force's first 50 years.

THE AIR WAR IN KOREA

For many, the natural metal finish and swept wings of this F-86, flown by fighter ace Lt. Col. George I. Ruddell, epitomize the air war in Korea. The aerial combat that took place between 1950 and 1953 was more than MiG vs. Sabre, however. Rare color photography on the following pages shows other sides of the war that introduced a newly independent service to the hot side of the Cold War.

Ken Collection via Warren Thompson



On June 25, 1950, North Korean leader Kim Il-Sung hurled his troops across the thirty-eighth parallel, expecting to unite the Korean peninsula under his Communist regime. Statements from US government officials implying that South Korea was outside American interests and the postwar disarmament of the US led the North Koreans to anticipate little resistance. Symbolic of the lack of preparation for the war that ensued is this Military Air Transport Service Douglas C-54, burning at Kimpo AB, South Korea, after a strafing by North Korean Yak fighters.

Charles Morehouse via Warren Thompson

Jim Farr via Warren Thompson

President Harry S. Truman ordered US air and naval forces to assist the South Koreans on June 27, 1950, and a United Nations resolution called for international assistance. The task of air defense fell to USAF's Far East Air Forces, equipped in July 1950 with 921 F-80, F-51, F-82, B-29, and B-26 combat aircraft, 468 support aircraft, and 54,477 personnel. At left, among the first major movements of aircraft rushed to the FEAF were these 145 Air National Guard F-51 Mustangs, accompanied by 70 experienced pilots, headed for Japan aboard the carrier USS Boxer.

"First blood": In North American Aviation F-82s like the one at right, Lts. William G. Hudson and Charles B. Moran and Maj. James W. Little scored the first kills of the Korean War over Kimpo AB on June 27, 1950.

Charles Toler via Warren Thompson

Budd Bulcher via Warren Thompson

Lockheed's F-80s were considered by some to be too fast for the strafing mission. They proved to be an outstanding support weapon, however, their speed making them less vulnerable to ground fire than piston-engine fighters were. Stable platforms for their six .50-caliber machine guns, they were hampered only by short range, corrected by the addition of "Misawa" tiptanks like those on the F-80s (above) from the 8th Fighter-Bomber Squadron, returning from a May 1951 mission. The tanks strained the wingtips but gave the fighter as much as 45 additional minutes in the air.

The F-80 was also tough. At right, amazed crew members surround a fighter that returned to base after a low-level bomb run in North Korea, where it had hit a cable strung across a narrow valley. Though a sizable portion of the right wing had been sheared off, the skilled pilot flew the plane back to Suwon AB, South Korea.

Chuck Baisden via Warren Thompson

RF-80As, less powerful but longer-range Shooting Stars, flew photoreconnaissance missions deep into North Korea to determine targets for fighter-bombers.

Via Robert F. Dorr

The US Navy and Marines also moved into the jet age during Korea. Carriers had significant responsibility in close air support and interdiction of Communist supply lines. At right is a view from "Vulture's Row" on the deck of USS Kearsarge in 1952. The deck is covered with Banshees, Skyraiders, Panthers, and Corsairs. More than a dozen carriers had rotated through the theater by war's end.

Gene Bezore via Warren Thompson

Via Robert F. Dorr

For three years, the Navy blockaded the enemy's harbors and sea movement. It also took on the search-and-rescue role. Navy aircraft like the unarmed Martin PBM-5 Mariner patrol boat at left, based at Naval Air Facility, Oppama, Japan, flew antisubmarine patrols and served as transports.

Among the early jets that saw extensive duty in Korea were F-84s like the gaggle at right, with their classic lines broken up by bulky bombs hanging beneath them. (Capt. Arnold W. Braswell, who went on to become a lieutenant general, took this photo in January 1952.) The Thunderjet entered the Korean War in December 1950, by which time the UN forces that had reached the Chinese border the month before had become aware that the North Koreans were backed by Communist Chinese forces.

Arnold W. Braswell via Warren Thompson

The 3d Bomb Wing Douglas B-26 at right had flown in the South Pacific in World War II. The venerable Invader was among the FEAF's combat aircraft that did yeoman work, blunting the North Korean advance, gutting the enemy's logistics by destroying railroads, roads, factories, and troops and transport assets in the field. Below right, a B-26 crew member catches on film air-to-ground rockets streaking toward a bridge in North Korea.

Via Robert F. Dorr

B-26 crews flew their first mission into North Korea in June 1950, bombing an airfield at Pyongyang. In July 1953, a B-26 crew from the 3d Bomb Wing dropped the last bombs of the war, on Wonson, minutes before the cease-fire took effect. The service changed the A-26s to B-26s in 1948, as the separate Air Force came into its own. In an odd turnaround, some of the same basic type of aircraft would be upgraded and see service in the Vietnam War, redesignated A-26.

Marv Jackson via Warren Thompson

Via Robert F. Dorr

The Korean War saw the development of forward air control techniques when North American AT-6 Texan trainers were fitted for the FAC role, or "mosquito missions." In cooperation with a ground FAC, the Mosquito pilot did some of the riskiest flying of the war, marking the targets with smoke rockets. Lightly armed and slow enough to attract small-arms fire, these forerunners of today's tactical air control parties and combat control teams pioneered techniques in air-to-ground operations that are still in use.

Chuck Baisden via Warren Thompson

At left, B-29s from the 93d Bomb Squadron, 19th Bomb Group, are en route to a bombing mission over Taechon, North Korea, in September 1951. USAF's strategic bombers were mobilized early in the war. FEAF's 19th Bomb Group, the only B-29 group outside Strategic Air Command control, moved immediately to Kadena AB, Okinawa, and flew bombing missions from there to North Korea. In the US, SAC alerted the 92d and 22d Bomb Groups. Nine days and 8,000 miles later, they flew their first combat missions—a tribute to flyaway kits, crew resilience, and SAC theories on mobility. By July 1950, two additional wings had been alerted, and the big bombers were used for interdiction and battlefield support, as well as to bomb strategic targets in the north.

Forced to fly at night by the MiG threat, B-29 missions were long and dangerous. This 307th Bomb Group Superfortress (below left) ran into night-flying MiGs and antiaircraft artillery over a target. Unable to return to its base in Japan, it crashed into a mountainside near Taegu AB, South Korea.

Charles Higgins via Warren Thompson

Jim Lynch via Warren Thompson

Above, at Kadena AB in 1951, Bugs Buster *loads up for a night bombing mission over North Korea.*

The Korean War helped forge many of the Air Force's finest leaders. At right, Daniel "Chappie" James, then a captain, begins another day "in country" in 1950. He flew F-51s and F-80s on 101 combat missions with the 12th Fighter-Bomber Squadron. He went on to become commander in chief of North American Air Defense Command and the first African-American four-star general.

Harry Moreland via Warren Thompson

Al Gamblin via Warren Thompson

For the long haul: The C-124 Globemaster II was the largest aircraft in the Korean War and the only one able to carry many of the Army's vehicles. When it first became operational in the Far East, it was only allowed to land at major bases, such as Taegu, Kimpo, Suwon, and Osan, to prevent wear and tear on smaller tactical air bases used by fighter-bombers. Earlier transports hauled cargo to Korea by departing from Travis AFB, Calif., refueling at Hickam AFB, Hawaii, Wake Island or Midway, and Yokota AB, Japan. The C-124A could fly from Travis to Yokota nonstop. Here, a C-124 unloads cargo, including troops, at Kunsan AB, South Korea, in spring 1953.

For the short haul: C-46s gained their greatest fame by airlifting supplies over "the Hump" in the China-Burma-India theater during World War II and continued in service in the Korean War, transporting cargo. Here, C-46s line the runway at Pusan, South Korea, in October 1950. Transports racked up 999,381 flying hours in the war.

John Corrigan via Warren Thompson

Via Robert F. Dorr

Through the UN, 19 nations offered trade, technical, economic, or medical assistance to South Korea during the war, and 15 joined the US in sending military forces. At left are two aircraft of the Royal Australian Air Force's Number 77 Squadron at Kimpo AB: an F-51 Mustang being worked on in the foreground and a Gloster Meteor Mk. 8.

Via Robert F. Dorr

Communist China rocked the world with massive intervention on the side of North Korea. Attacking Chinese forces drove UN troops below the thirty-eighth parallel again. China also sought air superiority by introducing the sweptwing MiG-15 jet fighter—many piloted by Russians. USAF responded to the MiG challenge by sending the 4th Fighter-Interceptor Wing to Korea with F-86 Sabres.

The F-86 was similar to its main adversary, the MiG-15, but training and experience gave Sabre pilots the edge, and they posted an imposing 10-to-one kill advantage. The first battle between sweptwing jets took place on December 17, 1950, when Lt. Col. Bruce Hinton sent more than 1,500 rounds into a MiG before the MiG inverted and dove straight in.

At top is a typical scene in a revetment, with a crew chief and a pilot going over procedures before the Sabre heads north. Above right, two F-86s from the 335th Fighter Squadron fly in formation past Mount Fuji, Japan, in 1953.

F-86s, like the one at right, could be pulled apart, but maintenance (often done outdoors) was never easy. Troops suffered from bitterly cold winters, hot summers, and torrential monsoon seasons.

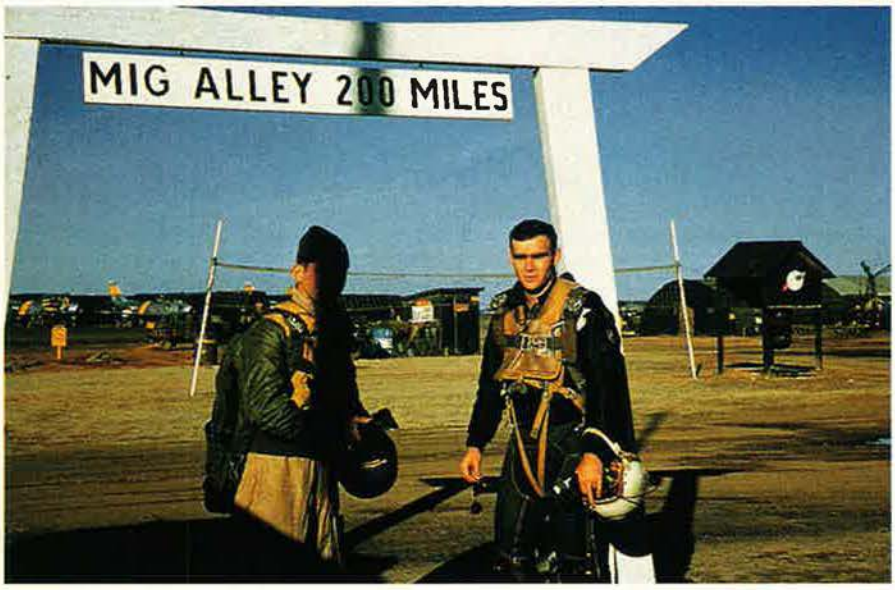
Ed Hughes via Warren Thompson

Iven Kincheloe via Warren Thompson

The gunports of his aircraft blackened by the heat of battle on May 18, 1953, Capt. Joseph C. McConnell, Jr., is greeted by squadron members on returning from downing his last three MiGs, making him the top-scoring ace of the Korean War. Although he had completed 106 missions in Korea and had requested 25 more, Captain McConnell was immediately ordered home from Suwon, having entered Air Force history with 16 jet-to-jet victories.

Gil Lowder via Warren Thompson

Most pilots saw MiGs from the vantage point shown above, including these Korean War aces, l–r: 1st Lt. James F. Low, Capt. Robinson Risner, Col. Royal N. Baker, and Capt. Leonard W. Lilley. Risner went on to serve in the Vietnam War and survived seven and a half years as a POW in North Vietnam. He retired as a brigadier general.



Dick Erratt via Warren Thompson

Lt. Dick Erratt (on the right) and a fellow pilot from the 336th Fighter Squadron stopped in front of one of the icons of the Korean War, the torii near the operations building and flight line at Kimpo AB. In July 1951, with the war at a stalemate, negotiations began at Panmunjom, North Korea. Although the war never came to a formal end, an armistice was signed on July 27, 1953. US forces remain in South Korea today, including more than 8,600 USAF personnel. ■

Gen. Walter Kross talks about airlift requirements, readiness, and more.

The New Boss at Air Mobility Command

For much of the last decade, significant parts of USAF's airlift system had to go largely untended. The only new aircraft program in that period—the C-17—was delayed by technical and financial problems, as other aircraft became more obsolescent. Unexpected C-17 cost growth (plus the expense of emergency fixes to the C-141 fleet) siphoned money away from less-visible yet important needs elsewhere in the system.

Among them: upgrades to the C-5 airlifter to improve its reliability, procurement of new loaders to replace ancient cargo-handling equipment, replacement of the KC-135's outdated avionics and electronics, and the purchase of global command-and-control systems and components for global air traffic management.

By John A. Tirpak, Senior Editor

For the next decade, the C-5 Galaxy will be the "backbone" of strategic airlift, as the C-141 retires and the C-17 becomes the mainstay of the force. The Galaxy fleet needs improvements to stay current and become more reliable.

Staff photo by Guy Aceto

USAF photo by Bill Chan

General Kross is intent on bringing AMC into the twenty-first century with refreshed capabilities and better-equipped people. Here, he shakes hands with 1st Lt. William Zortman of the 1st Weather Squadron, Fort Lewis, Wash.

Now that the C-17 program has turned around—with costs under control and DoD committed to buying a full fleet—a notion has spread that the airlift problem somehow has been "fixed."

Not so. Those other, untended problems haven't gone away, said Gen. Walter Kross, head of Air Mobility Command. In fact, he warned, Air Force procurement of the C-17 aircraft marks not the conclusion but the start of what will have to be a long renewal of AMC assets on many fronts. That will be required, said the General, if AMC is to remain highly capable in years to come.

Splitting Hairs

In an interview with *Air Force* Magazine, General Kross discussed the road ahead in modernizing AMC, a hairsplitting task of judging between priorities when everything is a priority and needed right away. He also discussed the recently completed Intratheater Lift Analysis, the status of the Civil Reserve Air Fleet (CRAF), and the recent repatriation of C-130s from Air Combat Command to AMC.

Governing the choices ahead are three themes, General Kross said. First is readiness, "supporting the warfighting CINC and his requirements." The second is "to prepare now—the key word is 'now'—to operate effectively in the twenty-first century," because so many procurements require long lead times. Third, he said, "is continuous improvement of the critical processes associated with rapid global mobility." The three themes all play together, but "they're all very, very important."

In the case of the C-17, "the expectations are way ahead of the numbers," said the General. The C-17 has achieved some stunning successes and demonstrated excellent reliability. Even so, the program still is in its infancy.

Congress and many in the defense establishment, the General said, have formed the impression that "the C-17 is here, it is upon us, and we have enough tails to service the world. We don't." He noted that, in two years, AMC will have retired 47 more C-141 Starlifters but will have received only 11 more C-17s. Of the 34 C-17s in service in 1999, 14 will be dedicated to training, in depot, or in test, leaving only 20 or so airplanes available for day-to-day airlift operations. And, while the C-17 can carry more and larger items than a C-141 can, there will still be a lag in replacing the gross carrying capabilities of the retiring Starlifters.

During the transition from 256 C-141s to 120 C-17s as "the backbone of our fleet," the 115 C-5 Galaxys—which the General described as "the least-reliable wide-body airplane built in America"—will have to fill the role of "backbone." The last currently planned C-17 will reach the flight line in 2005, while the last active-unit C-141 will retire in 2003 and the last Air National Guard or Air Force Reserve C-141 in 2006.

The airlift force available for the next decade will be one that can handle "a single major regional contingency . . . with moderate to high risk," General Kross said. The level of 120 C-17s now planned, along with rest of the inventory, will meet "the accepted *characterization* of risk," he said, adding, "I was trying to avoid using the word 'standard,' because 'moderate to high' should never be a standard" of risk.

Airlift studies over the last two years have identified a need for as many as 140 C-17s, and new requirements are being added all the time. For example, no successor aircraft has been identified for some C-141s now filling a special operations mission. A study of intratheater airlift completed last year found a requirement for at least one squadron of C-17s in that role, as well—above and beyond its strategic airlift mission.

As the world changes, airlift requirements will also change, General Kross observed, and "the debate will still be on years from now" as to whether the nation should buy more than 120 C-17s.

"There will always be a contractor" who will insist that the Air Force has to "make the decision right now, because of long lead, spare parts, and all those kinds of things," General Kross said, "but, in fact, we have a number of years before we have to come to grips with that decision."

In the meantime, there are other ways to "drive down" the amount of risk inherent in maintaining the airlift force at present levels, he said.

Additional sealift now entering the inventory will somewhat reduce the load that airlift will have to carry, General Kross—who is also head of US Transportation Command—pointed out.

Moreover, better "global command and control, additional precision munitions," and other adjustments to the overall force have narrowed the gap between lift capability and requirements. Precision weapons, for example, reduce the number of weapons that must be transported to a theater to conduct an air campaign because fewer bombs are needed per target. Better information exchange will make it easier to deliver cargo more precisely to where it is needed and away from where it isn't.

Another "big driver" of reduced airlift requirements is the increased amount of prepositioned equipment overseas. Although less has to be carried overall by sea or by air, "in the early phases" of an overseas contingency, "you have to carry more by air . . . to marry up with the [prepositioned equipment]," the General noted. In this respect, a large part of the burden can be carried by the CRAF, a contingent of commercial carriers that commit their airplanes to military airlift in wartime or under commercial contract in peacetime.

Since the early phase operation "is largely a CRAF/passenger capability that's required, we're . . . playing to the strength of America's aviation industry," General Kross said.

After the Galaxy, What?

Because the C-17 issue appears largely settled for now, attention has shifted to the C-5's expected retirement, slated to begin in 2006. Musings about a replacement—possibly even a "stretch" C-17—have already begun in aviation circles.

But General Kross dismisses talk of a C-5 replacement as premature, arguing that "this aircraft is not anywhere near the end of its service life. . . . You don't replace an airplane that hasn't worn out—not in the airlift business. . . . It's simply too expensive to replace."

Instead, because the C-5 will have to be the "backbone" of the airlift fleet for a decade, a C-5 upgrade is boiling up near the top of AMC's list of preferred investments.

"This nation should look very seriously at improving the reliability of the C-5 as the next major action in strategic mobility," General Kross asserted.

Right now, the C-5's reliability in takeoffs is about 87 percent—a number that sounds good until it is multiplied by four or five takeoffs and arrivals per day. After several legs of only 87 percent reliability, "you're not managing flow anymore, you're managing a series of problems," General Kross noted. The commercial standard for takeoff reliability—both cargo and passenger—is 98 percent.

"Any advancement of the C-5 toward . . . dispatch reliability in the low- to mid-90s is a significant march forward for this nation, given the . . . *tremendous* capability of the C-5," which can haul 36 pallets to the C-17's limit of 18, he noted.

Over the past two years, thanks to aggressive exploitation of all available low-cost improvements and changes, the C-5's departure reliability has been increased by seven percentage points, what General Kross called "very significant in a mature system."

However, "we have now hit the wall. We have to expend significant amounts of money in order to advance these percentages very much further, in fits and starts."

Those "fits and starts" could be funded separately, but the cost would still add up to the several billions necessary for a comprehensive Service Life Extension Program.

A SLEP proposal that could boost reliability to near-commercial standards "and also be in the low billions [of dollars in cost]," spread out over a five- to seven-year period, "is a . . . significantly interesting improvement to our strategic mobility," General Kross said.

He noted that "the biggest drivers" of the C-5's low reliability rate are the engines, autopilot, avionics, and hydraulics.

Lockheed Martin, prime contractor on the C-5, has offered USAF a proposal to do a "one-time" comprehensive update of the Galaxy fleet that would render it serviceable into the 2030s for under $35 million per airplane. The proposal involves reengining the fleet with leased powerplants that would increase thrust and

Intratheater Lift Analysis

The Intratheater Lift Analysis "briefed out" at the end of 1996 was the first study to identify a potential role for C-17s in that mission, said Gen. Walter Kross.

As speed becomes more critical in any contingency, and as Army equipment grows in size, the ability of the C-17 to bring outsize equipment directly from the US or a neighboring theater to a front-line airstrip can no longer be ignored, the AMC commander reported.

In Bosnia-Hercegovina, he said, "in one day we moved a mechanized battalion," a capability "greatly appreciated by the Army and the warfighting CINCs."

While USAF has had a "direct delivery capability with the C-5" for decades, it has been limited to sufficiently large, improved strips, something usually in short supply at the front lines. The C-17 can operate on "semiprepared, austere airfields," General Kross said, "and bring a wider range of equipment, . . . so you can eliminate . . . in-theater transshipment" factors.

"We will be altering the paradigm as to how you define" the difference between strategic and theater lift, he said.

The ILA conclusions do not demand immediate action, he added, since "there's always another Intratheater Lift Analysis. . . . But this is where minds will be stretched, as we refine these requirements."

Photo by Randy Jolly

The C-17 performed so impressively in Bosnia that USAF is rethinking its intratheater lift requirements: Additional C-17s could eliminate a host of transshipment problems by bringing cargo directly to the front lines.

Repatriation of C-130s

At their Corona meeting last October, top USAF leaders decided that the C-130 fleet—which had been given to Air Combat Command in the midst of the Air Force's reorganization of the early 1990s—would return to Air Mobility Command.

Gen. Walter Kross, AMC commander, said the move was made not because there was "anything broken . . . [or that] really needed to be fixed" but because theater airlift forces will work better if they are re-integrated with other mobility forces, for purposes "of training, . . . exercises, for doctrinal air mobility development, for integrated tactics." The change means a theater commander won't have to "go to two commands" to get theater lift, he added.

AMC "has the core competency for the entire range of rapid global mobility," he said. The move is expected to smooth out professional development and personnel issues as well.

A squadron of C-130s will remain in each theater under PACAF and USAFE to do work deemed necessary by each theater's air component commander, and "plenty of work" will keep them busy, the General said. Their role will be analogous to that of tankers deployed overseas to support fighter refueling, he added.

The change will be "as close to no-cost as we could make it," he said, mostly "base signage and letterhead stationery," and the move will likely be "transparent to the customer."

improve efficiency. The proposal would entail "glass cockpit" improvements borrowed from the company's C-130J effort, structural enhancements, and other changes. *[See February 1997 "Aerospace World," p. 15.]*

The company claims the upgrade can reduce operating costs by up to 45 percent per ton-mile.

Not a Crisis

However, because the C-5's status is not a near-term crisis, neither a replacement nor a SLEP appears on AMC's list of top acquisition priorities.

Because the C-17 fleet is still only a couple of squadrons strong, it will remain the command's top modernization priority almost through program completion.

Next on the list is something much more mundane but altogether as critical: loading equipment.

"The moral equivalent of trucks for the Army are our materiel-handling equipment that we use to load our planes," General Kross said.

The existing MHE fleet "is old [and] very disparate . . . a lot of different models," the General noted. More important than the lack of uniformity is the MHE fleet's rapidly decreasing reliability, with a mean-time-between-failure rate of 10 hours. "We need loaders that are tenfold that," he said.

The MHE procurement will be in a high-low mix. At the high end is the "60K," a machine able to carry and hoist 60,000 pounds into any airplane in the fleet, soon to go into operational test. At the low end is the next-generation small loader, an off-the-shelf commercial loader with 20,000 to 25,000 pounds of capability, now out for bid.

However, when the MHE procurement is completed in 10 years, it still won't have replaced the entire MHE fleet, General Kross noted.

"It will just provide us with a modernized, highly reliable—very deployable—core set of equipment," he said.

Third on the list of priorities is "what we call global command and control," General Kross said. This system will give AMC the same kind of "in-transit visibility"—the ability to find a piece of cargo wherever it is in the pipeline and route it as required—that the major commercial cargo companies like Federal Express Corp., United Parcel Service, or CSX Corp. already have.

"We . . . place more emphasis on the rapid movement of timely information than . . . taxiing the aircraft to takeoff," General Kross asserted. "Our global mobility system absolutely requires it. . . . The information's got to get there before the airplane does."

He added that "to have a plane show up . . . unannounced, and nobody knows what the cargo is on the inside, is a failure."

The "global transportation network" is now "up and running" on the World Wide Web, and AMC also has access to it through other servers, as well.

Besides the need to "stay the course on procuring this system," General Kross emphasized that it must tie easily to the commercial carriers, as well, since "so much of our stuff moves on the commercial [carriers]."

Other aspects of the command-and-control system involve electronic interfaces with the other services, which will tie all US military transportation data together. This system, called Transportation Coordinators' Automated Information for Movement System II (TC AIMS II), "is actually an Army program. We've got to make sure the Army keeps their money on that program. And we've got to make sure the Air Force supports the Army in doing so."

Staff photo by Guy Aceto

MSgt. Horace Booker, a loadmaster from the 6th Airlift Squadron, McGuire AFB, N. J., is about to complete a seven-hour flight from Germany to Qatar. Upgrades to information systems and other equipment will ease the burden on AMC's crews.

Fourth on AMC's procurement priority list is a "basketful" of relatively small but vital system improvements that will allow AMC aircraft to continue operating under rapidly shifting international rules and standards for air safety.

The International Civil Aviation Organization and International Air Transport Association have been establishing new equipment standards that will help organize and deconflict airspace, which is increasingly congested, and AMC simply must keep up, General Kross asserted.

The new regulations dictate "whatever equipment you must have to fly a transoceanic route . . . or to land at an airport like Heathrow, [UK], or to fly over France, or to be able to talk on the radio, or . . . to get preferential routing over the Pacific."

All these requirements have been "swept into a basket we call GATM," or Global Air Traffic Management, the General said. It is a critical program, since without it, AMC may be barred from flying at certain altitudes or along the most efficient routes.

"We will incur delays, we will have to fly around," and such limits would then invoke "penalties" that would affect the ability to carry out requirements for a major regional conflict.

Photo by Randy Jolly

General Kross calls the KC-135 cockpit a "museum piece" and argues for updates to put the Stratotanker on a par with international air traffic standards coming into force. Roping all of the "little" upgrades into one program increases their visibility.

Key to Global Reach

Collectively, GATM will continue to "guarantee unrestricted global reach," General Kross asserted.

Putting these modifications—like replumbing the KC-135's pitot-static system so it can fly at higher altitudes—into the collective GATM basket "has raised the consciousness level" of the Joint Chiefs of Staff and other decision-makers that these projects are linchpins of airlift that must be funded, the General said. And, time will not allow interminable delay.

"The first one of these [new equipment regulations] kicks off" on March 27, 1997, he observed, and more will come into force every year for the next three years or more. "I can't work that into the 1999 [program objective memorandum]" or the Pentagon five-year budget plan. The regulation governs vertical separation on major North Atlantic air routes, so it can't be ignored.

In order to fund these projects, "we're . . . slipping other things in order to get in front of this requirement, biting it off in chunks. But it will eventually become an overall, overarching Air Force requirement, and it will be something that everyone gets behind."

The fifth and last of AMC's top modernization priorities is the long-postponed update of the KC-135. Powerful and capable as the Stratotanker is, "if you go in the cockpit of that plane, it looks like a museum piece," the General observed. Though the reengining program from KC-135E to KC-135R has substantially enhanced the fleet, "the time has come . . . to modernize the electronics, the avionics, the brains of the plane," he said. The program "overlaps a little with GATM."

The General went on to say that the Air Force "has never stepped up to capitalizing the KC-135 properly . . . because there are so many planes. Even if you want to change the intercom . . . it's a $50 [million to] $60 million bill. And so we haven't done any of these things."

The Pacer CRAG (Compass, Radar, and Global Positioning System) program, as the update is called, will give the KC-135 a glass cockpit, color radar, GPS capability, and other improvements.

"We need to stay the course on that, do the whole fleet to one single standard: active, Guard, and Reserve," General Kross said. ■

CRAF Development

Gen. Walter Kross said that Air Mobility Command will "seek to mitigate" the level of risk in current airlift by adding as much capability as possible through the Civil Reserve Air Fleet program.

The Air Force is attempting to get "as much leverage as we can get in our annual CRAF contracts as well as other contracts, . . . such as [General Services Administration] small-package contracts, all of which [now] have clauses requiring various commitments to the CRAF by those who participate or who are award-winners," General Kross noted.

There has been a "modest" increase in CRAF participation over the last three years, chiefly because of steps taken after Operation Desert Storm, he pointed out. After the Persian Gulf War, some carriers pulled out because they had lost market share.

To bring them back, more government cargo business was made available to participants. It's an attractive piece of business, worth some $700 million a year, but to compete for it, airlines must commit at least 15 percent of their aircraft to CRAF. In the case of the GSA small-package contracts, it's 30 percent.

General Kross said he's "very satisfied" with the current level of participation in CRAF and pointed out that in 1997, for the first time, the program will meet its requirements for aeromedical evacuation–equipped aircraft.

The drawdown continues in both aircraft and manpower. There is no end in sight to the budget crisis.

Profiles in Russian Airpower

By Benjamin S. Lambeth

DoD photo by R. D. Ward

Workers at Engels Heavy Bomber Base, Russia, cut apart wings and fuselage sections of a Tu-95 "Bear" bomber. Russia's Long-Range Aviation now has fewer than 300 bombers and tankers all told.

RUSSIA's military aerospace establishment—comprising the Air Force, Air Defense Forces, and Naval Aviation—is a beleaguered institution that has lost much effectiveness and prestige. Military leaders understand the problems and are working hard to correct them, but the fate of the three air services will be determined by economic and political factors that lie almost completely beyond the military leadership's control.

During the past four years, the air arm underwent a massive drawdown. A severe budget crisis not only postpones improvements but also steadily reduces the inventory of available aircraft.

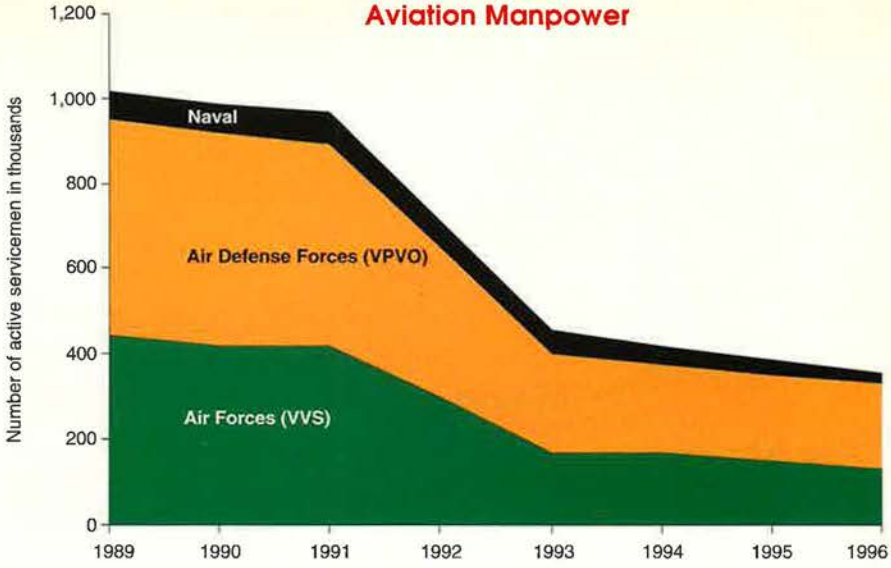
Sufficient funding will not be available until Russia emerges from its current fiscal crisis. For now, Russia can do little more than tighten its belt and set the stage for recovery whenever political and fiscal realities will allow it to take place.

—From Russia's Airpower at the Crossroads, *RAND Corp., 1996, by Benjamin S. Lambeth. Used by permission.*

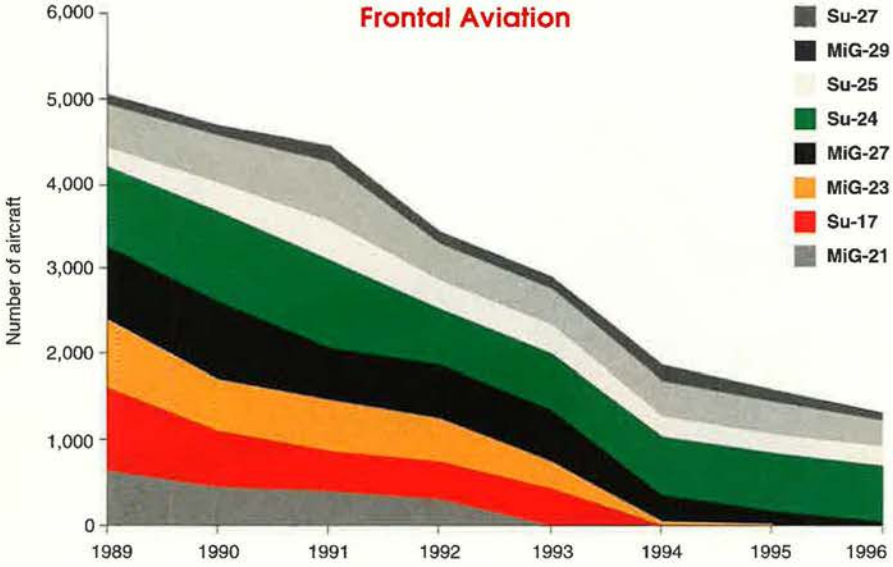
Benjamin S. Lambeth is a senior staff member at RAND Corp., specializing in international security affairs and airpower. His most recent article for Air Force *Magazine, "Technology and Air War," appeared in the November 1996 issue.*

Russia's aviation manpower has undergone a significant decline in strength from its former Soviet level. From a total of a little more than a million troops in 1989, the combined number for the three air arms today is down to fewer than 400,000. Moreover, because of the failure of conscription, the three services have become abnormally top heavy with officers.

Aviation Manpower



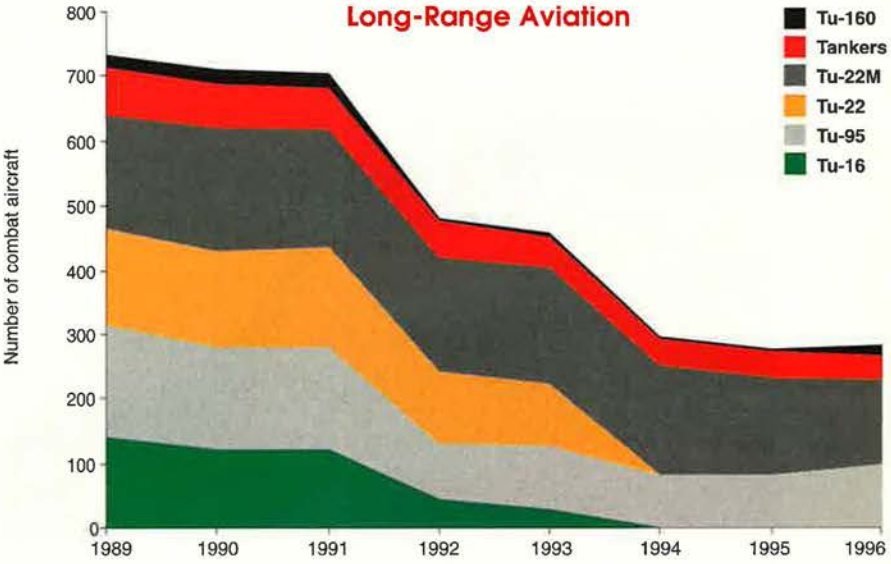
Frontal Aviation



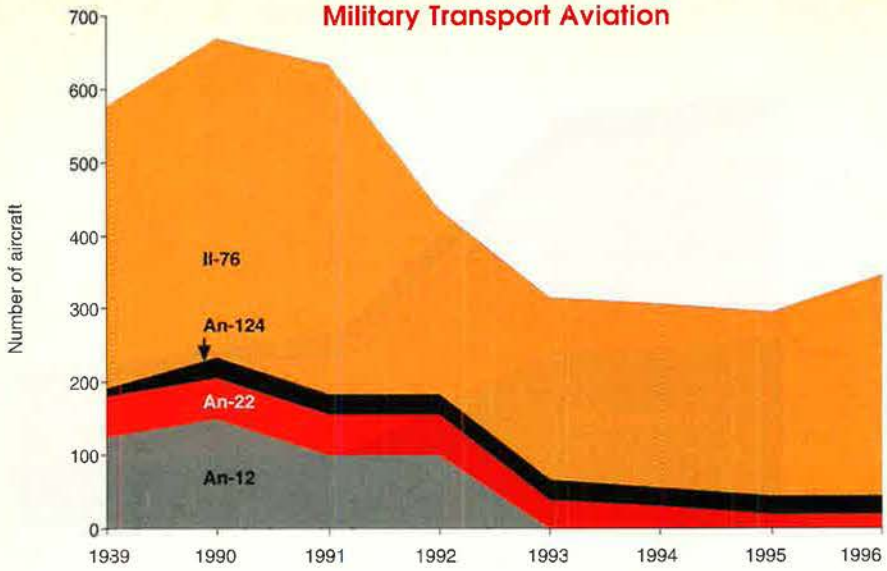
Frontal Aviation has shrunk from a high of more than 5,000 combat aircraft in 1989 to little more than a quarter of that number today. Around a third of these are fourth-generation MiG-29s and Su-27s. The remainder are older aircraft slated to be retired before the end of the decade.

Long-Range Aviation shed much of its intercontinental nuclear attack role and embraced a new mission of providing strategic reach in support of Russia's regional power-projection needs. LRA experienced a significant drawdown since the late 1980s. Its total number of aircraft has dropped from more than 700 to fewer than 300, and many of its most modern bombers have been lost to the newly independent states.

Long-Range Aviation



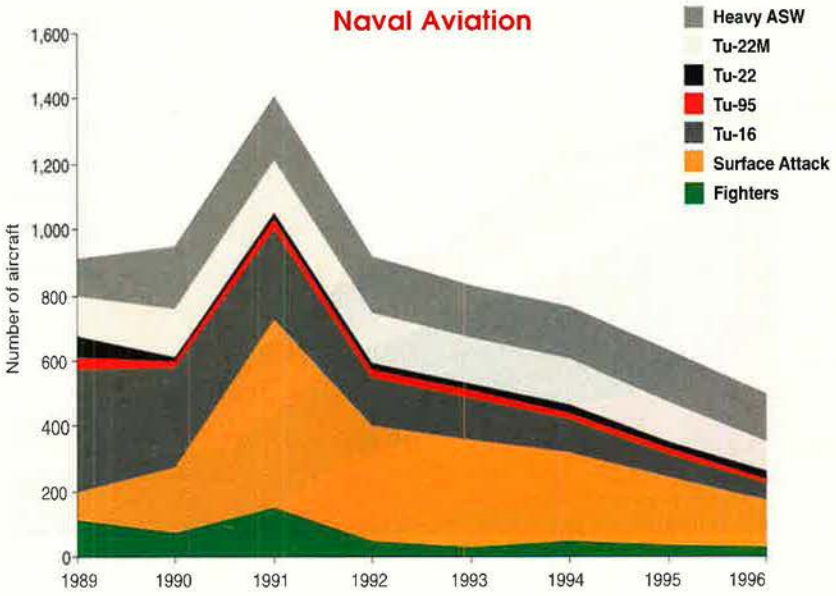
Military Transport Aviation



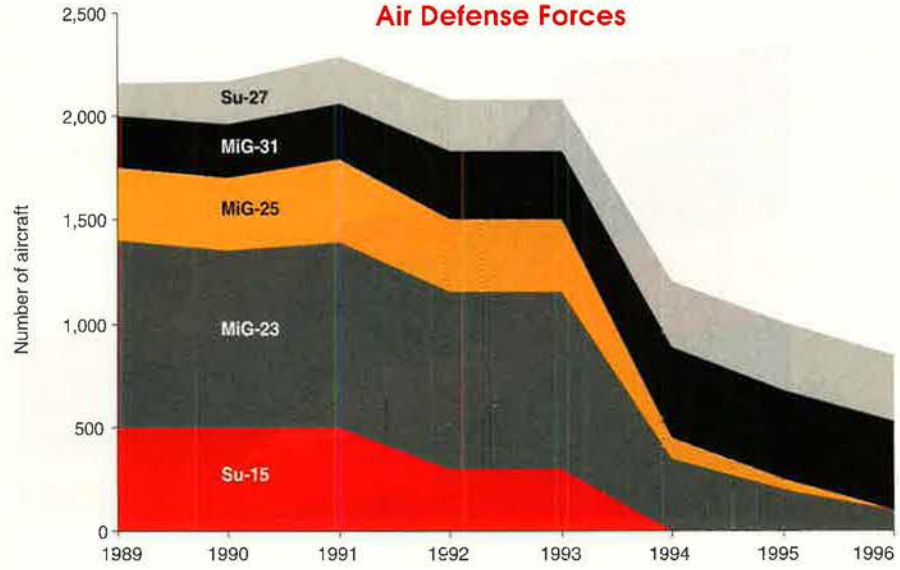
A painful post-Soviet loss was registered in Military Transport Aviation, which provides airlift. A large portion of its Il-76 jet transports (200 out of the 450 possessed by the USSR) was based in Ukraine, which claimed possession. Moscow viewed this as an especially acute loss in light of Russia's new regional peacekeeping challenges.

Naval Aviation

Naval aviators are afflicted by post-Soviet constraints no less severe than those that have beset the other air arms. From a level of about 1,000 during the Soviet era, the number of naval aircraft has declined dramatically to about 500 of all types today. The outlook for carrier-based fighter aviation is grim.



Air Defense Forces



Russia's Air Defense Forces have experienced a sharp rate of decline, dropping from a Soviet-era high of about 2,300 interceptors on the eve of the USSR's collapse to fewer than 900 today. ■

Valor

By John L. Frisbee, Contributing Editor

Valor, Dedication, and Miracles

William Cameron's distinguished combat career was unique in its combination of personal and providential intercession.

MANY "Valor" stories have been about extraordinary heroism in a single combat engagement, but valor also has other faces. Not the least of them is prolonged dedication to the mission against increasingly unfavorable odds. On both counts, retired Col. William R. Cameron's World War II career is remarkable, embracing both an element of luck and some incidents uncanny enough to appear miraculous.

As a lieutenant, Cameron was a member of the 44th Bomb Group, one of the two B-24 Liberator groups in the European theater during the early days of AAF participation in World War II. The 44th BG arrived at Shipdham, UK, in October 1942. The other early arrival, the 93d Bomb Group, had been in the UK less than a month; hence there was little background of combat experience with B-24s in Europe. Their operational characteristics were not entirely compatible with the B-17, the glamor aircraft of Eighth Air Force bombers.

Lieutenant Cameron, assigned to the 67th Bomb Squadron, launched his combat career as a copilot during the terrible winter months of 1943. The 44th BG soon came to be known as a hard-luck outfit, the "Flying Eightballs." By March, the 67th Bomb Squadron had lost five of its original nine crews and two weeks later had been further reduced to three aircraft and crews. Promised replacements had not arrived. Along with other experienced copilots, Bill Cameron was made an aircraft commander, a new crew was scraped together, and he was assigned a B-24 that he named *Buzzin' Bear.*

While Cameron was on a three-day pass to celebrate his new job and the forming of a new crew, the group was sent against the heavily defended Krupp Submarine Works at Kiel, Germany. The decimated 67th Bomb Squadron could muster only three aircraft for that May 14 mission. All were lost, leaving Bill Cameron the only remaining pilot originally assigned to the squadron. Fate had spared him during five months of vicious combat, but how long could its blessing last?

In June, the 44th Bomb Group was deployed to North Africa for an important but undisclosed mission, which turned out to be the low-level attack on oil refineries at Ploesti, Romania. As a warm-up for the still-mysterious mission, the group flew strikes against targets in Italy to support the invasion of Sicily. On one of these missions, Cameron's crew shot down five enemy fighters but took hits that forced their pilot to shut down an engine for the very first time and make refueling landings at Sicily and Malta.

On return to the group's base at Benina Main in Libya, Cameron, now a captain, was assigned to lead the group against a target at Rome, Italy. It was his twenty-sixth mission and the completion of a combat tour during which he had witnessed the loss of so many squadron mates. He was eligible to return to the States but instead volunteered to fly what soon was revealed as the Ploesti mission. The group would be led by its commander, Col. Leon W. Johnson, with Bill Cameron as deputy leader.

Many readers know the story of the August 1, 1943, attack on Ploesti. The intricate mission plan was disrupted by unanticipated weather en route and faulty navigation by one of the leading groups. When Colonel Johnson made a correct turn for his target, the Columbia Aquila Refinery, it already had been hit in error by another group. Nevertheless, Johnson led his B-24s at an altitude of 250 feet into a maelstrom of smoke, flame, exploding bombs, and ground fire to complete destruction of the target. Only two of Colonel Johnson's aircraft—his and Cameron's *Buzzin' Bear*—made it back to Benina Main that day. Leon Johnson, later a four-star general, was awarded the Medal

of Honor and Bill Cameron the Distinguished Service Cross. General Johnson later called Cameron "the finest combat pilot I have ever known."

After Ploesti, newly promoted Major Cameron was named commander of the 67th Bomb Squadron. On August 16, the group was ordered to hit an airfield at Foggia, Italy. Opposition was expected to be light, so Cameron used the mission to give combat experience to some of his new crews, one of which would fly *Buzzin' Bear,* while he continued preparation for the squadron's return to the UK. Unknown to the Americans, the Luftwaffe had moved a large number of fighters into the area. Five of the squadron's seven aircraft, including *Buzzin' Bear* and its crew, were lost. Up to that time, no crewman of an aircraft that Bill Cameron had flown as copilot or aircraft commander had been a casualty. Again, fate had been kind to Cameron, if not to his crews. With his luck stretched gossamer-thin, Major Cameron volunteered for a second tour and continued to fly missions until his war ended.

After the war, Colonel Cameron flew B-47s, commanded 7th Air Force Advanced at Guam, and served in several staff assignments. He was always an unassuming gentleman with a keen sense of humor and determination to do what was right. Now living in Carmel, Calif., he retired in November 1969, ending an Air Force career seldom matched in dedication and sustained valor by other bomber pilots of World War II. ■

The organizational charts at Headquarters USAF have shifted again.

The Air Staff, Before and After

The Air Force changed its Air Staff organization "to more effectively employ its warfighting capabilities," USAF announced in a December statement. The changes mark the first top-level reorganization since 1991.

The reorganization, which took effect in January, included these major changes:

FROM	TO
Deputy Chief of Staff, Plans and Operations	**DCS, Operations** **DCS, Plans and Programs**
DCS, Logistics	**DCS, Installations and Logistics**
DCS, Communications and Information	**Commander, Air Force Communications and Information Center** (Dual-hatted as Director, Communications and Information)
Assistant Chief of Staff, Intelligence	**Now part of DCS, Operations**
Director, Programs and Evaluations	**Now part of DCS, Plans and Programs**
Civil Engineer	**Now part of DCS, Installations and Logistics**
Director of Services	**Now part of DCS, Installations and Logistics**
New position	**Commander, Air Force Security Forces Center** (Dual-hatted as Director, Security Forces)

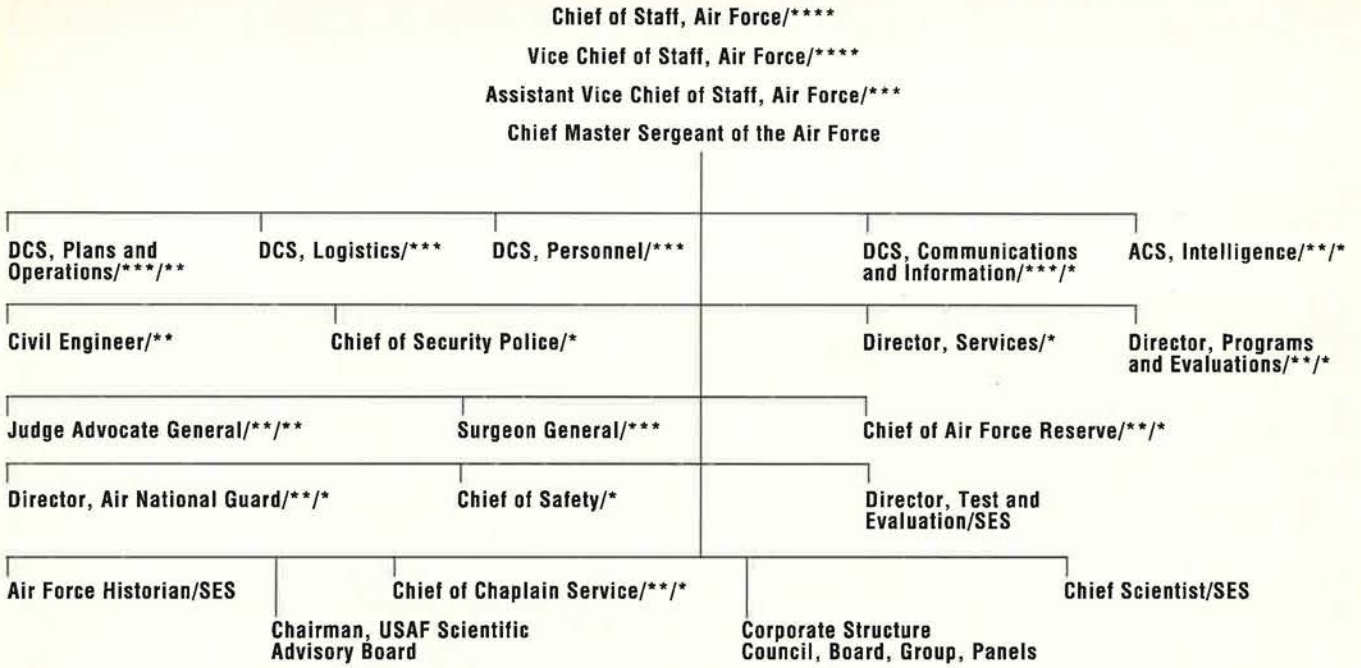
The Air Force merged intelligence with operations to "lead to creation of an information-operations culture." The DCS, Operations, now controls functions in intelligence, surveillance and reconnaissance, weather, command and control, and operations.

Air Force officials stated that the service also wanted to centralize programming and planning processes under a DCS, Plans and Programs. It now hosts all long-range planning efforts and ties "the revitalized long-range planning process" into programming plans to meet national objectives.

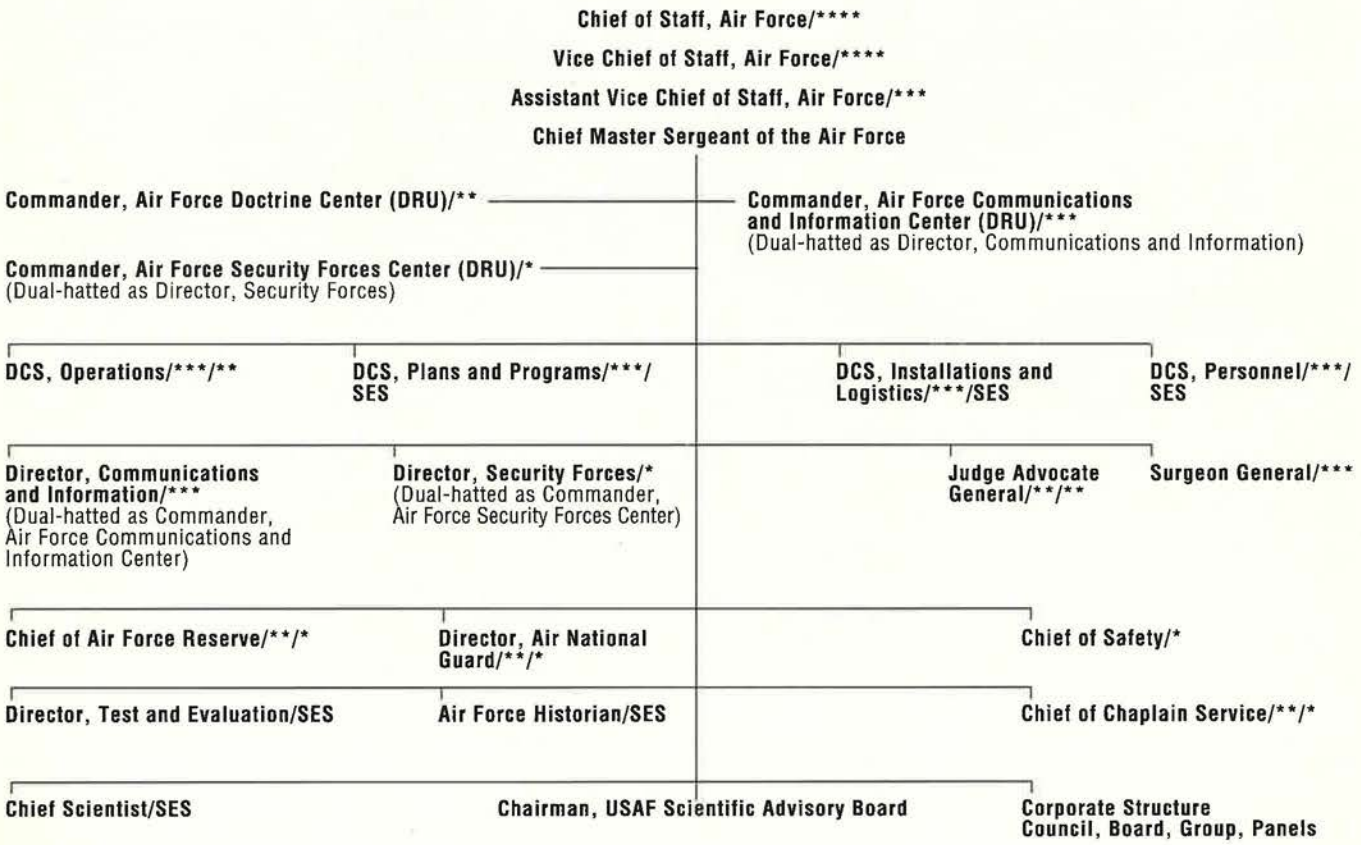
The new Security Forces directorate, charged with the responsibility for force protection, will oversee a new direct reporting unit, located at Lackland AFB, Tex. Air Force officials said the new DRU would focus on quick and effective responses to threats to airmen.

Changes also include moving the Air Force Doctrine Center from Langley AFB, Va., to Maxwell AFB, Ala., where it will become a DRU. The new Air Force Communications and Information Center, a DRU, will be set up in the Washington, D. C., area. ■

OLD STRUCTURE



NEW STRUCTURE



**** General's billet

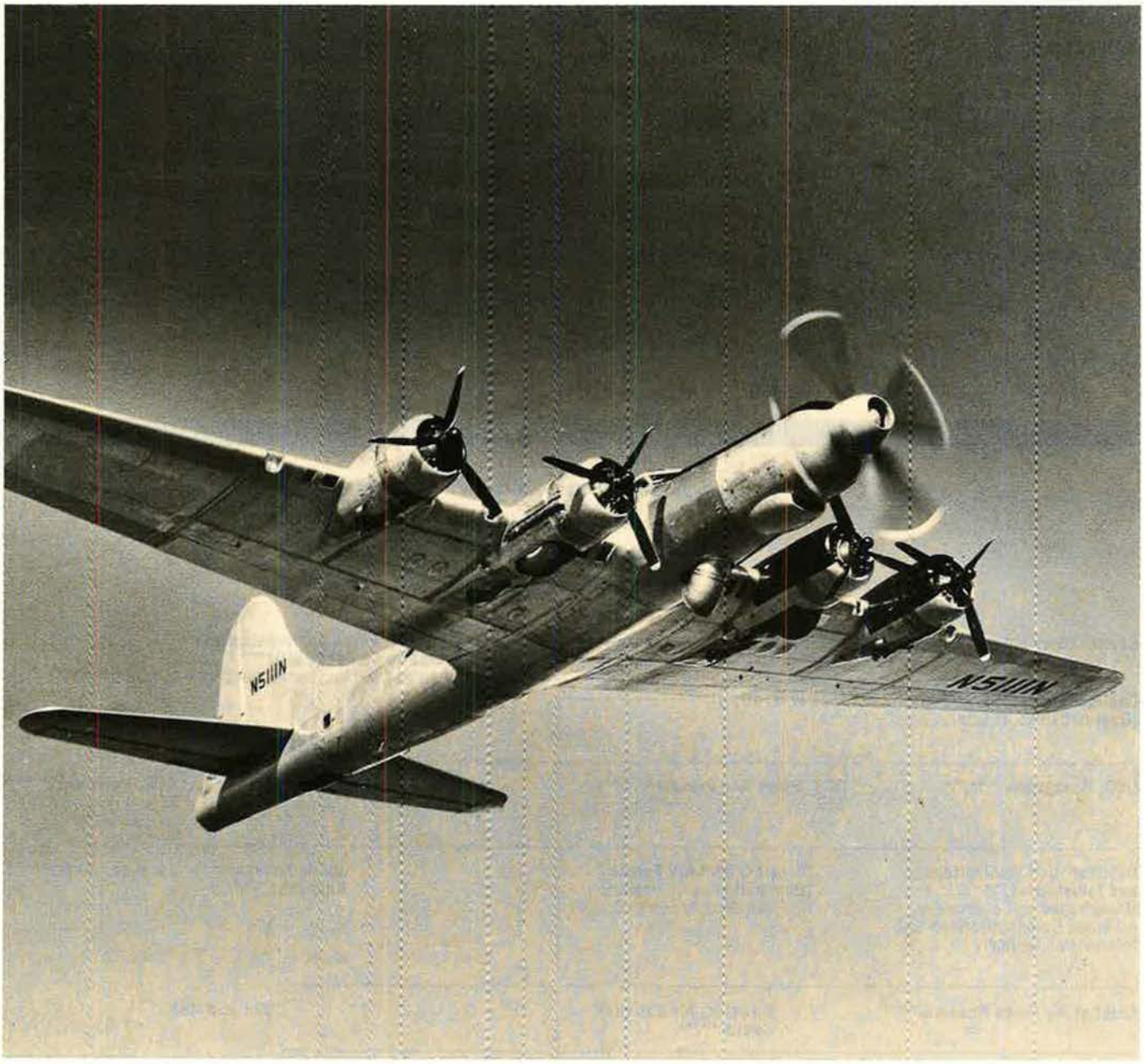
*** Lieutenant general's billet

** Major general's billet

* Brigadier general's billet

SES Senior Executive Service position

Four Feathered



In 1946, as engine manufacturers were developing turbojet and turboprop technology, Boeing drastically modified two B-17G Flying Fortresses as flying test-beds for the new engines. These airframes, model number 299-Z, had all military features removed, and the pilot's compartment was moved aft. The nose was modified to accommodate either the Wright XT-35 Typhoon or the Pratt & Whitney XT-34 turboprop engine where the bombardier and navigator stations had been. In flight, the B-17's standard engine propellers were feathered; the 5,700-horsepower turboprop XT-34, above, was more powerful than all four piston engines put together. Note the duct under the fuselage for jet exhaust.

Television coverage of defense reveals both preconceived attitudes and lapses in journalistic standards.

The Distorted World of Network News

By Stephen P. Aubin

IN THE 1980s, millions of Americans who tuned into the evening newscasts of "ABC World News Tonight," "CBS Evening News," and "NBC Nightly News" often saw US defense policies sketched in terms of weapons that did not work as advertised, corrupt contractors, outrageously high defense budgets, and provocative arms-control positions that threatened the "stability" of the superpower nuclear standoff.

All of these points were at least highly debatable. Some were flat untrue. They were, however, continually emphasized in network news reports while other aspects of the complicated defense debate went largely ignored.

Network correspondents and producers seemed incapable of capturing the normal ups and downs of a 12- to 15-year-long weapon development process in 90 seconds of airtime but had no trouble putting together a report on a failed weapons test. Industry scandals were deemed to be more "newsworthy" than "dull" stories about corporate successes. News about defense budgets made the cut when an administration was fighting to increase it

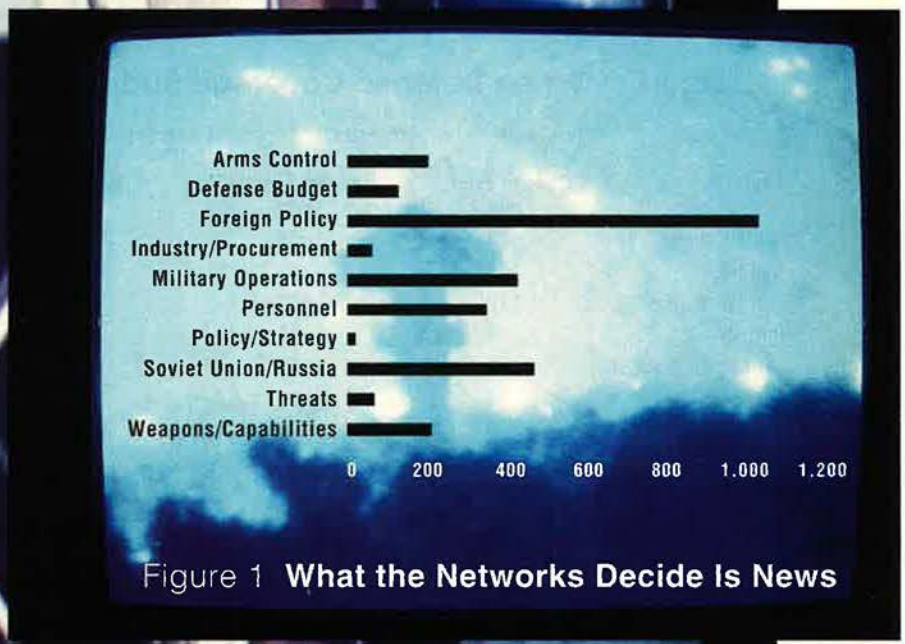


Figure 1 **What the Networks Decide Is News**

A breakdown of 2,947 individual news reports from sample periods in 1983, 1985, 1990, 1991, and 1994 indicates that the networks' evening newscasts favor foreign policy news and give short shrift to such important defense topics as the budget, industry, policy, and strategy.

but not when Congress was slashing it.

Network news reporting of nuclear arms-control developments was similarly selective, slanting heavily toward the precepts and conclusions of Washington's arms-control establishment. Short shrift was given to those with an opposing view—the skeptics who saw fundamental flaws in past arms-control agreements and argued that they locked the US into an inferior strategic position. These critics were dismissed as "obstructionists" or "hard-liners."

In short, the public in the 1980s received a distorted picture of important defense policies and even some controversial foreign policies, such as the Reagan Administration's approach toward Central America.

Dissecting National Security News

The Reagan defense buildup (which actually began toward the end of the Carter Administration) involved billions of dollars in budget increases. Certainly, no one argued that a government enterprise of such magnitude could or should have been declared off-limits to media scrutiny. However, a detailed examination of the record over the years shows that the fairness, accuracy, and objectivity of network defense reporting fell well short of minimum requirements, even by the networks' own standards.

These are the conclusions that emerged from a lengthy analysis, conducted by the author, of evening newscasts during January–April periods in the four sample years of 1983, 1985, 1990, and 1994. Also included in the analysis was the period of the Persian Gulf War in January and February 1991. The inescapable conclusion is that network defense coverage was routinely distorted by serious problems of context and balance. By contrast, most foreign policy coverage was relatively neutral. The big exception, however, concerned the Reagan Administration's controversial policies toward Nicaragua and El Salvador.

The analysis used full-text transcripts of individual national security news reports from each of the network's evening newscasts. On the most basic level, reports were catalogued by anchor, beat, correspondent, length, and date. On a more subjective level, topics were assigned, a summary of overall content was annotated, and problems related to journalistic standards were identified. If no such problems were found, the report was coded as "neutral." If any problems were identified, the report was coded as "problematic" and the problems were described.

It was important to try to impose some consistency on the subjective process of determining problems. For this purpose, the study used a set of questions based on standards outlined in the Society of Professional Journalists' Code of Ethics.

Topics assigned included arms control, defense budget, foreign policy, industry, military operations, personnel, policy and strategy, procurement, Soviet Union/Russia, threats, the Strategic Defense Initiative (SDI), and weapons and capabilities.

Overall, 2,947 individual news reports (or items) were included in this sample of 18 months' worth of evening newscasts. A "news report" was defined in three ways:

- As a segment delivered by the anchor alone (the anchor tell).
- As a segment in which the anchor introduced one correspondent.
- As a segment in which the anchor introduced more than one correspondent up front, followed by their back-to-back reports.

By comparing network approaches to various national security topics over time and across administrations with similar and dissimilar policies, several patterns of news coverage emerged.

Coverage by the Numbers

What did Americans see on the networks' evening newscasts during these periods in the 1980s and early 1990s? On a day-to-day basis, foreign policy news dominated national security reporting. Along the same lines, but often with a defense component added, there was a heavy dose of reporting on the Soviet Union and, after the USSR collapsed, Russia.

Defense topics, such as the struggle

Figure 2 **When Defense Coverage Suddenly Fades**

(Number of Reports by Primary Topic and Administration)

Topic	Reagan First Term	Reagan Second Term	Bush	Clinton
Arms Control	128	56	17	0
Budget	63	29	26	0
Foreign Policy	215	173	192	359
Industry	4	31	8	6
Military Operations	72	50	37	53
Personnel	64	75	77	108
Policy/Strategy	8	2	1	0
Procurement	1	5	4	2
SDI	3	13	4	0
Soviet Union/Russia	93	108	232	30
Threats	0	10	21	32
Weapons/Capabilities	62	67	29	11

As the actual number of reports suggests, some topics disappeared from network coverage in the Clinton period that was analyzed. For example, the defense budget was treated as "news" when the Reagan Administration was seeking substantial increases but was not when the Clinton Administration was cutting it.

Figure 3 **Defense Attracts the Networks' Weakest Reporting**

(Problematic Reporting by Primary Topic and Administration)

Topic	Reagan First Term	Reagan Second Term	Bush	Clinton
Arms Control	46.8%	37.5%	41.1%	n/a
Budget	71.4%	75.8%	80.7%	n/a
Foreign Policy	35.8%	47.9%	23.4%	11.4%
Industry	75.0%	100%	100%	66.6%
Military Operations	15.2%	50%	24.3%	43.4%
Personnel	24.2%	26.6%	38.9%	42.5%
Policy/Strategy	100%	50%	0%	n/a
Procurement	100%	80%	75%	100%
SDI	100%	61.5%	50%	n/a
Soviet Union/Russia	15%	25.9%	7.7%	13.3%
Threats	n/a	0%	4.7%	18.7%
Weapons/Capabilities	51.6%	47.7%	75.8%	72.7%

The percent of problematic reporting was most pronounced in key areas of defense coverage. These included arms control, the defense budget, industry, procurement, and weapons/capabilities.

over the defense budget or the weapons and capabilities the armed forces must rely on in war and peace, did not rate a lot of attention by the networks.

The range of issues covered during the two Reagan Administrations and the Bush Administration was similar, with reports on foreign policy dominating. Other areas that received attention included the Soviet Union, arms control, personnel-related issues, military operations, the defense budget, and weapons and capabilities.

During the Clinton Administration sample, foreign policy coverage dominated—almost to the exclusion of other areas of national security. In fact, no primary coverage of the defense budget, arms control, or policy and strategy occurred, and very little coverage of weapons and capabilities took place during the period sampled from the Clinton Administration.

Many changes in the patterns of coverage can, of course, be explained by external events. The highly charged Soviet-American arms-control negotiations in the Reagan years gave way to a more cooperative relationship with Russia in the latter Bush years and in the Clinton years. On the other hand, such topics as the defense budget and weapons development have a continuity about them. Why the networks chose to cover or ignore them revealed something about how the networks approached particular topics.

It was also important to determine the quality, and not just the quantity, of coverage related to each topic. Because the content of each news report was judged in qualitative terms and coded by topics, it was possible to evaluate each topic as a discrete "set" of news reports. Each set could also be viewed over select periods of time and be analyzed in a number of ways, from beat and correspondent to an individual network.

"Problematic" news reports fell into six broad areas:

- General lack of balance or context.
- Lack of context as a result of brevity.
- Lack of knowledge on the part of the correspondent.
- Overemphasis on drama or bad news at the expense of substance and context.
- "Loaded" labeling or advocacy.
- Bad news judgment.

Overall, the analysis of national security reporting in the 1980s and

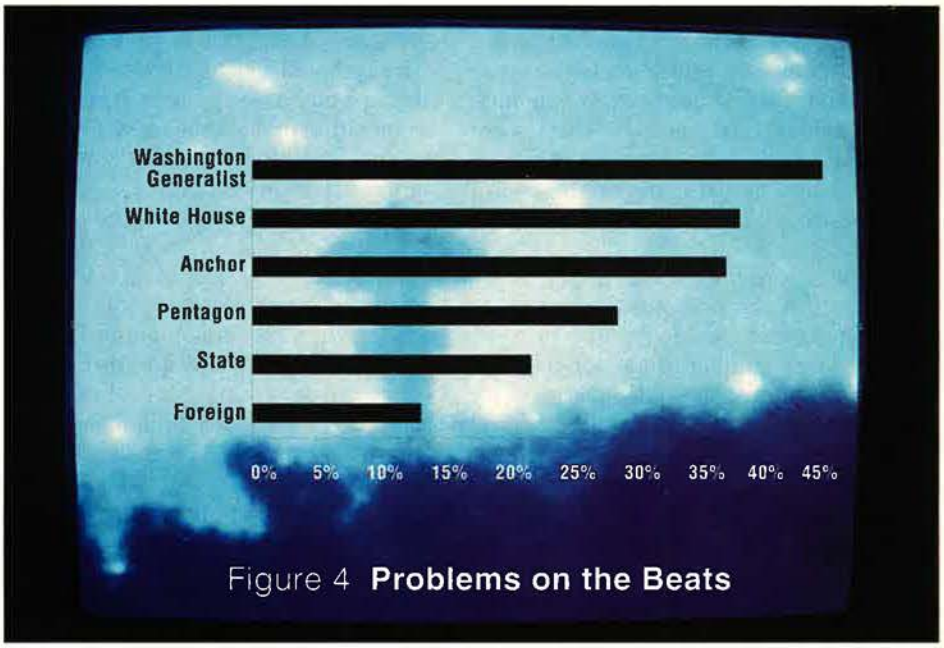


Figure 4 **Problems on the Beats**

Depicted above is the percentage of problematic coverage by beat. As might be expected, the Pentagon, State Department, and foreign correspondents are far more reliable in their coverage of national security topics than were the anchors, White House correspondents, and other general-assignment reporters.

early 1990s yielded good news and bad news. The good news: Network national security reporting was fairly informative, balanced, and in context about 70 percent of the time. Out of the 2,947 network news reports analyzed, only 886, or 30 percent, had basic problems related to journalistic standards.

The bad news is that, outside of general foreign policy coverage, in a number of key national security areas—ranging from arms control to the defense budget to developments related to defense industry and weapons—problems related to journalistic standards cropped up anywhere from 37 to 100 percent of the time.

To the extent coverage was inadequate or distorted, the reasons were fairly obvious:

The networks often allowed the attitudes of producers, correspondents, and anchors to surface in reports, creating problems in the areas of balance and context. When such attitudes were spotted, they were most often anti–defense spending, pro–arms control, negative toward new weapons technology, and anti-industry.

Decisions taken in the area of news selection and presentation often reflected these prevalent points of view. The large number of anchor-only reports devoted to national security coverage (29 percent of all national security coverage) often made it difficult, if not impossible, to present context when reporting on highly complex and often controversial areas of national security. Beat correspondents and producers with the most expertise in national security—at the Pentagon, the State Department, and on foreign beats—tended to report on national security less frequently as a group (46.2 percent of the time) than did White House correspondents, anchors, general-assignment reporters, and other Washington beat correspondents (53.6 percent of the time).

Hostility and Skepticism

That certain attitudes reflecting hostility or skepticism toward higher defense spending (and associated policies) were present in the 1980s is not terribly surprising. Americans have a long tradition of resistance to high military expenditures and to reliance on a professional military. The real problem of network defense coverage has less to do with American preferences than with lapses in journalistic standards.

From all indications, only certain aspects of important national security issues were covered adequately during the periods analyzed. In fact, a number of significant arguments and viewpoints were either downplayed, dismissed, or ignored entirely.

The main messages conveyed to the public during the 1980s—and, to some extent, in the early 1990s—tended to reinforce only certain sides of key defense issues. The conventional wisdom of network anchors, producers, and correspondents was also evident in the heavy reliance on certain sources, especially more-liberal Democrats and members of the arms-control establishment, who tended to have strong faith in the efficacy of negotiations as a means of strengthening US security. The unifying bond among these groups was opposition to the Reagan-Weinberger defense buildup and their "hard-line" approach to arms control.

With regard to the defense budget, the liberal view in Congress was that too much money was being directed at the armed forces at a time when tax and spending cuts threatened to cause the unraveling of social programs. Moreover, some conservative Republicans in Congress, concerned about the deficit, also were looking for a way to reduce defense expenditures. The networks covered both of these critical groups but most often echoed the liberal view.

New weapon purchases ran into trouble with both liberal Democrats and the conservative deficit hawks because they diverted resources from already squeezed social programs, in the one case, and deficit reduction in the other. Again, the first view was a regular refrain on the networks.

The arms-control establishment's view was that negotiation, rather than confrontation, was the best way to deal with the Soviet Union. Superpower relations, moreover, could be "managed" by skillful use of inducements. That, too, came across loud and clear on the networks.

Because SDI threatened this precept, it, too, was seen by the arms-control establishment as "destabilizing," technically infeasible, and too costly—points routinely favored in network reports.

Industry coverage was the most distorted, thanks to the practice by anchors of spooning out tidbits of news about scandal and corruption, which accounted for less than one percent of the day-to-day business that American industry conducted with the Defense Department. Overall, defense industry coverage presented a grotesque caricature of an industry that has consistently produced the most technologically advanced weapon systems in the world. Again, the liberal view tended to ascribe greed and corruption to business at large.

Most revealing of the networks' ideological mindset was coverage of Central America. Here the liberal-conservative lines stood out starkly. In the case of El Salvador, the liberal view was that the government was right-wing and murderous, while the left-wing guerrillas were noble and fighting for a good cause. Just the opposite was true of conservatives. They believed that the US could influence the Salvadoran government to move toward democracy and economic reform while the guerrillas threatened to destroy the democratic transformation.

Nicaragua was the mirror image. Conservatives viewed the Sandinista regime as repressive and Marxist, even Stalinist, and liberals thought the Sandinistas should be left alone to find their own path. The anti-Sandinista *contras,* on the other hand, were viewed as right-wing villains by liberals and "freedom fighters" by conservatives.

In both cases, the networks tilted toward the liberal view.

Out of Touch?

In a 1986 book, *The Media Elite,* Robert S. Lichter and his colleagues noted that journalists as a group tend to be more liberal than the public at large, and they tend to favor liberal sources—people who think as they do and people with whom they associate.

In Washington, D. C., that tendency is even stronger. A 1996 survey conducted by The Freedom Forum and the Roper Center found that 91 percent of 139 Washington reporters in the sample described themselves as "liberal" or "moderate."

Stephen Hess of the Brookings In-

stitution conducted similar surveys in the late 1970s. He found that 51 percent of Washington reporters saw a bias in the Washington news corps. Of that 51 percent, 96 percent characterized the bias as liberal. Mr. Lichter pointed out that, over the years, journalists have described themselves as liberal between 42 to 55 percent of the time and conservative between 17 and 21 percent of the time.

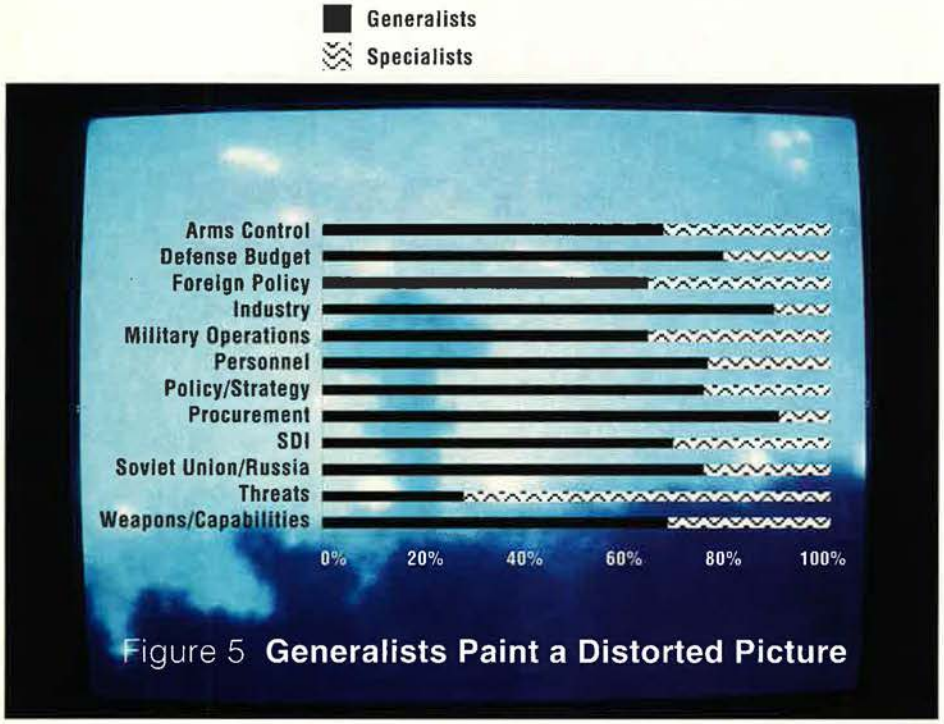


Figure 5 **Generalists Paint a Distorted Picture**

Television generalists, such as anchors, White House correspondents, and general-assignment reporters, are responsible for the majority of the problematic reports. The only exception to this rule concerns reporting on "threats," where generalists appear to have done a better job than the specialists.

It also appears that national reporters have lost touch with working class society. According to a 1992 report by David Weaver and G. Cleveland Wilhoit, journalists who work at the networks and the major newspapers are better educated than the average citizen and are better paid, factors that regularly produce charges of elitism.

Another aspect of the attitude of the media in the early 1980s reflected lingering memories of the Vietnam War. While New York *Times* reporter Hedrick Smith was portraying the public's choice of Ronald Reagan in 1980 as the first step in overcoming what was dubbed the "Vietnam syndrome," network correspondents and producers appeared to be preoccupied by Vietnam. Regular references to Vietnam in coverage of Central America were just one manifestation of the networks' continuing obsession with the war in Southeast Asia.

Network views on defense spending were also out of touch with prevailing public attitudes of the early 1980s. In reality, the Reagan defense buildup resulted from a public consensus *in favor of* increased defense spending, a consensus that began to emerge toward the end of the Carter Administration but that seldom got mentioned or explored in network newscasts. To the contrary, Reagan's buildup, coupled with his Administration's early involvement in El Salvador, did not sit well in the House of Representatives, which had a strong liberal wing, or with the media, who had their own strong liberal inclinations.

What About the Next Time?

The analysis suggested seven steps that the networks can take now if the news divisions wish to have a better batting average in the politically charged areas of defense and foreign policy.

- Rely more on specialists when reporting on national security, whether the story emerges on Capitol Hill, from the defense industry, or from the federal bureaucracy. This seems so obvious that it is scary it has not been standard practice. *[See Figure 4, p. 51, and Figure 5, at left.]*
- Minimize—perhaps even eliminate—the currently large role of the White House beat reporter in defense coverage.
- Give special care to preparing the short anchor-tell spots—using more input from specialized beat reporters—because such spots are fraught with dangers of distortion, oversimplification, lack of context, and outright bias.
- Keep generalists away from the longer, investigative pieces on national security topics or, at a minimum, make them work with or for Pentagon or State Department correspondents and producers.
- Turn more frequently to the underutilized State Department correspondents and producers, instead of going to the White House, for areas of foreign policy and arms control.
- Maintain a healthy network of foreign bureaus to help develop expertise in foreign affairs.
- Resist the temptation to fly in poorly informed anchors to cover major international stories that could be better covered by foreign correspondents on the spot.

National security—and defense in particular—consumes an extraordinary amount of the nation's resources. In the 1980s and 1990s, the network newscasts did little to help inform the American public about how these resources were managed or what the nation received in return for trillions of dollars.

No wonder network correspondents and their viewers were surprised in the first days of the Gulf War. The US military went into action with "overpriced," "overly complex," high-tech weapons built by a "corrupt" industry and an "incompetent" Pentagon bureaucracy, and they worked brilliantly. ■

Stephen P. Aubin is the director of Communications for the Air Force Association. This article is based on research conducted while completing a Ph.D. in National Security Studies and Communications at Boston University.

Problems still exist, but patient satisfaction and other approval ratings are on the way up.

Turnaround at Veterans Affairs

By Bruce D. Callander

WHAT may prove to be a significant new factor in veterans' health care can be seen in the case of a retired US Army staff sergeant who thought he had run out of coverage options but who found one in an unexpected place.

When he retired in 1971, the sergeant, like many Air Force, Army, Navy, and Marine Corps retirees, had several ways to obtain health care. These included insurance from his civilian employer, space-available care at a military medical center, and, after 1977, the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS). Over the years, he used all three.

The retired staff sergeant developed serious medical problems in his late 60s. By that time, however, his health-care options seemed to have simply dried up. His home in Florida wasn't near a military medical facility, his former civilian employer no longer provided insurance coverage, and he had lost access to CHAMPUS when he became eligible for Medicare.

Even Medicare turned out to be beyond his means. Its system of deductibles and copayments, modest though they were, proved to be a heavy drain on his meager finances.

Then, a friend suggested he turn to the Department of Veterans Affairs (VA). The sergeant was skeptical. First, his health problems weren't related to military service. Second, he could not claim to be impoverished. He wasn't wealthy, but with his retired pay, a tiny mortgage-free home, and a small bank account, he was not indigent. He assumed he would not be eligible for VA health-care benefits.

He was wrong. He learned that the VA does not, in all cases, require

that disabilities be service-connected. It is true that, before the VA provides benefits for nonservice-related health conditions, it applies a "means test" to determine ability to pay. However, veterans are not required to fall below the poverty level to qualify. For 1996, the cutoff for a married veteran was $25,203 per year in household income and a combined income and net worth of less than $50,000. Moreover, the value of a veteran's permanent residence does not count in the VA's calculation of net worth.

The New Focus of Care

The retired sergeant relies on the VA Medical Center in Gainesville, Fla., for virtually all of his health-care needs, as do many older veterans in that area. Florida, long a magnet for seniors, now has some 1.7 million veterans, 42 percent of whom are over age 65. Other states with large veteran and retiree populations report similar figures.

Nancy Reissener, special assistant to the director of the Gainesville center, explained why such facilities are getting new attention from older vets, despite the availability of Medicare.

"Basic Medicare hospital insurance [Part A] is free," she said, "but it covers only inpatient hospital care, and patients still must pay some costs when they are hospitalized. To add physician care and outpatient coverage, seniors must sign up for additional medical insurance [Medicare Part B] and pay monthly premiums as well as copayments. Many older veterans just can't afford the costs and turn to us."

Those payments represent only a fraction of actual medical costs. However, for many older veterans on limited incomes, they can be prohibitive. In 1997, for example, patients under Medicare Part A must pay $760 for the first 60 days in hospital and $190 per day thereafter. Monthly premiums under Part B are $43.80, and patients must pay an annual deductible of $100, plus at least 20 percent of the approved physician fees. If doctors charge more than Medicare's approved rates, the additional amount becomes the patient's responsibility.

Older veterans unable to cope with such costs make up a major part of the VA's patient load and are likely to do so for some time. More than half of the 16 million Americans who served in World War II are alive and in their 70s or beyond. Large numbers of Korean War veterans are nearing the 65-year point, and a wave of Vietnam War veterans will enter the system in another decade or so. Officials predict that the total veteran population will begin to drop by 2002 but that the percentage of veterans over age 65 actually will continue to increase.

The demographic changes are occurring at a time when the requirements for VA care are being loosened. The Veterans' Health-Care Eligibility Reform Act of 1996, signed into law on October 9, made significant changes in eligibility for VA care. The new law simplifies the rules, for example, by making criteria for inpatient and outpatient care identical.

Two Categories

The legislation established two eligibility categories:

The first includes veterans to whom the VA must furnish needed hospital and outpatient care and may furnish nursing home care, consistent with Congressional appropriations. This group includes veterans receiving disability compensation payments; former prisoners of war and World War I veterans; veterans who were exposed to Agent Orange in Vietnam, environmental hazards in the Persian Gulf, or ionizing radiation; low-income veterans who do not have other special eligibility but whose income and net worth fall below a specified threshold based on means testing; and noncompensable service-connected veterans who need treatment for their service-connected disability.

The second category comprises veterans to whom the VA may furnish needed hospital, outpatient, or nursing home care, to the extent that sufficient resources and facilities are available, and only if the veteran agrees to pay the VA a copayment for the care. This group includes all veterans not on the first list—veterans without service-connected problems whose incomes and net worth are above the specified threshold based on means testing. This group also includes higher-income veterans with a zero percent service-connected disability rating who do not receive compensation and need care for a nonservice-connected disability.

Older persons with wartime service make up the bulk of the veteran population. However, younger members continue to complete their service by the tens of thousands each year and become veterans. At last count, more than 26 million Americans claimed to have had some time in service in the US armed forces. That total exceeds the population of every US city and all but one state. Including dependents and survivors, VA officials estimate, almost one-third of the nation's population is at least potentially eligible for benefits of some kind.

While the types of benefits range from disability pensions to low-cost home loans and educational entitlements, medical care remains the VA's most important and most visible activity.

Last year, the Gainesville VA Medical Center cared for some 9,500 inpatients and another 250,000 outpatients, and it is only one of 171 such centers in the United States. The VA operates 126 nursing homes, 35 domiciliaries, and more than 350 outpatient, community, and outreach clinics.

Basic health care for veterans long has been viewed as a government responsibility, but today, the department's concern extends into areas not envisioned in 1930, when it was set up as the Veterans Administration.

Recently, for example, it established a toll-free hot line (800-827-1000) for female veterans who have experienced sexual trauma while on active duty. The department also has become the nation's single largest source of direct care to AIDS and HIV-infected patients and does major research on the disease.

Praise and Laurels

The VA has won praise from some for its early response to conditions that the Pentagon has been slow to recognize as service-related. Recently, it published new regulations on compensation for veterans with prostate cancer and other conditions based on their exposure to Agent Orange in Vietnam. It also has proposed legislation that would allow it to provide medical care and other benefits to children of

Vietnam veterans who are born with spina bifida.

VA centers also are deeply involved in medical research projects. Last December, three VA physicians received Presidential recognition for their work, one in molecular genetics related to schizophrenia, another in the use of skin as the vehicle for gene therapy in various diseases, and the third in the treatment of tissue injury. The three work at medical centers in Tennessee, Connecticut, and California.

Additional services, new technology, research, and the rising costs of operating centers have put a strain on the VA's budget, however. To cope, the facilities are changing traditional ways of doing business. For example, many patients once would have been hospitalized for minor surgery; now these veterans are treated as ambulatory patients. At the Gainesville center, Ms. Reissener said, this change eased the demand on the center's 300 beds and reduced costs.

Despite the fact that millions of American veterans use its free and low-cost health-care services, the VA continues to suffer from image problems. VA centers still battle the perception that they are overcrowded, uncaring institutions with less-than-first-rate resources. One difficulty stems from the sheer magnitude of the work load. The Gainesville center, for example, serves more than 15 counties in north central Florida whose population includes more than 300,000 veterans. The center also accepts referrals from other parts of northern Florida and southern Georgia.

Because of its heavy patient load, Ms. Reissener conceded, the center has had complaints about long waits for appointments and care. Two years ago, however, the VA launched a program to streamline customer services. Improvements include features as simple as a toll-free telephone program at Gainesville that now lets patients make their initial contacts by phone. This relieves some of the obligation to drive to the center only to be told to come back later.

The center's aim, Ms. Reissener said, is to have medical personnel see scheduled patients as close to appointment times as possible and to have unscheduled patients examined by a nurse within 15 minutes and referred appropriately.

Ms. Reissener contended that the center's medical performance is comparable to that found in civilian institutions. One reason: its close affiliation with the University of Florida, also located in Gainesville. The center's professional staff members have dual status as faculty members at the university's Colleges of Medicine, Nursing, Dentistry, Pharmacy, and Health-Related Professions. Because the Gainesville center is a teaching hospital, it also trains medical students, interns, and residents. This is not uncommon in VA centers. Studies show that more than half the doctors in the US received some of their training at VA facilities.

State of the Art

Gainesville also has added a number of state-of-the-art resources to improve care. In late 1995, the center opened a new cardiovascular surgical intensive-care unit. At about the same time, it began using a magnetic resonance imaging unit funded jointly by the center and the university. The center also has a 90-bed nursing home, satellite clinics at Daytona Beach and Jacksonville, and research programs in such fields as cancer, geriatrics, cardiology, and alcoholism. Again, such facilities and programs are not unique to Gainesville. They are common throughout the system.

Patient surveys indicate that the efforts to improve service and expand facilities are paying off. At the Gainesville center, Ms. Reissener said, recent polls showed that more than 84 percent of users felt that VA care met their expectations. Studies among former users show similar approval rates.

Other medical centers claim high approval ratings as well. Overall, VA studies show, patient satisfaction rates have risen from 60 percent to 65 percent over the past two years. Approval ratings for other VA benefits show similar improvements.

If top VA officials have their way, the department's facilities may become busier in the future. The VA, like the Defense Department, proposed Medicare Subvention legislation to establish a pilot program under which certain veterans would have the option of using their Medicare benefits to obtain VA health care. The legislation would permit the VA to be reimbursed by the Department of Health and Human Services (HHS) for treatment costs.

The upshot of this change, said Secretary of Veterans Affairs Jesse Brown, would be to "expand the choices for many veterans, particularly some World War II and [Korean War] veterans, who would like to come to the VA but are unable to get care because of budget constraints and strict eligibility criteria."

It also means that the VA will be able to recover and retain the costs of the services it provides, the Secretary added.

Currently, veterans over age 65 may not use their Medicare benefits for this purpose. Though the VA is authorized to submit claims to insurance carriers to recover a portion of the cost of medical care provided to certain veterans, it cannot claim Medicare reimbursement.

The pilot program would be established at up to eight VA medical centers, or four VA medical centers and one Veterans Integrated Service Network. The sites would be determined by the Secretaries of Veterans Affairs and HHS.

Veterans participating in the project would still be subject to Medicare's regular copayments. Care for these patients would be funded by Medicare receipts, not VA appropriations.

Plans call for the pilot program to run for three years, with a possible two-year extension. VA and HHS will arrange for an outside evaluation of the program, with a first report submitted to Congress 18 months after the establishment of the project at the first site. A final report, due to Congress no later than three and one-half years after the project begins, will include recommendations on whether the program should be expanded and whether permanent authorization should be sought. ■

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, *serving as editor from 1972 to 1986. His most recent story for* Air Force *Magazine, "When Is a Major Not (Exactly) a Major?," appeared in the November 1996 issue.*

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Compiled by Wendy Alexis Peddrick, Editorial Associate

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DoD Senior Leadership

As of February 1, 1997

Compiled by Wendy Alexis Peddrick, Editorial Associate

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 of Defense

Secretary of Defense
William S. Cohen

Deputy Secretary of Defense
John P. White

ASD for Public Affairs
Kenneth H. Bacon

PDASD for Public Affairs
Clifford H. Bernath

DASD for Public Affairs (Information)
Capt. Michael W. Doubleday, USN

DASD for Public Affairs (Communications)
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Inspector General
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DASD for Legislative Affairs
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DASD for C^3
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DASD for C^3I Acquisition
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DASD for Intelligence & Security
PDASD for C^3I (Acting)
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Dennis Nagy

DASD for Plans & Resources
Belkis Leong-Hong

Personnel & Readiness

USD for Personnel & Readiness
Edwin Dorn

PDUSD for Personnel & Readiness Policy
Frederick F. Y. Pang

DUSD for Readiness
Louis C. Finch

ASD for Force Management Policy
Frederick F. Y. Pang

PDASD for Force Management Policy
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There's new interest in a reusable aerospace vehicle that could be anywhere on Earth in less than an hour.

The Spaceplane

By Suzann Chapman, Associate Editor

NASA and US industry are developing reusable launch vehicle technologies with an eye toward cutting costs and reestablishing US dominance in the field. The Air Force, however, has begun to envision RLV applications that go beyond pure space launch.

In May 1996, officials at Air Force Space Command and Air Force Materiel Command created a military spaceplane integrated concept team to capitalize on the NASA-led effort to produce an RLV demonstrator, the X-33. "The [AFSPC and AFMC] commanders asked us to look at what mission areas might be satisfied by this technology, at the timing, and then to establish a roadmap," said Brig. Gen. Herbert M. Ward, AFSPC director of Requirements, in a January interview. The team is not locked into one mission area—such as space operations, which covers satellite launch. Instead they envision applications across all space missions. Hence the use of the broader term "spaceplane."

The USAF team, which includes NASA and Air Combat Command personnel, developed a concept of operations last summer. It envisions aircraft-like operations with rapid turnaround time; operations to, through, and from space; multimission capability; and worldwide operations from continental US basing.

Over the past several months, AFSPC officials pulled together basic data about the history, critical technologies, and possible missions in a briefing called "Military Spaceplanes: The Future."

One key question for the team concerns whether a spaceplane could help US space forces conduct their tasks more efficiently and cheaper than they do today. The civil-commercial RLV effort is geared toward providing lower-cost, reliable, and fast-turnaround space transportation. That satisfies only one aspect of the US military space missions: launch.

The ability to perform space control—that is, ensuring safe passage of US satellites on orbit and denying an enemy the ability to use its satel-

lites against the US or its allies—does not exist today. Nor does the US possess any capability to apply force from space, other than with an ICBM, whose trajectory would take it through space before it plunged back to strike a target on Earth.

For that reason, the Air Force's team members are also looking at the potential of military spaceplanes to provide space control and force application from space, as well as to provide force enhancement, such as space surveillance, reconnaissance, warning, and communications.

A military spaceplane might take military payloads into orbit, deorbit payloads, or perform on-orbit maintenance. It might release a satellite in space, then come back into suborbit and fly around the globe once or twice to conduct communications support or bomb-damage assessment. It could take advantage of the high ground of space and, with operations closely resembling a conventional airplane's, fly over any region of the globe with impunity.

General Ward emphasized that he is not predisposed to a particular RLV concept. He said that no decisions had been made concerning whether the spaceplane should be manned or unmanned, employ vertical or horizontal takeoff, or be single-stage or multistage to orbit.

Early successes in NASA's current RLV effort, which since its inception has included participation by engineers from USAF's Phillips Lab at Kirtland AFB, N. M., spurred officials to formalize the operational concept team to ensure that they would be in a position to use those technologies when they matured. When that might be is another question that concerns the team members.

The concept team will try to answer these questions when it reports this spring. It will also try to determine what kind of investments to make in research and development or prototyping to develop that capability for the Defense Department. "One of our responsibilities is to go back to our commanders with the roadmap that says if this technology is mature then we can do the next step and these are the kinds of funds required," stated General Ward.

Not Really Déjà Vu

The spaceplane concept is not really new. In fact, the general idea has been around for more than 50 years. In 1944, two German scientists, Eugen Sanger and Irene Bredt, set down their prewar and postwar work into a concept for a hypersonic rocket-powered aircraft that could be boosted into orbit, then glide back to Earth—creating the term "boost glider." NASA officials credit the Sanger-Bredt work with directly influencing the shape of the first US spaceplane, the X-15, conceived in 1954. From it, USAF's Dyna-Soar X-20A, and the follow-on lifting bodies, the US developed technologies that led to the space shuttle.

However, today, the Air Force, NASA, and industry maintain that the technology for turning the original concept into reality now exists or is very close at hand.

Both the Air Force and the Navy collaborated with NASA on the X-15 program, which produced three vehicles for hypersonic aerodynamic research. In all, 199 flights took place from 1959 through 1968 in which the X-15s reached Mach 6.7 and an altitude of 354,200 feet.

The lifting bodies, such as the lightweight M2-F1 and heavyweight M2-F2, HL-10, and X-24A and B, were wingless vehicles designed to fly back to Earth from space and land like airplanes. Versions of these lifting bodies, both powered and unpowered, flew successfully from 1963 to 1975.

Probably the most recent US research effort was the high-profile USAF-NASA National Aerospace Plane (NASP), or X-30. Established at Wright-Patterson AFB, Ohio, in 1986, the NASP program heralded some of the same concepts now set forth by the spaceplane concept team. However, budget cuts forced the program's demise in 1994.

AFSPC officials point out that timing and technology separate NASP from the current spaceplane concept. The technology is more mature now than it was 10 years ago. They said the key also is to ensure that the system is affordable, as well as useful.

The US is not the only country interested in spaceplanes. Britain has developed several spaceplane concepts, some of which date to the 1950s. Japan began research into spaceplane technology in 1987. The European Space Agency had similar thoughts in mind when it designed its Hermes manned spaceplane.

NASA officials are so confident of RLV technology that they have already begun to discuss follow-ons to the X-33.

Today's RLVs

NASA began a three-pronged RLV program in 1994. The research effort includes technology demonstrations with the DC-XA, X-34, and X-33—each designed to demonstrate various technologies that could lead to a commercial RLV.

NASA and McDonnell Douglas upgraded the DC-X, a subsonic rocket flown eight times by Phillips Lab from 1993 to 1995. The DC-XA, Clipper Graham, made four successful flights demonstrating its vertical landing capability. However, testing ended July 31, 1996, when the vehicle toppled and exploded after its fourth flight.

The rocket tipped over, according to an incident investigation released January 7, because "a brake line on the helium pneumatic system for landing gear number two was not connected." NASA officials believe the four DC-XA test flights will aid RLV research but do not plan to build a follow-on DC-XB.

The second element of the RLV program features the X-34, a single-engine rocket with short wings and a small tail surface capable of flying at Mach 8 and an altitude of 250,000 feet. Orbital Sciences Corp. is developing the X-34, which will be carried aloft aboard OSC's L-1011 aircraft. It is scheduled to fly in 1998.

The final element is the larger, more powerful X-33 test vehicle, which will reach Mach 15 and altitudes of up to 50 miles. It will be half the size of but demonstrate all the technologies needed for a full-scale RLV. NASA selected Lockheed Martin to build the X-33, based on its lifting-body concept called VentureStar. It has a new aerospike engine and will launch vertically but land like an airplane. The first test flight for the X-33 single-stage-to-orbit vehicle is set for March 1999.

NASA officials stated last year that they are already working on technology beyond the X-33. They are looking at air-boosted rocket engines, currently under study, as well as the possibility for small two-stage vehicles. Unofficially dubbed "X-37," the effort would probably include two to four variants rather than one, as with X-34 and X-33. The only criteria, they said, is that they be reusable. ■

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Gallery of Russian Aerospace Weapons

By John W. R. Taylor

Attack Aircraft

Sukhoi Su-24M (NATO "Fencer-D")

Russia's primary theater attack aircraft, the variable-geometry Su-24M, is entering its fourteenth year of operational service. The number available to tactical strike elements of Russian Air Forces remains constant, at 367, but only 70 now serve with Naval Aviation, compared with 110 at the last count. Reconnaissance and ECM versions are described separately on p. 72.

The two crew members of the Su-24M have Zvezda K-36DM zero/zero ejection seats of the type that is standard on current Russian fighter and attack aircraft. Cockpit instrumentation is 1970s vintage, but efficient nav/attack and terrain-following radars make possible low-level flight at high speed at night or in adverse weather, to deliver ordnance within 180 ft of any target. Ability to carry a wide range of ASMs provides defense suppression and some hard-target kill potential. An in-flight refueling probe is standard, and the Su-24M can operate as a buddy tanker carrying an underbelly hose/reel pod.

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 49,163 lb, gross 87,235 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, on side-by-side zero/zero ejection seats.

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 17,857 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 330-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")

Several projects for Frogfoot replacements have been revealed during the past year, but the Su-25 in various forms is expected to continue in service into the twenty-first century. With its large wings and maximum speed of Mach 0.8, it might appear vulnerable in any contemporary combat area; yet Su-25s sent to the war in Afghanistan suffered only 23 losses, with eight pilots killed, in 60,000 sorties. One aircraft returned safely after more than 80 combat hits. All but two of 139 laser-guided ASMs launched in combat achieved direct hits.

Survivability was a key design requirement for the Su-25, enabling it 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 engines will run on any fuel likely to be found in a combat area, including MT gasoline and diesel oil.

Russian Air Forces have 179 Su-25s; Naval Aviation has 50. Versions in service:

Su-25 (Frogfoot-A). Basic single-seat close-support aircraft. Standard 9,039 lb thrust R-95Sh turbojets replaced by R-195s in late production aircraft. Operational since 1981.

Sukhoi Su-25T *(Yefim Gordon)*

Sukhoi Su-34 *(Yefim Gordon)*

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

Su-25UTG (G for *gak*, "hook") (Frogfoot-B). As Su-25UB but without weapons; ILS standard; 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 of the Fleet Kuznetsov*. Ten built; four based at Severomorsk, Kola Peninsula, for service on *Admiral Kuznetsov*.

Su-25BM (Frogfoot-A). Standard Su-25 with added underwing pylons for a Kometa towed target or PM-6 rocket-powered targets released for missile training by fighter pilots; R-195 engines; 50 built.

Su-25TM. See separate entry. *(Data for late-production Frogfoot-A.)*

Power Plant: two Soyuz/Gavrilov 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, on zero/zero ejection seat.

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-25ML (AS-10 "Karen"), and Kh-29L (AS-14 "Kedge") ASMs, SPPU-22 pods for 23-mm guns with twin barrels that pivot downward, 57-mm to 370-mm rockets, bombs, 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") self-protection AAMs.

Su-25TM

The three original development versions of this considerably upgraded "Frogfoot" derivative 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. Embodying lessons learned during action in Afghanistan, they were designed to take advantage of improved navigation and attack systems and new missiles in a dedicated antitank role. The first of them flew on August 17, 1984, and eight preseries **Su-25T**s followed from July 1990.

The Voskhod navigation system, with two digital computers and an inertial platform, permits flights to and from combat areas under largely automatic control. The Schkval subsystem in the widened nose comprises a TV, laser rangefinder and target designator, and laser missile homing system. The TV can be activated five miles from the target, after which target tracking to an accuracy of two feet, weapon selection, and release are automatic. Chaff/flare dispensers are installed in a large cylindrical housing at the base of the rudder. This housing also contains an infrared jammer, optimized against Stinger and Redeye frequencies, and a radar warning/emitter location system is standard. A Merkuriy centerline TV pod can be fitted for night operations, enabling a main battle tank to be identified over a distance of nearly two miles. This is replaced by podded Khod IR and Kopyo-25 radar for all-weather use on the **Su-25TM**, with the gun transferred to an underbelly position on the starboard side of a farther-offset nosewheel. No production order for the Russian Air Forces is yet considered necessary.

Power Plant: as for Su-25.

Dimensions: span 47 ft 7¾ in, length 50 ft 4½ in, height 17 ft 0¾ in.

Weight: gross 45,194 lb.

Performance: max speed at S/L Mach 0.77, ceiling 32,800 ft, T-O run 2,135 ft, landing run 2,465 ft, combat radius with 4,410 lb of weapons at S/L 248 miles, at height 391 miles.

Armament: one twin-barrel NNPU-8M 30-mm gun, with 200 rds. Ten underwing pylons for 9,612 lb of weapons, incl two eight-rd clusters of Vikhr M (AT-X-16) tube-launched ASMs able to penetrate 35 in of reactive armor, KAB-500 laser-guided bombs, Kh-25ML (AS-10 "Karen"), Kh-58 (AS-11 "Kilter"), and Kh-29L (AS-14 "Kedge") ASMs, and R-27R/RE (AA-10 "Alamo-A/C") or R-77 (AA-12 "Adder") AAMs.

Sukhoi Su-34

The Su-34 has top production priority for the Russian Air Forces in this period of budget stringency. It is a side-by-side two-seat attack aircraft, developed from the Su-27. The first preseries Su-34, built at Novosibirsk, flew December 18, 1993. Twelve production Su-34s are scheduled for completion by 1998, and the aim is to replace all Su-24s by 2002. The aircraft has a dielectric nose, wider than that of the Su-27, to house phased-array 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. There are no ventral fins. The twin-wheel 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 new, with smaller, tandem wheels. Titanium armor, 17 mm thick, protects the cockpit, which has multifunction displays.

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 twin cruciform brake-chutes and, at its tip, a rearward-facing radar. A retractable flight refueling probe is fitted under the port windshield.

Power Plant: two Saturn/Lyulka AL-31F turbofans; each 27,557 lb thrust with afterburning. (Two 28,220–30,865 lb thrust AL-35F turbofans in later aircraft.)

Dimensions: span 48 ft 2¾ in, length 82 ft 8 in, height 20 ft 4 in.

Weight: gross 97,800 lb.

Performance: max speed at height Mach 1.8, at S/L Mach 1.15, ceiling 65,000 ft, 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; 12 pylons for up to 17,635 lb of high-precision ASMs, KAB-500 laser-guided bombs; R-73 (AA-11 "Archer") and R-77 (AA-12 "Adder") AAMs.

Bombers and Maritime

Antonov An-72P/An-76 (NATO "Coaler")

Based on the airframe of the An-72 STOL transport, the An-72P/An-76 is intended for armed surveillance of coastal areas, within 230 miles of shore, in all-weather day/night conditions. Its 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. Bombs can be carried in the roof of the hold, above the rear loading 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. Russia ordered 20 An-76s, of which delivery is believed to have started in the late 1980s. *(Data generally as for An-72.)*

Weight: 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")

The basic **A-40** amphibian was designed to replace the Il-38 "May" and M-12 "Mail" in Russian Naval Aviation service, though not on a one-for-one basis. The first of two prototypes flew on December 8, 1986, and an initial series of 20 was ordered in 1992, but manufacture has been delayed by lack of funding. When equipped for ASW/surveillance/mine-laying duties, the A-40 would carry weapons and other stores in a 21 ft 4 in bay in the bottom of the hull aft of the step. Features would 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.

If manufacture is resumed, production aircraft will probably be completed as **Be-42** search-and-rescue amphibians, with all ASW equipment, the booster turbojets, and ESM deleted. Instead, the Be-42 would carry 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 could be carried, and there is room for up to 54 survivors. On-board equipment to combat hypothermia would be available, together with resuscitation and surgical equipment and medicines. *(Data for 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-38K booster turbojets, each 6,580 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: up to 14,330 lb of ASW torpedoes, ASMs, and other weapons.

Beriev M-12/Be-12/Be-14 Tchaika (NATO "Mail")

About 65 **M-12/Be-12** twin-turboprop amphibians remain in Naval Aviation service. They were built for overwater surveillance and antisubmarine duties within a 230-mile radius of shore bases, but some have been converted into **Be-14** search-and-rescue amphibians. All may be retired this year. *(Data for M-12.)*

Power Plant: two ZMKB Progress/Ivchenko AI-20M turboprops; each 4,190 ehp.

Dimensions: span 97 ft 11 in, length 98 ft 9 in, height on wheels 29 ft 10 in.

Weights: empty 54,013 lb, gross from land 79,365 lb, from water 77,160 lb.

Performance: max speed 294 mph, service ceiling 26,250 ft, max range 2,235 miles.

Accommodation: crew of four.

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.

Beriev A-40 Albatross ("Mermaid") *(Paul R. Dulfy)*

Tupolev Tu-22M-3 ("Backfire-C") with Su-27 escort *(Piotr Butowski)*

Tupolev Tu-142M ("Bear-F") *(Peter J. Cooper)*

Ilyushin Il-38 (NATO "May")

Thirty-six Il-38 intermediate-range, shore-based, anti-submarine/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, Berkut (NATO "Wet Eye") 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 8½ in, length 131 ft 10 in, height 33 ft 4½ in.

Weights: empty 78,263 lb, gross 145,500 lb.

Performance: max cruising speed 400 mph, patrol speed at 100–3,300 ft 199–248 mph, ceiling 36,000 ft, max range 4,660 miles, patrol endurance 10–13 hr.

Accommodation: normal crew of seven.

Armament and Operational Equipment: up to 18,520 lb of stores; typically 216 RGB-1 sonobuoys, 144 RGB-2 sonobuoys and two AT-1 torpedoes, 10 PLAB-250-120 depth bombs, or eight AMD-2-500 mines.

Sukhoi Su-32FN

First flown on December 28, 1994, this variant of the Su-34 is a coastal-based strike aircraft for defense against hostile submarines and surface ships by day and night in all weather. The example (with "45" painted on its fuselage) displayed at the last Paris Air Show was fifth in a succession of side-by-side two-seat airframes developed from the Su-27 ("Flanker"). They include the Su-27IB prototype ("42"), preseries Su-34 ("43"), and two static test airframes ("41" and "44"). Two more were under assembly in mid-1995, when the Su-32FN was stated to be in production to replace Su-24s of Russian Naval Aviation.

Details are generally as for the Su-34. Probably common to both types are the Su-32FN's "active artificial intelligence system to support the pilot in critical situations," smooth-flight system to damp turbulence in low-level flight at high speeds, liquid-crystal EFIS, and Sorbtsya active ECM jamming pods on the wingtips. Specialized equipment includes "Sea Snake" coherent maritime search radar, 72 sonobuoys, MAD, IIR, and laser rangefinder.

Dimensions: similar to Su-34.

Weight: gross 99,205 lb.

Armament: one 30-mm GSh-301 gun; total 17,635 lb stores on 10 pylons and wingtips can include six Kh-25M (AS-10 "Karen"), Kh-29 (AS-14 "Kedge"), or Kh-31P/A (AS-17 "Krypton"), three Kh-59M (AS-18 "Kazoo"), two Kh-35 (AS-20 "Kayak"), or one Kh-41 Moskit ASMs; bombs ranging from 34 AB-100s to three KAB-1500s; rockets from 120 S-8s to six laser-guided S-25Ls; and six R-73 (AA-11 "Archer"), or eight R-27 (AA-10 "Alamo") or R-77 (AA-12 "Adder") AAMs.

Sukhoi T-60S

The Sukhoi OKB is reported to be 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")

The Russian medium-range bomber force for attacking deep theater targets consists of 130 variable-geometry Tu-22Ms; Naval Aviation units also have 130. A high proportion of these forces are equipped with the Tu-22M-3, newer of the two bomber versions in service:

Tu-22M-2 (Backfire-B). Initial series production version, with 48,500 lb thrust NK-22 turbofans; operational from 1978. Wingsweep variable from 20° to 65°. Slightly inclined lateral engine air intakes, with large splitter plates. Armament included a Kh-22 (AS-4 "Kitchen") ASM or 46,300 lb of conventional bombs or mines. Two GSh-23 twin-barrel 23-mm guns in radar-directed tail mounting. Above-nose fairing replaces in-flight refueling probe that made possible strategic roles before SALT treaty restrictions. Production totaled 211.

Tu-22M-3 (Backfire-C). Advanced version with more powerful engines and wedge-type air intakes; strengthened wings for increased weapon load; upturned nosecone with no flight-refueling probe; improved avionics including INS, active and passive ECM, new radios, and electro-optical bombsights; and automated flight controls. First flown June 20, 1977, and deployed from 1981. Can carry up to three Kh-22s, or Kh-15P (AS-16 "Kickback") SRAMs. Single GSh-23M gun, with barrels one above the other and 4,000 rds/min rate of fire, in aerodynamically improved tail mounting. Production totalled 268.

Backfire is capable of performing high- or low-level

nuclear strike, conventional attack, and antiship missions. A further version is described in the "Reconnaissance, ECM, and Early Warning Aircraft" section. *(Data for Tu-22M-3.)*

Power Plant: two Samara/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 zero/zero 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. The Tu-22M-3 can also carry Kh-31A/P (AS-17 "Krypton") and Kh-35 (AS-20 "Kayak") ASMs. 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")

The prototype of this wholly unique turboprop aircraft flew on November 12, 1952, and crashed in the following year. Forty-four years later, the Russian strategic forces still have 31 Tu-95MS6 and 57 Tu-95MS16 missile carriers as the spearhead of their long-range bomber force; Naval Aviation has 82 maritime reconnaissance/ASW/"TACAMO equivalent" versions.

All aircraft with original Tu-95 airframes have been grounded or scrapped; the major current versions listed below utilize basic Tu-142 airframes, regardless of their designations:

Tu-142 (Bear-F). Antisubmarine aircraft; first flown July 1968; deployed by Naval Aviation 1972. Extensively redesigned by comparison with original Tu-95; more cambered wing airfoil, double-slotted flaps, and longer fuselage forward of the wings. Twelve-wheel main landing gear bogies, retracting into long fairings aft of inboard engine nacelles. Large underfuselage blister fairing for Berkut J-band surface-search radar; glazed nose with chin-mounted radome and superimposed in-flight refueling probe; MAD fairings on tailplane tips. Two stores bays for sonobuoys, torpedoes, and nuclear or conventional depth charges in rear fuselage; defensive armament reduced to tail turret only, containing two 23-mm NR-23 guns. Able to attack submarines 3,100 miles from its base. 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 radar deleted. Fewer protrusions.

Mod 2 (**Tu-142M-Z**): Entered service after Mod 3, with new avionics, including Korshun search system, and improved crew accommodation. Roof of flight deck raised. Angle of refueling probe lowered by 4°.

Mod 3 (**Tu-142M**): Improved avionics for earlier detection of low-noise submarines; more accurate INS; satellite data link to base; MAD boom transferred to fintip; fairings at tips of tailplane deleted. Observation blister on each side of rear fuselage deleted. Length over probe 174 ft 1½ in. First flown November 4, 1975.

Mod 4 (**Tu-142M-Z**): ECM thimble radome on nose; chin-mounted weather radar reintroduced, together with FLIR, radar altimeter, and com antennas in undernose fairing; ESM receiver and antennas under rear fuselage. Production ended 1992–93.

Most of 58 Bear-Fs in service are to Mod 3 or Mod 4 standard, with crew of 10. All versions of the Tu-142M can carry eight Kh-35 (AS-20 "Kayak") active radar homing antiship missiles in underwing pairs, and 450-mm ASW torpedoes, 533-mm ASV torpedoes, or depth charges internally.

Tu-95MS (Bear-H). Late-production bomber based on Tu-142 airframe, but fuselage shortened. Improved NK-12MA engines, with longer TBO; rating unchanged. Initial **Tu-95MS16** version carried six Kh-55 (AS-15A "Kent") long-range cruise missiles on an internal rotary launcher, two more under each wingroot and a cluster of three between each pair of engines, for a total of 16. All will be modified to **Tu-95MS6** final production standard, with the pylons for 10 underwing missiles removed to conform with SALT/START treaty limitations. Bear-H attained IOC in 1984. Features include a larger and deeper radome ("Clam Pipe") built into the nose and a small fintip IR warning receiver fairing. 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). Modified Tu-142M-Z airframe. 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 suspended-wire antenna, several kilometers long, under center-fuselage in weapons bay area. Undernose fairing as on Bear-F Mod 4. Fintip IR warning pod like that on Bear-Hs. Satcom dome aft of flight deck canopy. Entered service 1980; about 10 operational with the Northern and Pacific Fleets. *(Data for Tu-95MS.)*

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

Dimensions: span 164 ft 2 in, length 161 ft 2¼ in, height 43 ft 7¾ in.

Weights: empty 264,550 lb, gross 412,258 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.

Tupolev Tu-160 (NATO "Blackjack")

Flown for the first time on December 19, 1981, the Tu-160 is the heaviest and most powerful combat aircraft ever built but has a smaller radar cross section and lower aerodynamic drag than USAF's B-1. It is in no way a 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

Tupolev Tu-160 ("Blackjack") *(Yefim Gordon)*

MiG-29 ("Fulcrum-C") *(Yefim Gordon)*

large fences. The very long and sharply swept fixed root panel of each wing, and the engine installation, resemble those of the Tu-144 supersonic transport, one of which has been updated and hired as a supersonic research vehicle by NASA. Control is fly-by-wire, but the flight deck has no head-up display (HUD) or CRTs.

As well as being able to operate as a high-altitude standoff cruise missile carrier, the Tu-160 carries SRAMs for defense suppression during low-altitude penetration missions at transonic speed. An active jamming self-defense system is standard.

Deliveries to what was then the 184th Guards Bombing Regiment of the former Soviet Strategic Forces, at Pryluky in Ukraine, began in May 1987. Nineteen Tu-160s were still there in mid-1996. Their transfer to Russia is possible, but they have not flown since 1992 and would be difficult to restore to combat status. Meanwhile, the Russian Strategic Forces have only five operational Tu-160s, at Engels Heavy Bomber Base in Saratov Region.

Power Plant: four Samara NK-321 turbofans; each 50,925 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 260,140 lb, gross 606,260 lb.

Performance: max speed at high altitude Mach 2.05, nominal cruising speed 596 mph, ceiling 49,200 ft, T-O run 7,220 ft, landing run 5,250 ft, combat radius at Mach 1.5 1,240 miles, max unrefueled range 7,640 miles.

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

Armament: no guns; internal stowage for up to 88,185 lb of free-fall bombs, mines, or ASMs. Typically, two rotary launchers, in forward and rear weapons bays, for a total of 12 Kh-55 (AS-15B "Kent") ALCMs or 24 Kh-15P (AS-16 "Kickback") SRAMs.

Fighters

MiG 1-42

Intended originally as Russia's counterpart to USAF's F-22, the MiG 1-42 is a single-seat, twin-engine, and twin-fin fighter with multirole air-to-air and air-to-surface potential. It is a tailless delta, with foreplanes, and is designed to have thrust-vectoring engine nozzles to ensure optimum agility. 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 phased-array fire-control radar has been under development by Phazotron.

The 1-42 has a wingspan comparable with that of the Su-27 series, and new Saturn/Lyulka AL-41F turbofans, each rated at about 40,785 lb thrust with afterburning. Gross weight is reportedly in the 77,160-lb (35,000-kg) class. It will be able to cruise at supersonic speed without using afterburning. Flight testing of two completed prototypes has been delayed by funding problems, leading to suggestions that production of the 1-42 will be abandoned in favor of a less costly fighter.

MiG-29 (NATO "Fulcrum")

The basic MiG-29 is described by the commander of the Luftwaffe Wing that operates a single squadron as "the best of the best" for close combat but with limitations in other respects. Operational since early 1985, it is a twin-engine aircraft comparable in size to the US Navy's F/A-18A/B/C/D Hornet. Its N019 Sapfir-29 coherent pulse-Doppler look-down/shoot-down radar (search range 62 miles, tracking range 43 miles; ability to track 10 targets simultaneously and engage one) 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 operating, like all Russian interceptors, under ground control; but the MiG-29 has dual-role air combat/attack capability. About 433 are in service with Russian tactical air forces and 35 with naval forces. Current versions in service with Russian forces:

MiG-29 (Fulcrum-A). 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, each with 30 cartridges, in "fences" forward of dorsal tailfins. Airbrakes above and below rear fuselage. Max gross weight 40,785 lb, including 6,615 lb of weapons.

MiG-29UB (Fulcrum-B). Combat trainer. Second seat forward of the normal cockpit, under a continuous canopy, with periscope for rear occupant. No radar. Gun, IRST sensor, laser rangefinder, and underwing stores pylons retained.

MiG-29 (Fulcrum-C). Generally as Fulcrum-A but with deeply curved top fuselage aft of cockpit housing additional avionics, including active jammers. Internal fuel increased by 20 gallons. Optional external fuel tanks under wings and belly. Weapon load 6,615 lb.

MiG-29S (Fulcrum-C). Multistage upgrade of MiG-29 Fulcrum-C, with increased angle-of-attack range. Upgraded radar (N019M) can engage two targets simultaneously. Able to carry R-77 (AA-12 "Adder") AAMs or up to 8,820 lb of bombs, rockets, or cluster bombs. Approximately two squadrons only in Russian Air Forces.

MiG-29SM. As MiG-29S but with added capability to carry ASMs, including two Kh-29T/TE (AS-14 "Kedge") or Kh-31A/P (AS-17 "Krypton"), or four KAB-500KR TV-guided bombs. Gross weight 44,090 lb. First flown 1995.

Each new version has improved considerably the MiG-29's operational capability, with in-flight refueling, improved avionics, new radar and weapons available for export versions. There is also a greatly redesigned derivative:

MiG-29M. Not yet ordered for Russian use. Fly-by-wire controls and a "glass cockpit" with CRTs. First of six prototypes flown April 25, 1986; first flight with definitive 19,400 lb thrust RD-33K engines September 26, 1987. Movable lower air intake lips to increase mass flow on takeoff. New N010 Zhuk terrain-following and ground-mapping radar (able to engage four targets simultaneously) in larger-diameter radome, new IRST, added TV, and laser designator/marked-target seeker. Nose lengthened by approximately 7½ in. Higher canopy. Less curved dorsal spine, terminating in a "beaver-tail" structure that extends beyond the jet nozzles. New wing airfoil; bulged wingtips with fore and aft RWRs. Larger tailplane with dogtooth leading-edge. New aluminum-lithium center-section, without engine air louvers, containing additional fuel; eight underwing hardpoints, single large airbrake above rear fuselage. Larger, sharp-edged, repositioned wingroot leading-edge extensions, and modifications to extend aft center-of-gravity limit for relaxed stability make the MiG-29M more comfortable to fly, with increased permissible angle of attack, better maneuverability, and improved cruise efficiency. Max external stores load increased to 9,920 lb. Armament options include Kh-31A/P, Kh-29T, Kh-29L, and Kh-25ML ASMs and up to eight R-77 AAMs. Export designation **MiG-33.** Normal gross weight 37,037 lb. Performance as for MiG-29S, except range 1,242 miles on internal fuel, 1,988 miles with three external tanks. *(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 1.225, ceiling 59,055 ft, T-O run 820 ft, landing run 1,970 ft, range on internal fuel 888 miles, with external tanks 1,800 miles.

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

Armament: six close-range R-60T/MK (AA-8 "Aphid") AAMs, or four R-60T/MK 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 in attack role. One 30-mm GSh-301 gun in port wingroot leading-edge extension, with 150 rds.

MiG-31M ("Foxhound-B") with wingtip ECM pods *(Yefim Gordon)*

Sukhoi Su-30M *(Chris Sorensen/Messe Berlin)*

Sukhoi Su-33 *(Royal Air Force)*

MiG-31 (NATO "Foxhound")

The MiG-31 inherited little but its general configuration from the MiG-25 interceptor that it has superseded in the Russian Air Forces. The design requirement was for an all-altitude, all-weather, two-seat aircraft with advanced digital avionics. There was no need for higher redline speed than the MiG-25's Mach 2.83, but a longer range was specified, together with a redesigned airframe that would permit supersonic flight at low altitude. Mikoyan reduced the airframe's welded nickel steel content from 80 to 49 percent, with 16 percent titanium, 33 percent aluminum alloy, and two percent composites.

The first prototype flew September 16, 1975, and deliveries of the fully developed **MiG-31** (Foxhound-A) to operational regiments began seven years later. Its N007 Zaslon ("Flash Dance") fire-control 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. In typical Russian style, Foxhound can be guided automatically and can engage targets under ground control. Operational equipment includes a semiretractable IRST sensor, RWR, and active infrared and electronic countermeasures. 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 320 are deployed for home defense and 57 with tactical air forces.

Developed by means of six prototypes, since 1984, the **MiG-31M** (Foxhound-B) was intended to have an improved Zaslon-M radar, with a 55-in-diameter antenna, in a 3.5° downward-inclined nose, but this radar is reported to have been abandoned. The M model is identified by a one-piece rounded windshield, small side windows for the rear cockpit, a wider and deeper dorsal spine containing additional fuel, more rounded wingtips (except when carrying ECM jammer pods), smaller wing fences, taller fins with larger curved root extensions, modified and extended wingroot leading-edge extensions, a fully retractable IRST, upgraded engines with modified nozzles, a retractable flight refueling probe on the starboard side, and four new-type underwing pylons for R-77 (AA-12 "Adder") 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-37 AAMs in addition to the side-mounted R-33s. All systems are upgraded; digital flight controls and multifunction CRT cockpit displays are standard.

Some basic MiG-31s have been converted and others built as **MiG-31Bs**; these are compatible with R-37 missiles but retain basic radar. Under development is the **MiG-31BS,** a conversion of the basic MiG-31 with unchanged radar but provision for R-37 and R-77 AAMs. *(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 2.35 447 miles, at Mach 0.85 with external tanks 901 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.

MiG-35

This single-seat multirole fighter is expected to fly for the first time this year, as a relatively low-cost competitor or backup to the Su-37. Derived from the MiG-29M, it will have new wings with increased root chord and reduced tip chord, with no sweep on the trailing edge of the inner panels. RD-133 turbofans (each 18,660 lb thrust) will be located 3 ft farther aft to make room for 3,307 lb of additional fuel, with provision for thrust-vectoring nozzles. A Phazotron RP-35 electronically scanned phased-array radar, with 31.5-in aerial, will offer a detection range of 87 miles, with the ability to track 24 targets and engage four simultaneously. Weapons will include R-77 (AA-12 "Adder") AAMs, on 10 stations. More powerful RD-333 engines (each 22,030 lb thrust) and foreplanes are expected to be installed later.

Sukhoi Su-27 (NATO "Flanker")

The number of Su-27s operational in Russian Air Forces has increased dramatically since previous totals were given by Moscow: 325 now equip Russian air defense units; 136 others serve with tactical air forces, their duties including escort of attack aircraft on deep penetration missions. Current variants:

Su-27 (Flanker-B). Basic single-seat production version, first flown April 20, 1981; deliveries began in 1985. Square wingtips carry launchers for AAMs in Su-27P interceptor role, Sorbtsya ECM jammer pods in Su-27S 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, when additional air enters the ducts through louvers surrounding the intake. No composites, but extensive use of aluminum-lithium alloys and titanium in the airframe. Integrated fire-control system enables the NIIP N001 Myech ("Slot Back") 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 62 miles, can track 10 targets simultaneously and attack one. Provision for reconnaissance pack on centerline pylon. Chaff/flare dispensers in tailsting.

Su-27UB (Flanker-C). Tandem two-seat trainer with full combat capability, based on Flanker-B. Instructor in raised rear seat. Taller fin; height 20 ft 10¼ in.

Su-27PU and Su-27IB: see Su-30 and Su-32FN/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 50,705–72,750 lb.

Performance: max speed at height Mach 2.35, at S/L Mach 1.1, ceiling 59,055 ft, T-O run 1,475 ft, landing run 2,035 ft, combat radius 930 miles, max range 2,285 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, incl 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 8,818 lb of air-to-surface weapons, incl 550-lb and 1,100-lb bombs,

packs of 80-, 130-, and 250-mm rockets, cluster bombs, or 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 being built in two forms:

Su-30. Two-seat long-range interceptor for Russian home defense missions of 10 hours or more, with two in-flight refuelings, including group actions with four Su-27s. Only the Su-30 would operate its radar, to assign targets to the other aircraft by radio data link, while Su-27s maintained radar silence. Configuration similar to that of Su-27UB, with unstable aerodynamic characteristics and automatic control system. Able to carry bombs and rockets but not guided ASMs. New avionics: nav system based on Loran and Omega; N001 radar, with detection range of 50 miles, tracking range 34 miles, able to track 10 targets and engage two simultaneously. Flight refueling probe and buddy refueling standard. Deliveries to Savotsleyka advanced training base began in 1996.

Su-30M. As Su-30 but equipped for multirole operations, with high-precision guided weapons. Export **Su-30MKI** for India will eventually have foreplanes and thrust-vectoring jet nozzles. *(Data for Su-30M, except where indicated.)*

Dimensions: as Su-27, except height 20 ft 10¼ in.
Weights: empty 39,020 lb, normal gross 54,010 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: normal crew of two, on zero/zero ejection seats in tandem identical cockpits; rear seat raised.
Armament (Su-30): gun and AAMs as Su-27, plus R-77 (AA-12 "Adder") AAMs.
Armament (Su-30M): as Su-30 for air-to-air role. Up to 17,635 lb of stores on 12 hardpoints for ground-attack role, incl Kh-59M (AS-18 "Kazoo"), Kh-31A/P (AS-17 "Krypton"), and Kh-29L/T (AS-14 "Kedge") ASMs, bombs, KAB-500KR and KAB-1500KR TV-guided bombs and rockets.

Sukhoi Su-33

At least 10 Su-33s were based on the Russian Navy carrier *Admiral of the Fleet Kuznetzov* when it deployed temporarily to the Adriatic in late 1995. They were from the Severomorsk Regiment, based on the Kola Peninsula with the first 18 production Su-33s and some trials aircraft. They are single-seat air defense fighters, with antiship capability, developed via Su-27K prototypes. Their airframe differs from that of the Su-27 (Flanker-B) in having collectively movable foreplanes, folding outer wings and tailerons, strengthened landing gear with twin nosewheels, an added arrester hook, and navaids for maritime operations. The Su-27's flaperons are replaced by high-lift slotted flaps. 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. The IRST has a wider field of vision.

Power Plant: as Su-27.
Dimensions: span 48 ft 2¾ in, width wings folded 24 ft 3½ in, length 69 ft 6 in, height 19 ft 4¼ in.
Weight: gross 66,000 lb.
Performance: max speed at height Mach 2.165, ceiling 55,775 ft, 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.

Sukhoi Su-35

Known as the Su-27M to the Russian Air Forces, this advanced single-seat development of the basic "Flanker," with foreplanes, is designed to have quadruplex digital fly-by-wire controls. The first prototype flew June 28, 1988; 10 more prototype and preseries Su-35s followed, of which the last has thrust-vectoring nozzles and is serving as the prototype Su-37.

Compared with the Su-27, the airframe (with many carbonfiber components), power plant, and armament are all upgraded. The NIIP N011 primary radar is of an improved look-down/shoot-down type, with the ability to acquire fighter-size airborne targets at ranges up to 62 miles. Fifteen targets can be tracked, and four to six engaged, simultaneously. An N012 rearward-facing radar (range 2.5 miles) is fitted in the tailcone. A small external TV pod, new-type IRST, enhanced ECM with wingtip jammer pods, and RWR are standard. All combat flight phases are computerized; cockpit displays include three-color CRTs. Entry into Russian Air Forces service was scheduled for the second half of the 1990s but may be switched to the Su-37.

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 8¾ in, length 72 ft 10 in, height 20 ft 10¼ in.
Weights: empty 37,480 lb, gross 57,320–74,955 lb.
Performance: max speed at height Mach 2.35, at S/L Mach 1.14, 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.
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-73E (AA-11 "Archer"), and R-77 (AA-12 "Adder") AAMs. Optional air-to-surface weapons include Kh-25ML (AS-10 "Karen"), Kh-25MP (AS-12 "Kegler"), Kh-29T (AS-14 "Kedge"), Kh-31 (AS-17 "Krypton"), and Kh-59 (AS-18 "Kazoo") ASMs, S-25LD laser-guided rockets, S-25IRS IR-guided rockets, laser- and TV-guided bombs of up to 3,307 lb, KMGU cluster weapons, KAB-500 bombs, and rocket packs. Max external stores 17,635 lb.

Sukhoi Su-37

The star of the 1996 Farnborough Air Show was the eleventh Su-35 preseries aircraft, fitted with two-dimensional collective/differential thrust-vectoring engine nozzles as the prototype Su-37. Described as superagile, it demonstrated a maneuver known as a *Kulbit.* This involves pitching up rapidly beyond the vertical, through a tight 360° somersault within its own length, and pulling out to resume level flight with no height loss—one of several new tactics that could make this fighter a uniquely difficult target in air-to-air combat. The thrust vectoring that makes the maneuver possible is actuated automatically as an element of the fly-by-wire control system, with manual override. The cockpit controls are new, comprising an articulated sidestick controller and a fixed sidebar throttle with thumbswitch actuation. There are four Sextant Avionique liquid-crystal color multifunction displays and modified N011M radar.

Power Plant: two Saturn/Lyulka AL-37FU turbofans; each 31,970 lb thrust.
Weight: gross 56,590–74,960 lb.
Performance: speeds as Su-35, ceiling 61,700 ft, max range on internal fuel 2,050 miles, range with one in-flight refueling 4,040 miles.
Armament: as Su-35, plus R-37 and KS-172 AAMs, Kh-15P (AS-16 "Kickback") ARMs and Kh-65S ALCMs.

Helicopters

Kamov Ka-25 (NATO "Hormone")

About 75 Ka-25s remain in service with Russian Naval Aviation in four versions:

Ka-25B (Hormone-A). Ship-based ASW helicopter, with contrarotating three-blade rotors. Undernose search radar; racks for small stores on the starboard side of the fuselage. Dipping sonar in compartment at rear of cabin, or suspended MAD under tailboom.

Kamov Ka-25B ("Hormone-A") *(Swedish Air Force)*

Kamov Ka-31 *(Paul Jackson)*

Ka-25Ts (Hormone-B). Special electronics variant, to provide over-the-horizon target acquisition for cruise missiles carried by cruisers and destroyers on which Ka-25Ts helicopters are based. Larger undernose radome than that of Ka-25B, 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 Ka-25B.)*
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 and sonobuoys in underfuselage weapons bay.

Kamov Ka-27, Ka-29, Ka-31, and Ka-32 (NATO "Helix")

First flown in 1973, the military Helix serves in Russian Naval Aviation in the following forms:

Ka-27PL (Helix-A). ASW helicopter, with crew of three (pilot, tactical coordinator, ASW systems operator). Able to stow in small shipboard hangars with the contrarotating rotors folded. 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 two torpedoes, four depth charges, or other stores, internally stowed sonobuoys, chaff/flare dispensers, IFF, RWRs on nose and above tailplane, ESM "flower pot" above rear of engine bay fairing, forward of IR jamming pod, 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 on aircraft carriers, cruisers, destroyers, and frigates.

Ka-29 (Helix-B). Assault transport. Entered service in 1985. Nonretractable landing gear. Heavy armor on wider flight deck and engine bay. Flexibly mounted four-barrel 7.62-mm machine gun behind downward-articulated door on starboard side of nose, with 1,800 rds; primary radar in port side. Four pylons on outriggers carry two four-rd 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, with 250 rds. Undernose pods for missile guidance/terrain-following radar 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 50 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. Air-droppable dinghy packs in ventral stores bay; racks for marker floats.

Ka-31. Radar picket version, first flown in 1988 and shown on carrier *Admiral of the Fleet Kuznetsov* in August 1990. Crew of two. Large (64.5 sq ft) 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 (not always fitted). Two-piece air stair-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. Flight recorder in conical tailcone. No stores pylons, gun door, or armor. Endurance on station 2 hr 30 min at patrol speed of 62–75 mph at 11,500 ft; surveillance radius 62–93 miles for fighter-size targets, 155 miles for ships; up to 20 targets tracked simultaneously, with automatic data transmission to command center.

Ka-32A2. Twenty-five used by Moscow Militia. Seats for 11 passengers, two of whom can operate pintle-mounted guns in port rear doorway and starboard rear window. Hydraulic hoist; two sets of loudspeakers; searchlight under nose. Gross weight 28,000 lb.

Ka-32A7. Armed version for border and maritime economic zone patrol, first seen 1995. Osminog radar; large oblique camera; pairs of Kh-35 (AS-20 "Kayak")

antiship missiles, Kh-25 ASMs, 23-mm gun pods or 80-mm rocket pods under wings. Provision for 30-mm gun and two searchlights. Seats for 13 passengers in secondary roles. Gross weight 24,250 lb. *(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 24,250–27,775 lb.

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

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

Armament: see above.

Kamov Ka-50 (NATO "Hokum-A")

Nearly 15 years have elapsed since the prototype of this single-seat close-support helicopter was first flown, on July 27, 1982. There have been repeated suggestions that production is under way in the Progress plant at Arsenyev, but no more than 14 appear to have been built, including static test airframes.

The Ka-50 is intended to attack targets fast and low, with great agility, at close range. There are four computers to meet navigation, mission control, and display demands. Other equipment includes a laser marked-target seeker and rangefinder, but the intention is to rely on another aircraft to locate and designate targets.

Composite materials constitute 35 percent by weight of the structure, including the three-blade coaxial rotors. All canopy and windscreen panels are of heavy bulletproof glass, and the double-wall steel armor surrounding the cockpit 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 are separated by explosive charges and the cockpit roof opened; the pilot is then extracted by a large rocket. Alternatively, he can jettison the cabin doors and stores before rolling out of the cockpit sideways. All systems are configured to permit combat flying from an advanced base for at least two weeks without need for ground maintenance equipment.

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 242 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 1 hr 40 min to 4 hr.

Accommodation: pilot only.

Armament: one 30-mm 2A42 gun, with limited flexibility, on starboard side of fuselage, with 500 rds; four wing pylons for two six-rd clusters of Vikhr M (AT-X-16) laser-guided ASMs, up to four packs of 20 x 80-mm S-8 rockets, 23-mm gun pods, Kh-25MP (AS-12 "Kegler") ARMs, Igla B or R-73 (AA-11 "Archer") AAMs, or dispenser weapons.

Kamov Ka-52 (NATO "Hokum-B")

This side-by-side two-seat all-weather day/night combat and training version of the Ka-50 was scheduled to fly early this year. It differs in having a new and wider fuselage forward of the rotor mast, and more extensive operational equipment. The avionics, integrated by Sextant Avionique of France, include a Thomson-CSF FLIR, head-down display, nav/attack system, helmet-mounted displays, image intensifiers, and GPS receiver. The Samshit-E weapons control system includes Phazotron FH-01 MMW radar in a mast-mounted ball, and TV/laser/radar sensors in a chin fairing that has earned the Ka-52 the nickname "Alligator." The crew is provided with night vision goggles and full dual controls. One of the planned missions for the Ka-52 is to operate as lead aircraft for a formation of Ka-50s, with the weapon systems officer acting as helicopter group commander. *(Data generally as for Ka-50, except:)*

Power Plant: turboshafts uprated to 2,465 shp.

Weight: gross 22,925 lb.

Performance: hover ceiling 11,800 ft.

Armament: nose recessed on starboard side to improve field of fire of gun, now with 280 rds.

Mil Mi-6 (NATO "Hook")

Basic task of more than 200 Mi-6s in service with Russian armies is to haul guns, armor, vehicles, supplies, freight, or troops in combat areas in **Mi-6T** form; but some are equipped for command support roles (see Reconnaissance, ECM, and Early Warning Aircraft section). Russian Naval Aviation has 10 Mi-6s.

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. Versions as follows:

Mi-8T (Hip-C). Assault transport used by army support forces, carrying 24 troops or freight, loaded via rear clamshell doors and hook-on ramps. Twin rack for stores on each side of cabin, able to carry 64 x 57-mm rockets in four packs or other weapons. Estimated 1,520 in service with Russian armies, 70 with the Navy.

Mi-8MT and **Mi-8MTV:** See Mi-17.

Mi-8PS (Hip-C). Military VIP transport.

Mi-8VZPU (Hip-D). Airborne reserve command post; see p. 72.

Mi-8TB (Hip-E). Development of Hip-C, with emphasis on weapons for escort duties. One flexibly mounted 12.7-mm machine gun in nose, with 700 rds. 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. About 250 in service.

Mil Mi-6T ("Hook-A")
(John Fricker)

Mil Mi-8AMTS

Mi-8AMTS. Variant of Mi-17 series for flight in IMC. TV3-117VM turboshafts rated at 1,874 shp. Max payload 11,023 lb. Demonstrated at the 1996 Farnborough Air Show with thimble radar on nose, chin-mounted electro-optical pod, and armament of eight 9M114 (AT-6 "Spiral") missiles.

Mi-9 (Hip-G). See Mi-9 entry on p. 72.

Mi-17 (Hip-H). See Mi-17 entry below.

Mi-8SMV (Hip-J) and **Mi-8PPA** (Hip-K). ECM versions; see p. 72. *(Data for Mi-8T.)*

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 155 mph, ceiling 13,120 ft, range as personnel transport 264 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.

Russian Navy versions of the Mi-14 are:

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 chutes for 18 sonobuoys or signal flares, and a towed MAD "bird" stowed against the rear of the fuselage pod. One AT-1 ASW torpedo, APR-2 torpedo, eight depth charges, or nuclear depth charge in a weapons bay in the bottom of the hull. **Mi-14PLM** has updated equipment, including rescue basket.

Mi-14BT (Haze-B). Mine-countermeasures version. Long duct for hydraulic tubing, and air-conditioning pod, on starboard side of cabin. No MAD. Searchlight to observe towed 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 19 survivors in cabin, including two on litters; provision for towing many more in 10 20-place life rafts carried on board together with floating containers of survival equipment, including food, medicines, and clothes. Normal crew of three.

Russian Naval Aviation has 63 Mi-14PLs, plus around 25 other versions.

Power Plant: two Klimov TV3-117M 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 19,620 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 (NATO "Hip-H")

This derivative of the Mi-8 has more powerful TV3 engines in shorter nacelles. 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, a VMR-2 fit for air-dropping such loads as mines, chaff/flare dispensers, IRCM jammer, engine nozzle IR suppressors, and external armor plate on the cockpit sides.

A special-duty version is listed in the Reconnaissance, ECM, and Early Warning Aircraft section. All Mi-17s in Russian military service have 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 289–307 miles.

Accommodation and Armament: as for Mi-8 Hip-E.

Mil Mi-24 (NATO "Hind")

Six major versions of the Russian Army's standard gunship helicopter are currently operational:

Mi-24D (Hind-D). First observed 1977. Tandem stations for weapons operator (in nose) and pilot have individual canopies, with rear seat raised to give pilot an unobstructed forward view. Cabin to rear of pilot accommodates eight fully armed troops in assault transport role. Undernose turret for four-barrel Gatling-type 12.7-mm machine gun with 1,470 rds, slaved to adjacent electro-optical sight and providing air-to-air as well as air-to-surface capability. Four hardpoints under stub-wings for 32-rd packs of 57-mm rockets, 20-rd packs of 80-mm rockets, five-rd packs of 130-mm rockets, 240-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 300-rd 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 IR suppressors standard. **Mi-24DU** dual-control 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 eight 9M114 (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

gun (450 rds) 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.

Mi-24R (Hind-G1). Instead of wingtip weapon attachments, this version has "clutching hand" mechanisms for soil sampling, associated with nuclear, biological, and chemical (NBC) warfare, on lengthened pylons, with analysis equipment and data link console in the cabin. Other features include a bubble window on the starboard side and a small rearward-firing marker flare pack on the tailskid. The cockpits are hermetically sealed, and the crew of four wear NBC kits. No undernose electro-optical or RF guidance packs for antitank missiles, but underwing pylons are retained for rocket pods, external fuel tanks, or unidentified containers. This version is deployed six per helicopter regiment throughout ground forces.

Mi-24K (Hind-G2). As Mi-24R but with a large camera in the cabin, with the lens on the starboard side, for reconnaissance and artillery spotting. No target designator pod under nose.

Around 800 Mi-24s serve with Russian Armies. A few were modified for minesweeping duty in 1973, under the designation **Mi-24BMT.** A night-capable upgrade for current combat versions, designed to meet air mobility requirements of the Russian Army, has been exhibited on an **Mi-35M** demonstrator. Features can include Mi-28 rotors and transmission, more powerful engines, new avionics, FLIR, 23-mm twin-gun nose turret, and 9M114 (AT-6 "Spiral") or alternative ASMs. Empty weight is reduced to 17,747 lb, gross 24,030 lb. Service ceiling is 18,860 ft. *(Data for Mi-24P.)*

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

Dimensions: rotor diameter 56 ft 9¼ in, length excl rotors and gun 57 ft 5¼ in, height 21 ft 4 in.

Weights: empty 18,078 lb, gross 26,455 lb.

Performance: max speed 208 mph, ceiling 14,750 ft, range on internal fuel 310 miles, with auxiliary tanks 620 miles.

Accommodation: crew of two; flight mechanic, and provisions for eight troops or four litter patients in main cabin.

Armament: see individual model descriptions. Max external load 5,290 lb.

Mil Mi-26 (NATO "Halo")

Operational since 1983, the **Mi-26** is the heaviest production helicopter yet built anywhere in the world. It is immensely capable, with a payload and cargo hold similar in size to those of a C-130 Hercules, loading via clamshell doors and ramp at the rear of the cabin pod, and main landing gear legs that are adjustable individually in length to facilitate loading and permit landing on varying surfaces. However, its size makes it a tempting target in combat areas. So, although nearly 200 Mi-26s have been built at Rostov-on-Don for military and civil use by day and night, in all weather, only 35 are believed to be operated by the Russian Army. Infrared jammers, exhaust heat suppressors, and chaff/flare dispensers can be fitted. Under development is the uprated **Mi-26M** with more powerful ZMKB Progress D-127 engines (each approx 14,000 shp), all-composites rotor blades, and max payload of 55,115 lb for crane operations. The current **Mi-26TM** flying crane has a belly gondola for a pilot/sling supervisor, and an **Mi-26TZ** tanker version is projected.

Power Plant: two ZMKB Progress D-136 turboshafts; each 10,000 shp.

Dimensions: rotor diameter 105 ft 0 in, length of fuselage 110 ft 8 in, height to top of main rotor head 26 ft 8¾ in.

Weights: empty 62,170 lb, gross 123,450 lb.

Performance: max speed 183 mph, ceiling 15,100 ft, range with standard fuel 497 miles, with auxiliary tanks 1,190 miles.

Accommodation: crew of four; about 40 tip-up seats along side walls of hold; seats can be installed for total of 80 combat-equipped troops, plus four more passengers in compartment aft of flight deck, or litters for 60 casualties plus up to five attendants. Other loads incl two airborne infantry combat vehicles or a standard 44,100-lb ISO container.

Armament: none.

Mil Mi-28 (NATO "Havoc")

The **Mi-28** two-seat attack helicopter is Russia's counterpart of the US Army AH-64A Apache. It has been flying in prototype and preseries forms since November 1982, but production continues to be delayed by lack of funding. Emphasis was placed on survivability. The cockpits have armored glass transparencies and are protected by titanium and ceramic armor. Energy-absorbing seats and landing gear are designed to protect the crew in a 40 ft/sec vertical crash landing. Escape by parachute would be facilitated by a system that blasts away the doors and stub-wings (but not the main rotor) in an emergency. A door aft of the port stub-wing gives access to a compartment large enough to enable the crew to land and pick up two or three persons in a combat rescue situation.

The 30-mm 2A42 turret-mounted gun is identical to that on many CIS Army ground vehicles and uses the same ammunition. It is fired by the navigator/gunner in the front cockpit, together with the aircraft's guided and unguided weapons. The pilot would normally fire only unguided weapons but can also fire the gun if it is fixed. The autopilot provides autohover, autostabilization, and hover/heading hold lock for stabilized weapon firing. Operational equipment includes a swiveling and gyrostabilized undernose platform for a daylight optical sight, TV, and laser rangefinder. A pod on each wingtip houses chaff/flare dispensers and sensors, probably RWR.

Further development and manufacture are likely to concentrate on the **Mi-28N** variant with night/all-weather capability. Existing in prototype form, this has 360° scan mast-mounted MMW radar, a FLIR ball, and LLLTV. Its armament can include Igla (SA-16 "Gimlet") AAMs. *(Data for basic Mi-28.)*

Power Plant: two Klimov TV3-117VM turboshafts; each 2,070 shp (2,465 shp in Mi-28N).

Dimensions: rotor diameter 56 ft 5 in, length excl rotors 55 ft 9¾ in, height overall 15 ft 5 in.

Weights: empty 17,846 lb, gross 25,705 lb.

Performance: max speed 186 mph, ceiling 19,025 ft, max range 285 miles.

Accommodation: crew of two, in tandem.

Armament: one 30-mm 2A42 gun, with 250 rds, in undernose turret. Four underwing pylons for 4,230 lb of stores, typically two UB-20 pods of 20 x 80-mm or 130-mm rockets and total of 16 9M114 Shturm (AT-6 "Spiral") antitank missiles. Missile guidance equipment in thimble radome on nose.

Antonov An-12PPS ("Cub-D")
(David Stephens)

Beriev A-50 ("Mainstay") with Su-27
(Piotr Butowski)

Ilyushin Il-87 ("Maxdome")
(Sebastian Zacharias)

Reconnaissance, ECM, and Early Warning Aircraft

Antonov An-12 (NATO "Cub-A, B, C, and D")

Four variants of this veteran four-turboprop transport were produced for special duties:

Cub-A. Elint version. Generally similar to basic An-12BP transport but with blade antennas on front fuselage, aft of flight deck, and other changes.

An-12BK (Cub-B). Conversion of Cub transport for elint missions. Two additional radomes under the forward- and center-fuselage, plus other antennas.

An-12PP (Cub-C). ECM variant carrying several tons of electrical generation, distribution, and control gear in the cabin and palletized jammers for at least five wavebands faired into the belly, plus chaff/flare dispensers. Glazed nose and undernose radar of transport retained. An ogival "solid" fuselage tailcone, housing jamming equipment, is fitted in place of the usual gun position.

An-12PPS (Cub-D). Further ECM variant for active countermeasures, with pods on each side of front-fuselage and tailfin.

The Russian Air Forces have 125 reconnaissance/ECM Cubs; Naval Aviation has seven Cub-Cs and Ds.

Antonov An-26RTR (NATO "Curl-B")

The An-26RTR sigint version of the An-26 transport can be identified by many short blade antennas above and below the fuselage. About 100 serve with Russian Air Forces.

Antonov An-72

An An-72 has been observed at Akhtubinsk Test Center with what is reported to be a large flat side-looking airborne radar panel built into each side of its upswept rear fuselage. The purpose is possibly stand-off battlefield surveillance.

Beriev A-50 (NATO "Mainstay")

This AEW&C version of the Il-76 "Candid" transport is produced by the Beriev OKB. Sixteen **A-50s** operate with MiG-29, MiG-31, and Su-27 counterair fighters of the Russian home defense force and tactical air forces, mainly in the northwestern TVD centered on the Kola Peninsula. Mainstay's configuration is conventional, with a 29 ft 6 in diameter pylon-mounted rotating "saucer" radome, satellite nav/com, a new IFF system, RWR, comprehensive ECM, and flight refueling probe. A crew of 15 is carried. The Il-76's nose glazing around the navigator's station is replaced by nontransparent fairings, and a hemispherical dielectric fairing replaces the rear gun turret. The rear ramp and cargo fittings are also deleted. The radar observers have color CRT displays.

The A-50 normally operates on a figure-eight course at 33,000 ft, with 62 miles between orbit centers, to detect and track aircraft and cruise missiles flying at high or low altitude over land and water.

An improved version, designated **A-50U,** was first seen at the 1995 Moscow Air Show. Enhanced performance is provided by the Vega Shmel-M radar system that includes a passive mode to detect hostile ECM sources without transmission-induced vulnerability, a computer-based three-dimensional pulse-Doppler radar, and a digital subsystem that gives the altitude of all moving targets. Search radius is 143 miles for small aircraft, 248 miles for ships. Up to 50 targets can be tracked and interception of 10 guided simultaneously. The A-50U was said to be entering service with capabilities equivalent to those of USAF's E-3C Sentry. Max gross weight is 418,870 lb; endurance four hours 620 miles from base.

Ilyushin Il-22 (NATO "Coot-B")

In its best-known form, this airborne command post conversion of the Il-18 airframe has a bullet-shaped pod on the fintip, a long and shallow container under the front fuselage, and many small blade antennas above and below the fuselage. The electronics and their fairings vary from one aircraft to another. About 20 are in Russian Air Forces service. (The Navy's Il-20DSR "Coot-A" elint/sigint/reconnaissance aircraft is no longer operational.)

Ilyushin Il-76VPK (Il-82?)

Two examples of this civil-registered special-mission version of the Il-76MD were first seen at Zhukovsky Flight Test Center in 1992. They are now used as communications relay aircraft for Il-87 command posts, with the reported service designation **Il-82.** Each has a

large fairing above the fuselage forward of the wing over satcom/IR equipment; a ventral canoe-shaped radome and strakes; five small antennas above the center-section; other small antennas and air intake scoops under the front fuselage and at the rear of the main landing gear fairings; a long, shallow fairing forward of the dorsal fin on each side at the top of the fuselage; a large, downward-inclined, flat-plate antenna on each side of the tailcone; and a long, pod-mounted probe on a pylon under each outer wing. Two AI-24 turbines are housed in the landing gear fairings to supply power for the mission avionics. The usual nose glazing around the navigator's compartment has been deleted, and the flight deck rear side windows are covered. The basket-drogue of a VLF trailing-wire antenna can be seen under the rear fuselage.

Ilyushin Il-87 (NATO "Maxdome")

Four special-mission versions of the Il-86 transport were observed at Zhukovsky Flight Test Center in 1992 with modifications similar to those seen on the Il-76VPK. They are now known to be strategic command posts, for use by Russian General Staff, with the reported service designation Il-87 Aimak. Each has a large boat-shaped fairing above the front fuselage, as well as a shallow dished fairing forward of the fin root, strake antenna under the rear fuselage, large blade antennas above the center- and rear fuselage and under the front fuselage, and large turbine-powered electric generator pods with a ram air intake under the wings inboard of the inner engines. A drogue for a VLF trailing-wire antenna is mounted on the lower fuselage on the port side.

Power Plant: four Samara NK-86 turbofans; each 29,320 lb thrust.

Dimensions: span 157 ft 8¼ in, length 195 ft 4 in, height 51 ft 10½ in.

Performance (as transport): normal cruising speed at 30,000–36,000 ft 559–590 mph, nominal range with max fuel 2,858 miles.

MiG-25BM (NATO "Foxbat-F")

MiG-25 interceptors have been replaced by MiG-31s in the Russian Air Forces; but about 40 ECM and reconnaissance versions of Foxbat remain in service.

The MiG-25BM (Foxbat-F) is a defense-suppression aircraft produced in 1982–85. Its airframe is generally similar to that of the MiG-25RB but with a dielectric panel for ECM aft of the radome on each side of a 2 ft 4½ in longer nose. There is a small blister each side at the rear of the radome and a dielectric panel on the nose of each outboard weapon pylon. A 1,400-gallon underbelly fuel tank can be fitted. Four Kh-58 (AS-11 "Kilter") antiradiation missiles are carried to attack SAM sites over standoff ranges. *(Data generally as for MiG-25R.)*

MiG-25R (NATO "Foxbat-B and D")

The MiG-25R is a single-seat reconnaissance aircraft, fitted with an automatic bombing system that makes possible all-weather, day and night precision attacks at supersonic speed and from heights above 65,600 ft, against targets whose geographic coordinates are known. No gun or AAMs for self-defense are carried because the aircraft's high speed and ceiling, and ECM, were considered adequate to ensure survival when it was designed. Its basic navigation system is an inertial type, updated by Doppler. The following variants were produced:

MiG-25RB series (Foxbat-B). Carries any one of three interchangeable reconnaissance/elint packs in its nose, offering combinations of cameras and SLAR. Later subtypes were **MiG-25RBV** and **MiG-25RBT**, with new Virazh SLAR and Tangazh elint, respectively. Foxbat-B can be identified by its five camera windows. All reconnaissance Foxbats also have large dielectric panels for the SLAR on the sides of the nose.

MiG-25RU (Foxbat-C). Training version of the MiG-25R, with separate cockpit for instructor, under individual canopy, forward of standard cockpit and at lower level. No reconnaissance sensors or combat capability. Limited to Mach 2.65.

MiG-25RBK series (Foxbat-D). Produced simultaneously with RB series in 1971–80. Modules contain different elint systems, including Kub SLAR, and no cameras, requiring no camera windows. **MiG-25RBS** had different sensors, and all RBSs were upgraded to **MiG-25RBSh** standard, with Shompol SLAR, from 1981. The **MiG-25RBF** is an updated RB, to RBK standard but retaining cameras and with Shar elint replacing Kub.

All versions have a generally similar specification, two 24,675 lb thrust R-15BD-300 engines, 4,665 gallons of internal fuel, and provision for a 1,400-gallon underbelly tank.

Dimensions: span 43 ft 10¾ in, length 70 ft 8½ in, height 21 ft 4 in.

Weights: gross 81,570–90,830 lb.

Performance: max speed at height Mach 2.83, at S/L Mach 0.98, ceiling 68,900 ft, range at supersonic speed on internal fuel 1,015 miles, subsonic with underbelly tank 1,490 miles.

Armament: provision for four to 10 1,100-lb bombs under wings and fuselage.

Mil Mi-6 and Mi-22 (NATO "Hook-B, C, and D")

There are three special-duty versions of the Mi-6 helicopter:

Mi-6VKP/Mi-22 (Hook-B). Command support helicopter, with flat-bottom, U-shaped antenna under tailboom, X-configuration blade antennas forward of horizontal stabilizers, large heat exchanger on starboard side of cabin, and small cylindrical container aft of starboard rear cabin door.

Mi-6AYa/Mi-22 (Hook-C). Developed command support version with sweptback plate antenna above forward part of tailboom instead of Hook-B's U-shaped antenna. Small antennas under fuselage. Pole antenna attached to starboard main landing gear of some aircraft.

Mi-6AYaSh (Hook-D). Command support helicopter. Flat panel, reportedly SLAR, forward of external fuel tank on starboard side. Many small antennas.

MiG-25R ("Foxbat-D") *(Jay Miller)*

Mil Mi-8VZPU ("Hip-D")

Ilyushin Il-78M ("Midas") refueling Su-27 *(Paul Jackson)*

Mil Mi-8 (NATO "Hip-D, J, and K")

Special-mission versions of this helicopter have the following NATO reporting names:

Mi-8VZPU (Hip-D). Airborne reserve command post. Generally similar to Hip-C transport but with canisters of rectangular section on outer stores racks and two large antennas above forward part of tailboom. No armament.

Mi-8SMV (Hip-J). Communications jamming version, with small transmitter boxes on sides of fuselage, fore and aft of main landing gear legs. Also carries 32 single-use jammers, released from four containers. Used mainly for border surveillance.

Mi-8PPA (Hip-K). Active radar jammer and communications intelligence (comint) helicopter, with three radar jamming stations; battery box and array of six cruciform dipole antennas on each side of cabin. Heat exchangers under front fuselage. No Doppler box under tailboom. Some to uprated Mi-17 standard, with port-side tail rotor.

Mil Mi-9 (NATO "Hip-G")

The designation Mi-9 applies to the command relay platform variant of the Mi-8 known to NATO as Hip-G. Rearward-inclined "hockey stick" antennas project from rear of cabin and from undersurface of tailboom, aft of box for Doppler radar. Short rearward-inclined whip antenna above forward end of tailboom. Strakes on fuselage undersurface. Crew of three to six. About 50 in Russian Army service.

Mil Mi-17P (NATO "Hip-K derivative")

The Mi-17P ECM communications jamming and comint helicopter, designated Hip-K derivative by NATO, has an airframe and power plant of Mi-17 standard. Behind the main landing gear on each side is a large, panel-like, 32-element array, with a separate four-element array to the rear, on the tailboom. A large radome is mounted on each side of the cabin, below the jet exhaust, with a further triangular container in place of the rear cabin window each side. There are six heat exchangers under the front fuselage.

Mil Mi-19

The Mi-19 is a command post version of the Mi-8MT (Mi-17 "Hip-H"), similar to the Mi-9.

Mil Mi-24 (NATO "Hind-G1 and G2")

See main Mi-24 entry for details of these special-duty versions.

Sukhoi Su-24 (NATO "Fencer-E and F")

Russian Tactical Air Forces have about 80 reconnaissance and EW versions of the Su-24, Naval Aviation has 25, in the following versions:

Su-24MR (Fencer-E). Reconnaissance variant; attack capability deleted. No overwing fences. Internal equipment includes Shtik side-looking airborne multimission radar in shorter radome, Zima IR reconnaissance system under center-fuselage, Aist-M TV reconnaissance system, with panoramic and oblique cameras in fuselage. 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 capability is retained.

Su-24MP (Fencer-F). Electronic warfare/jamming/signals intelligence (sigint) version. Added small fairing under nose. Centerline EW pod. Gun and four R-60 AAMs retained. Only eight built. *(Data generally as for Su-24M.)*

Tupolev Tu-22M (NATO "Backfire")

Two special-mission versions of the Tu-22M-3 have been built since 1985:

Tu-22MP. Three prototypes of this electronic warfare version have been completed. One, seen at Akhtubinsk Test Center in 1995, has a Miass jamming system, with a semirecessed pod in the weapons bay and dielectric fairings on the side of each engine duct and forward of the root of the dorsal tailfin. No details are available.

Tu-22MR. Reconnaissance version. About 12 reportedly built for service from the late 1980s.

Transports and Tankers

Antonov An-12BP (NATO "Cub")

More than 300 of these 1950s-vintage four-turboprop transports remain available to the Russian Military Transport Aviation force (VTA), but the number in day-to-day military service is likely to be much smaller. Their usefulness is limited by lack of an integral rear-loading ramp/door. Instead, the bottom of the rear fuselage is made up of two longitudinal doors that hinge upward inside the cabin to permit direct loading from trucks on the ground or air-dropping supplies and equipment.

The Cub-A, B, C, and D elint and ECM versions are described separately on p. 71.

Power Plant: four ZMKB Progress/Ivchenko AI-20M turboprops; each 4,190 ehp.

Dimensions: span 124 ft 8 in, length 108 ft 7¼ in, height 34 ft 6½ in.

Weights: empty 61,730 lb, gross 134,480 lb.

Performance: max speed 482 mph, ceiling 33,500 ft, range 2,236 miles with max payload.

Accommodation: crew of six; 44,090 lb of freight, 90 troops or 60 parachute troops. Built-in freight-handling gantry with capacity of 5,070 lb.

Armament: two 23-mm NR-23 guns in manned tail turret. Provision for carrying bombs on landing gear fairings.

Antonov An-22 (NATO "Cock")

Forty An-22s are available to VTA, often operating in civil markings. Each has a max payload of 176,350 lb, loaded via a rear ramp, enabling them to lift the Russian Army's main battle tanks and theater missile systems.

Power Plant: four Samara/Kuznetsov NK-12MA turboprops; each 14,795 shp.

Dimensions: span 211 ft 4 in, length 190 ft 0 in, height 41 ft 1½ in.

Weights: empty 251,325 lb, gross 551,160 lb.

Performance: max speed 460 mph, range with 99,200 lb payload 6,800 miles.

Accommodation: crew of five or six, 28–29 passengers in cabin forward of main freight hold. Four traveling gantries and two winches to speed freight handling.

Armament: none.

Antonov An-26 (NATO "Curl")

An-26s are assigned individually to Air Force units, with around 200 more forming a civil-registered reserve. The basic freighter version (**Curl-A**) was the first aircraft to embody Oleg Antonov's unique rear-loading ramp. This forms the underside of the rear fuselage when retracted but can be slid forward under the rear of the cabin to facilitate direct loading onto the floor of the hold or when the cargo is to be air-dropped. Max payload is 12,125 lb; conversion of the standard freighter to carry troops or litters takes 20 to 30 minutes in the field. The **Curl-B** sigint version is described in the Reconnaissance, ECM, and Early Warning Aircraft section.

Power Plant: two ZMKB Progress/Ivchenko AI-24VT turboprops; each 2,780 ehp. One 1,765 lb thrust RU 19A-300 auxiliary turbojet in starboard nacelle for turboprop starting and to provide additional power for takeoff, climb, and cruising flight, as required.

Dimensions: span 95 ft 9½ in, length 78 ft 1 in, height 28 ft 1½ in.

Weights: empty 32,518 lb, gross 52,911 lb.

Performance: cruising speed at 19,675 ft 270 mph, ceiling 24,600 ft, T-O run 2,855 ft, landing run 2,135 ft, range with max payload 770 miles, with max fuel 1,652 miles.

Accommodation: crew of five, plus station for load supervisor or dispatcher. Electrically powered mobile hoist, capacity 4,409 lb, and conveyor to facilitate loading and airdropping. Provision for carrying 40 paratroops or 24 litters. An-26B (Curl-A) version has improved handling system, enabling two men to load and unload three eight-ft-long freight pallets in 30 min.

Armament: none.

Antonov An-32 (NATO "Cline")

This 1976 development of the An-26 airframe has almost doubled engine power, triple-slotted trailing-edge flaps, automatic leading-edge slats, enlarged ventral fins, a full-span slotted tailplane, and improved systems. The basic **An-32** is able to operate from airfields 13,000 to 14,750 ft above sea level in an ambient temperature of ISA + 25°C. Turboprop uprating, to give an extra 200 shp from each engine, gives the **An-32B** a 1,100-lb increase in payload. Russian Air Forces have 50. *(Data for basic An-32.)*

Power Plant: two ZMKB Progress/Ivchenko AI-20 II Series 5 turboprops; each 5,109 ehp.

Dimensions: span 95 ft 9½ in, length 77 ft 8¼ in, height 28 ft 8½ in.

Weights: empty, equipped 38,371 lb, max payload 14,770 lb, gross 59,525 lb.

Performance: max cruising speed 329 mph, ceiling 30,840 ft, T-O run 2,495 ft, landing run 1,542 ft, range with max payload 528 miles, with max fuel 1,242 miles.

Accommodation: crew of three or four; freight, or 42 paratroops and a jumpmaster, or 24 litter patients and one or two medical attendants.

Armament: none.

Antonov An-70

Replacing the original prototype An-70, lost in an in-flight collision, a second prototype was nearing completion in the winter of 1996–97. Unique in being powered only by propfans, the An-70 is intended primarily as a wide-body freight carrier, with few cabin windows; but its pressurized and air-conditioned hold would permit the carriage of troops. Approximately 28 percent of the airframe, by weight, is made of composites. The freight hold is 61 ft 6¼ in long (70 ft 2½ in with ramp, which can be loaded), 13 ft 1½ in wide, and 13 ft 5½ in high. Loading is via rear fuselage ramp/doors, with adjustable sill height and built-in cargo-handling system. Normal payload is 66,135 lb, with a maximum 77,160 lb. Control is fly-by-wire, with backup by a unique fly-by-hydraulics system, immune to electromagnetic interference. Design life is 20,000 cycles and 45,000 flying hours in 25 years. Eight to 10 man-hours of maintenance per flying hour is estimated, and the An-70 is expected to be cost-effective with a minimum 200 flying hours per month.

Power Plant: four ZMKB Progress D-27 propfans; each 13,800 shp.

Dimensions: span 144 ft 6¾ in, length 133 ft 7½ in, height 53 ft 9 in.

Weights: empty 160,496 lb, gross 220,460–293,210 lb.

Performance (estimated): nominal cruising speed at 30,000 ft 466 mph, T-O run 4,920–5,905 ft, landing run 6,235 ft, max range with normal payload 3,107 miles.

Accommodation: crew of three, plus loadmaster; freight in containers, on pallets, or unpackaged, incl perishables or vehicles. Seats for 170 troops optional.

Armament: none specified.

Antonov An-72 and An-74 (NATO "Coaler")

First flown in prototype form in 1977, the An-72/74 is a STOL successor to the An-26, with twin turbofans and the same type of "slide-forward" loading ramp. Intended primarily for carrying freight, it can operate from unprepared airfields or from surfaces covered with ice or snow; the high location of the engines was adopted to avoid foreign-object ingestion. Their efflux is ejected over the wing upper surface and then down over large multislotted flaps to provide a considerable increase in lift for short-field operation. Other features include a Doppler-based automatic navigation system. Only 20 basic **An-72s** (Coaler-C) are operational with Russian Air Forces, but production for civil use and for export is maintained at the rate of 20 aircraft per year.

The **An-72P/An-76** is described in the Bombers and Maritime section. Details of the all-weather **An-74** series (Coaler-B) were given in the "Gallery of Russian Aerospace Weapons" in the March 1996 *Air Force* Magazine. *(Data for An-72.)*

Power Plant: two ZMKB Progress D-36 turbofans; each 14,330 lb thrust.

Dimensions: span 104 ft 7½ in, length 92 ft 1¼ in, height 28 ft 8½ in.

Weights: empty 42,000 lb, max payload 22,045 lb, gross 60,625–76,060 lb.

Performance (at T-O weight of 72,750 lb): max speed 438 mph, normal cruising speed at 32,800 ft 342–373 mph, ceiling 35,100 ft, T-O run 3,050 ft, landing run 1,525 ft, range with max payload 497 miles, with max fuel 2,980 miles.

Accommodation: crew of two or three; main cabin designed primarily for freight but with provision for 68 passengers or 57 paratroops on folding seats along side walls and removable central seats; or for 24 litter patients, 12 seated casualties, and attendant.

Armament: none.

Antonov An-124 (NATO "Condor")

The An-124 continues to be the world's largest production aircraft. More than 50 have been built, of which 26 are available to VTA. Others are owned or chartered by operators worldwide for carrying outsize cargoes, including missions for members of NATO. An upward-hinged, visor-type nose and rear fuselage ramp/door allow simultaneous front and rear loading/unloading. Advanced features include a fly-by-wire control system, "mobilely attached" titanium floor throughout the main hold, and 12,125 lb of composites, making up more than 16,150 sq ft of the airframe surface area. The 24-wheel landing gear enables the An-124 to operate from unprepared fields, hard-packed snow, and ice-covered swampland. The nosewheels can be retracted so that the aircraft "kneels" to facilitate front loading. Payloads range from the largest battle tanks to complete missile systems.

The first of two prototypes flew December 26, 1982. On July 26, 1985, an An-124 set 21 official records by lifting a payload of 377,473 lb to a height of 35,269 ft. On May 6–7, 1987, it set a closed-circuit distance record by flying 12,521.2 miles nonstop. Deliveries to the VTA began in the same year. During the Persian Gulf crisis, in 1990, an An-124 carried 451 Bangladeshi refugees from Amman, Jordan, to Dacca, Bangladesh, in emergency accommodation with chemical toilets, drinking water tank, and foam rubber cabin lining in lieu of seats.

Power Plant: four ZMKB Progress D-18T turbofans; each 51,590 lb thrust.

Dimensions: span 240 ft 5¾ in, length 226 ft 8½ in, height 69 ft 2 in.

Weights: empty 385,800 lb, max payload 330,693 lb, gross 892,872 lb.

Performance: max cruising speed 537 mph, T-O balanced field length 9,850 ft, landing run 2,955 ft, range with max payload 2,795 miles, with max fuel 10,250 miles.

Accommodation: crew of six, plus loadmaster and relief crew; up to 88 passengers on fully pressurized upper deck; freight on lightly pressurized lower deck, positioned by two electric traveling cranes with total lifting capability of 44,100 lb.

Armament: none.

Ilyushin Il-76 (NATO "Candid-B")

This four-turbofan transport is the standard medium/long-range workhorse of the Russian VTA, which has reduced its Il-76 fleet from about 375 aircraft to 300 during the past year. They are Il-76M/MDs (Candid-B), with rear guns and small ECM blisters on each side of the front and rear fuselage. When operating into combat areas, they can be fitted with packs of 96 x 50-mm IRCM flares, on the landing gear fairings and/or on the sides of the rear fuselage.

The basic **Il-76M** is comparable to USAF's C-141 Starlifters, with a max payload of 88,185 lb and gross weight of 374,785 lb. It has rear-loading ramp/doors, full-span leading-edge slats and triple-slotted flaps for good field performance, a glazed navigator's station and weather radar in the nose, navigation and ground-mapping radar in a large undernose fairing, and a 20-wheel landing gear. The entire accommodation can be pressurized, making it possible to carry 140 troops or 125 paratroops as an alternative to freight. Advanced mechanical freight-handling systems are fitted. Equipment for all-weather operation includes a computer for automatic flight control and automatic landing approach.

The improved **Il-76MD** has an increased gross weight and additional fuel to extend max range by 745 miles. A stretched version, with the freight hold lengthened by 21 ft 8 in, payload increased to 114,640 lb, and updated avionics, was flown for the first time on August 1, 1995. Designated **Il-76MF,** it has 35,275 lb thrust Aviadvigatel PS-90AN turbofans. Two were ordered in 1996, and the MF is expected to become one of the VTA's primary transports for the twenty-first century, with optional Western CFM56 engines. *(Data for Il-76MD.)*

Power Plant: four Aviadvigatel D-30KP-2 turbofans; each 26,455 lb thrust.

Dimensions: span 165 ft 8 in, length 152 ft 10¼ in, height 48 ft 5 in.

Weights: max payload 110,230 lb, gross 418,875 lb.

Performance: cruising speed at 29,500–39,350 ft 466–485 mph, T-O run 5,578 ft, landing run 2,950–3,280 ft, range with max payload 2,360 miles, with 44,090 lb payload 4,535 miles.

Accommodation: crew of seven, incl two freight handlers.

Armament: two 23-mm twin-barrel GSh-23L guns in tail turret.

Ilyushin Il-78M (NATO "Midas")

The initial-standard Il-78 in-flight refueling tanker derivative of the Il-76MD entered service during 1987, to support both strategic and tactical aircraft. It has since been superseded by the Il-78M, of which 20 are operational with Russian Air Forces. Using the probe-and-drogue technique, this can refuel up to three aircraft simultaneously. Two UPAZ-1A Sakhalin refueling pods are mounted conventionally under the outer wings. The third drogue is streamed from a similar pod on the port side of the rear fuselage. Fuel can be transferred from the standard 187,040-lb tanks in the wing torsion box as well as from two fixed cylindrical tanks, containing 79,366 lb of fuel, in the hold. The rear turret is retained as a flight refueling observation station, without guns. Special navigation systems allow all-weather day/night mutual detection and approach by receiver aircraft from distances up to 185 miles. Convergence is controlled automatically, but refueling is permitted only in direct visibility.

Power Plant: four Aviadvigatel D-30KP-2 turbofans; each 26,455 lb thrust.

Weight: gross 346,120–462,965 lb.

Performance: nominal cruising speed 466 mph, refueling speed at 6,500–29,500 ft 267–366 mph, refueling radius with 110,231 lb transfer fuel 1,616 miles, with 44,090 lb transfer fuel 3,138 miles.

Accommodation: crew of six.

Airborne Nuclear Attack and Cruise Missiles

AS-4 (Kh-22 Burya; NATO "Kitchen")

This large ASM is primary armament of the Tu-22M "Backfire" bomber. The original **Kh-22,** which entered service in 1964, had inertial guidance and a 350-kiloton nuclear warhead, needing no terminal homing. The **Kh-22N** with active radar terminal homing and alternative nuclear or 2,200-lb high-explosive (HE) warhead was developed in the early 1970s. The **Kh-22MP** defense-suppression version, with passive ra-

AA-12 (R-77 "Adder") and AS-10 (Kh-25ML "Karen") *(Piotr Butowski)*

dar homing and HE warhead, is also in service.
Type: medium-range ASM.
Power Plant: liquid-propellant rocket.
Guidance: inertial, or inertial plus active or passive radar homing.
Warhead: alternative nuclear (350 kilotons) or HE (2,200 lb).
Dimensions: span 9 ft 10 in, length 37 ft 1 in, body diameter 3 ft 3½ in.
Launch Weight: 12,750 lb.
Performance: max speed Mach 4.6, range 185 miles at low altitude, 285 miles at 50,000 ft.

AS-15 (Kh-55; NATO "Kent")

Russia's long-range bomber force consists of Tu-95MS "Bear-Hs" and Tu-160 "Blackjacks" armed with two different versions of the AS-15 ALCM. AS-15 appears to be similar in configuration and size to the US BGM-109 Tomahawk, with flip-out wings. Deployment on the Tu-95MS16 began in 1984, with six **AS-15A**s on an internal rotary launcher in each aircraft and 10 more in four underwing clusters. The Tu-95MS6 has only the rotary launcher. The Tu-160 has two rotary launchers for up to 12 **AS-15B**s, which appear to have slender external fuel tanks scabbed onto their sides, giving a triangular cross section, with rounded corners. *(Data for AS-15A.)*
Type: long-range ALCM.
Power Plant: podded turbofan, extended down from rear of body after launch.
Guidance: inertial with terrain comparison.
Warhead: nuclear (200 kilotons).
Dimensions: span 10 ft 8 in, length 26 ft 6½ in, body diameter 1 ft 8 in (AS-15B 2 ft 6¼ in).
Launch Weight: 3,750 lb.
Performance: speed subsonic, range 1,490 miles at height. CEP 500 ft.

AS-16 (Kh-15; NATO "Kickback")

Designated Kh-15 in Russia, the AS-16 is in the same class as USAF's now-withdrawn AGM-69 SRAM. An alternative nuclear or conventional warhead can be fitted, plus an active radar seeker in the **Kh-15A** antiship version and a passive radar seeker in the antiradiation **Kh-15P.** Twelve can be carried as an alternative to six AS-15B ALCMs on each of the Tu-160 "Blackjack's" rotary launchers. Up to 10 can be carried by the Tu-22M-3 "Backfire-C," and the Kh-15P is one of the ASMs specified for the Su-37. A version with conventional warhead and active seeker has been offered for export as the **Kh-15S,** for antiship use.
Type: medium-range ASM.
Power Plant: solid-propellant rocket.
Guidance: inertial, plus active or passive radar homing.
Warhead: nuclear (350 kilotons) or HE (330 lb).
Dimensions: span 3 ft 0¼ in, length 15 ft 8 in, body diameter 1 ft 5¾ in.
Launch Weight: 2,650 lb.
Performance: max speed Mach 5, range 62 miles at low altitude, 95 miles at height.

AS-? (Kh-65SE)

Possibly a shorter, conventional-warhead version of the AS-15, this ALCM has a basically cylindrical body, changing to a flat-bottom triangular section with rounded corners forward of the wings to reduce radar signature. The wings and three tail control surfaces fold for stowage on the missile launcher. After launch, these surfaces deploy, and the power plant pod extends through hinged doors in the weapon's undersurface. The Kh-65SE is 19 ft 10 in long, with a diameter of 1ft 8¼ in and launch weight of 2,755 lb.

AS-20 (Kh-35 "Kayak") *(Piotr Butowski)*

From a launch height of 985–39,375 ft, it has a range of 155–174 miles at 365–585 mph at a height of 130–360 ft. It is intended for antiship use and is specified for the Su-37.

AS-X-19 (BL-10; NATO "Koala")

Available information on this program for a supersonic ALCM can be found in the "Gallery of Russian Aerospace Weapons" in the March 1996 *Air Force* Magazine. Russia announced termination of the program in 1992, but its current status is not known. Reports suggested that Koala would cruise at Mach 2.5 to 3 at a height of 70,000 ft and might carry two independently targeted warheads able to impact up to 60 miles apart.

Airborne Tactical Missiles

AS-7 (Kh-23; NATO "Kerry")

This first-generation tactical ASM has a solid-propellant rocket motor, radio command guidance by joystick control from the launch aircraft, and a 242-lb, hollow-charge, high-explosive warhead. It is carried by the Su-24.
Dimensions: span 2 ft 7¼ in, length 11 ft 7 in, body diameter 10⅞ in.
Weight: 633 lb.
Performance: max speed transonic, range 3 miles.

AS-10 (Kh-25ML/MR; NATO "Karen")

Each of the two basic operational versions of Karen has a solid-propellant motor and 198-lb warhead. The **Kh-25MR** uses the same kind of radio command guidance system as the Kh-23 (AS-7 "Kerry"), to which it is similar. The **Kh-25ML** is laser-guided, with target designation by the launch aircraft. These include the Su-24, Su-25, Su-25TM, and Su-35/37. *(Data for Kh-25ML.)*
Dimensions: span 2 ft 7½ in, length 13 ft 11½ in, body diameter 10⅞ in.
Weight: 660 lb.
Performance: launch height 330–33,000 ft, max speed Mach 2.35, range 6.2–12.5 miles.

AS-11 (Kh-58; NATO "Kilter")

The AS-11 is a third-generation antiradiation missile of cruciform clipped-delta wing/tailfin configuration, with inertial guidance, a passive radar homing head and a dual-thrust solid-propellant rocket motor. A nuclear warhead is reported to be optional in place of the usual 330-lb or 440-lb HE blast/fragmentation type. Kilter, in various forms, is the primary armament of the MiG-25BM and is compatible with the Su-24 and the Su-25TM. A version for use against ship radars has a range of 112 miles after high-altitude launch.
Dimensions: span 3 ft 10 in, length 15 ft 9 in, body diameter 1 ft 3 in.
Weight: 1,433 lb.
Performance: max speed Mach 4, range from low altitude 6–43 miles, from high altitude 6–112 miles.

AS-12 (Kh-25MP; NATO "Kegler")

Kegler differs from the AS-10 "Karen" ASM in having a passive radar homing head. It can be carried by the Su-24, Su-25, Su-35/37, Tu-22M, and Ka-50. It has a 198-lb warhead.
Dimensions: as AS-10, except length 12 ft 6¾ in.
Weight: 705 lb.
Performance: launch height 330–49,200 ft, max speed Mach 2.5, range from low altitude 1.5–15.5 miles, from high altitude 1.5–37 miles.

AS-13 (Kh-59 Ovod; NATO "Kingbolt")

The medium-range, TV-guided AS-13 has a two-stage solid-propellant power plant. Although first displayed in 1991, it was probably developed in the 1970s to supplement the short-range AS-10. It is reported to have a 331-lb warhead and is carried by the Su-24, together with an ARK-9 data-link pod.
Dimensions: span 4 ft 1¼ in, length 16 ft 9 in, body diameter 1 ft 3 in.
Weight: 1,875 lb.
Performance: range from low altitude 56 miles, from high altitude 100 miles.

AS-14 (Kh-29; NATO "Kedge")

Basic versions of this tactical ASM are the TV-guided **Kh-29T** and the semiactive, laser-guided **Kh-29L.** Except for the interchangeable seeker heads, they are identical. In the class of USAF's Maverick, they are carried on the extended wingroot glove pylons of the Su-24M and by the MiG-29, Su-25, Su-25TM, and Su-35/37. Each version has a 705-lb HE warhead. A **Kh-29MP** version, with passive antiradiation seeker, has been reported. *(Data for Kh-29T.)*
Dimensions: span 3 ft 7¼ in, length 12 ft 8½ in, body diameter 1 ft 3¾ in.
Weight: 1,477 lb. (Kh-29L 1,448 lb.)
Performance: launch height 650–16,400 ft, range 1.85–7.5 miles.

AS-17 (Kh-31A/P; NATO "Krypton")

The inertially guided AS-17 was developed initially to attack US Patriot and AEGIS phased-array missile radars. It is powered by an integral rocket/ramjet, with four intakes for the ramjet disposed around the body, each carrying a wing and a control surface. Warhead weight is 198 lb. Four versions have been identified:
Kh-31A Mod 1. Antiship missile with active radar seeker and blast/penetration warhead. Length 15 ft 5 in, range 3–31 miles.
Kh-31A Mod 2. As Mod 1, but length 17 ft 2 in, range 3–43 miles.
Kh-31P Mod 1. Antiradiation missile with passive radar seeker and blast/fragmentation warhead. Length 15 ft 5 in, range 6–93 miles.
Kh-31P Mod 2. As Mod 1, but length 17 ft 2 in, range 6–125 miles.
All versions are designed for effectiveness in ECM environments. The Kh-31 has been seen mounted in inert form, or has been reported, on MiG-29M, Su-24, Su-32FN, Su-34, and Su-35/37 aircraft.
Dimensions: span 3 ft 9¼ in, length see above, body diameter 1 ft 2¼ in.
Weight: 1,323 lb.
Performance: launch height 165–49,200 ft, max speed Mach 3, range see above.

AS-18 (Kh-59M Ovod-M; NATO "Kazoo")

This conventionally armed short-range cruise missile has a cylindrical body with sweptback cruciform flip-out nose surfaces and a cruciform tail unit carrying inset control surfaces. It can be launched from heights between 330 and 16,400 ft. Guidance is command-updated midcourse inertial, with terminal homing via a Granit 7TM1 TV camera behind a glass nose, and the AS-18 is powered by a podded turbofan pylon-mounted under the rear of the body. A 705-lb HE or 617-lb cluster submunitions warhead can be fitted. The Russian designation Kh-59M implies that it is a development of the Kh-59 "Kingbolt," which has the same body diameter. It is specified for the Su-35/37.
Dimensions: span 4 ft 3 in, length 18 ft 8 in, body diameter 1 ft 3 in.
Weight: 2,050 lb.
Performance: speed at 330–660 ft Mach 0.7–0.82,

range 25 miles with prelaunch lock-on, 71 miles with command update.

AS-20 (Kh-35; NATO "Kayak")

Dubbed "Harpoonski" because of its similarity to the US AGM-84 Harpoon, the turbofan-powered Kh-35 is an active radar homing antiship ASM to arm combat aircraft and helicopters. First deployment was on the Tu-142M. With an added tandem booster, it can be launched from Ka-27 helicopters. Warhead weight is 320 lb. Midcourse guidance is inertial, with a sea-skimming approach to the target at 16–33 ft altitude.
Dimensions: span 4 ft 3¼ in, length 12 ft 3½ in, body diameter 1 ft 4½ in.
Weight: 1,322 lb.
Performance: launch height 650–16,400 ft, max speed 670 mph, range 3–80 miles.

AS-? (Kh-41 Moskit)

The configuration of this rocket/ramjet antiship missile resembles that of the much smaller Kh-31 but with the cruciform wings located toward the front of the wraparound ramjet air intakes. The wing and tail surfaces all fold to fit between the engine ducts of the Su-33, on which the Kh-41 has been exhibited. It has a 705-lb HE blast/fragmentation warhead and makes an inertially guided sea-skimming approach to its target. Terminal guidance is by a dual-mode active/passive radar seeker, with ECCM capability. Moskit has been described as a primary weapon for the Su-32FN coastal-based attack aircraft but too heavy for use from aircraft carriers at sea.
Dimensions: span (spread) 6 ft 10¾ in, length 30 ft 9½ in, body diameter 2 ft 6 in.
Weight: 9,920 lb.
Performance: max speed Mach 2.1–3, range sea-skimming 93 miles, at high altitude 155 miles.

AFM-L

A mockup of this antiship ASM was exhibited at the 1993 Moscow Air Show, but no details were given. The AFM-L has a long cylindrical body, with slightly reduced diameter on a short section behind the ogival nosecone. The only visible aerodynamic surfaces comprise small cruciform fins at the extreme tail, but there are long slots for retracted wings in the upper part of the center body.
Dimensions: length 24 ft 11¼ in, body diameter 1 ft 7¾ in.

ALFA

Under development without state funding, ALFA is a supersonic antiship missile for launch from ships or such aircraft as the Su-32FN. It has inertial midcourse guidance, with active radar terminal homing. The cylindrical body has a diameter of about 1 ft 9¾ in, with an ogival nose, small delta wings under the midbody, and cruciform tail surfaces. A rectangular air intake for the turbofan engine is located aft of the wings. The missile's length is estimated as 19 ft 8 in, with a weight of 2,645 lb and ability to carry an 880-lb warhead 375 miles.

AT-2 (9M17 Skorpion; NATO "Swatter")

This solid-propellant antitank missile (ATM) arms the Mi-24D and Mi-8TBK helicopters. **Swatter-A/B** employs radio command guidance and requires the helicopter's weapons operator to keep crosswires on his sight centered on the target. **Swatter-C** is similar but has semiautomatic command to line-of-sight and a range of 2.5 miles. *(Data for Swatter-A/B.)*
Dimensions: span 2 ft 2 in, length 3 ft 9¾ in, body diameter 5¼ in.
Weight: 65 lb.
Performance: cruising speed 380 mph, range 1.85 miles.

AT-6 (9M114 Shturm; NATO "Spiral")

The AT-6 is a solid-propellant, tube-launched missile with a radio command guidance system. It has two small flip-out control fins on the nose and four wrap-around stabilizing fins at the rear. The 16.3-lb HE warhead fitted to the basic antitank AT-6 can penetrate 37 in of armor plate, and this version is standard armament on the Mi-24V/P, Mi-28, and Ka-29. A variant with an HE fragmentation warhead for attacking other battlefield targets has been reported.
Dimensions: span 1 ft 0 in, length 6 ft 0 in, body diameter 5¼ in.
Weight: 74 lb.
Performance: cruising speed 895 mph, range 3.1 miles.

AT-9 (9M114M1/2 Shturm 2)

Seen in two eight-rd clusters on the outer underwing weapon pylons of an Mi-35M ("Hind") helicopter, at the 1995 Paris Air Show, the AT-9 has an improved radio command link, greater armor penetration, and an increased range compared with the AT-6. It can be used in both air-to-surface and air-to-air modes.
Weight: 88 lb.
Performance: range 5 miles.

AT-12 (9M120 Vikhr)

This tube-launched, solid-propellant ATM can be carried in eight-rd clusters under the wings of the Su-25TM attack aircraft. Its configuration is believed to be similar to that of the AT-6/9, but its nose projects from the launch tube. Guidance is by laser beam riding. The warhead weight is estimated at 16.5 lb. The AT-12 is cleared for use on Mi-24, Mi-28, and Ka-50 helicopters. An air-to-air version, with proximity fuze and rod warhead, is reported.
Dimensions: span 1 ft 0¾ in, length 5 ft 7 in, body diameter 5¼ in.
Weight: 95 lb.
Performance: range 5 miles.

AT-X-16 (9M120M Vikhr M)

This missile appears to be a lengthened and improved AT-9. It was first seen in 1992 on the Ka-50 combat helicopter in the form of six-rd underwing clusters. Other possible carriers include the Mi-24, Mi-28, and Su-25TM. The motor is believed to be two-stage solid-propellant. Semiactive laser guidance is standard, with a 17-lb shaped-charge warhead reportedly capable of penetrating 39 in of reactive protected armor.
Dimensions: length 9 ft 6 in, body diameter 5¼ in.
Weight: 99 lb.
Performance: cruising speed supersonic, range 6.2 miles.

AA-6 (R-40/46; NATO "Acrid")

This two-stage, solid-propellant AAM, with a 154-lb fragmentation warhead, can be carried by the MiG-31 and Su-35/37. The **R-40T** and updated **R-46TD** have command-updated inertial guidance and an infrared homing head. The **R-40R** and **R-46RD** are semiactive radar homing versions.

AT-6s (9M114 "Spirals") and AT-12s (9M120 Vikhrs)

AA-10 (R-27T "Alamo-B")
(Piotr Butowski)

Dimensions: length 20 ft 4 in, body diameter 1 ft 2 in, wingspan 5 ft 11 in.
Weight: 1,047 lb.
Performance: cruising speed Mach 2.2, range (R-40) 45 miles, (R-46) 50 miles.

AA-8 (R-60; NATO "Aphid")

The R-60 close-range AAM is intended for both interception and self-defense and can be carried by most Russian fighters and attack aircraft as well as by Mi-24D/24V helicopters. It is a highly maneuverable, solid-propellant weapon with infrared homing guidance. In addition to the basic **R-60T** with active radar fuze, an **R-60M** version has new electro-optical fuze to match all-aspect engagement capability and increased range. The **R-60MK** carried by MiG-29s is adapted for designation by the pilot's helmet-mounted sight. A 7.7-lb fragmentation warhead is standard. *(Data for R-60MK.)*
Dimensions: length 7 ft 0¼ in, body diameter 4¾ in, wingspan 1 ft 3½ in.
Weight: 99 lb.
Performance: range 1,000 ft min, 7.5 miles max.

AA-9 (R-33; NATO "Amos")

Standard armament on the MiG-31, the AA-9 is claimed to be capable of destroying targets, including ALCMs, flying at up to Mach 3.5 at all altitudes from 80 ft to 92,000 ft, in all weather. It has folding upper tailfins to facilitate stowage on the MiG's recessed launchers, a solid-propellant motor, and a 104-lb blast/fragmentation warhead and combines inertial autopilot guidance with semiactive radar terminal homing. The AA-9 is an alternative weapon for the Su-27 and Su-33. The basic **R-33** version has been followed by the **R-33S** with small cruciform front fins.
Dimensions: length 13 ft 7½ in, body diameter 1 ft 3 in, wingspan 3 ft 10½ in.
Weight: 1,080 lb.
Performance: range 75 miles.

AA-10 (R-27; NATO "Alamo")

The AA-10 has a complex configuration, with long-span, reverse-tapered, cruciform control surfaces to the rear of small foreplanes. An 86-lb expanding-rod warhead is standard. Six versions have been identified:

R-27R (Alamo-A). Short-burn version, with radio-corrected inertial guidance and semiactive radar terminal homing. Standard medium-range armament of MiG-29, Su-27, and Su-35/37.

R-27T (Alamo-B). Short-burn, all-aspect, infrared homing version with inertial midcourse guidance and fire-and-forget capability. Carried by MiG-29, Su-27, and Su-35/37.

R-27RE (Alamo-C). Long-burn version for longer ranges. Guidance as R-27R. Carried by Su-27 and Su-35/37.

R-27AE (Alamo-C). As R-27RE but active radar guidance, better able to deal with active maneuvering counterattacks and countermeasures.

R-27EM (Alamo-C). As R-27RE, with added capability against sea-skimming ASMs down to 10 ft above water.

R-27TE (Alamo-D). Long-burn, all-aspect, infrared counterpart of R-27RE, with fire-and-forget capability. Carried by Su-27 and Su-35/37.

Dimensions: length 13 ft 4¾ in (27R), 12 ft 5½ in (27T), 15 ft 8¼ in (27RE/AE/EM), 14 ft 9 in (27TE), body diameter 9 in (27R/T), 10¼ in (all others), finspan 2 ft 6½ in (27R/T), 2 ft 7½ in (all others).
Weights: 558 lb (27R), 560 lb (27T), 772 lb (27RE/AE/EM), 756 lb (27TE).
Performance: range 50 miles (27R), 45 miles (27T), 81 miles (27AE/RE), 105 miles (27EM), 75 miles (27TE), min launching range (tail-chase) 1,640 ft.

AA-11 (R-73; NATO "Archer")

This close-range missile is standard armament on the MiG-29, Su-27, Su-32FN/34, Su-33, Su-35/37, and Ka-50/52. Its controls are complex, with movable sets of vanes and fins fore and aft of fixed cruciform surfaces at the nose, control surfaces at the trailing-edge of each of the cruciform tailfins, and four thrust-vectoring control vanes in the efflux of the two-phase solid-propellant rocket motor. They ensure 12*g* maneuverability, particularly when the missile is launched at large off-boresight target angles via the pilot's helmet-mounted sight. Guidance is inertial, with terminal all-aspect infrared and ability to discriminate against decoy flares; a 17.5-lb fragmentation warhead is fitted. There are two versions:

R-73M1. Basic version; off-boresight capability ±45°.

R-73M2. Off-boresight capability ±60°; increased weight and range; digital control electronics and IRCCM; reported capability against low-flying missiles.

Dimensions: length 9 ft 6¼ in, body diameter 6¾ in, finspan 1 ft 8 in.
Weights: R-73M1 232 lb, R-73M2 243 lb.
Performance: range 18.6 miles (R-73M1), 25 miles (R-73M2), min launching range (tail-chase) 985 ft.

AA-12 (R-77; NATO "Adder")

This solid-propellant AAM will gradually become standard armament on late-model Russian aircraft. It is easily distinguished by its lattice tailfins, which fold for possible future internal stowage. Known also in Russia as the **RVV-AE**, this missile was designed to destroy highly maneuverable (12*g*) aircraft, helicopters, cruise missiles, SAMs, and AAMs at all aspects, by day and night, in all weather and intense ECM, over ground and sea, in fire-and-forget mode. It has inertial control, with midcourse radar updates and active radar home-on-jam terminal lock-on, and a planned future version will be able to attack AWACS aircraft at a range of 100 miles or more. Designated **R-77M-PD**, this will have a rocket/ramjet motor, infrared homing, and a weight of 496 lb. Warhead weight is 40 lb.
Dimensions: length 11 ft 9¾ in, body diameter 7⅞ in, wingspan 1 ft 1¾ in.
Weight: 385 lb.
Performance: max speed Mach 3, range 56 miles, min launching range 985 ft.

AA-? (R-37)
A MiG-31M has been depicted with two R-37 AAMs on centerline mounts in addition to R-33s on fuselage-side conformal weapon attachments. The R-37 can also be carried by MiG-31Bs and Su-37s. It is a greatly enhanced derivative of the R-33, with all four tailfins able to fold for internal stowage on future stealthy aircraft. Its cruciform wings are positioned farther forward than those of the R-33, and it has active radar terminal homing. A 132-lb fragmentation warhead is fitted.
Dimensions: length 13 ft 5½ in, body diameter 1 ft 3 in, wingspan 2 ft 3½ in.
Weight: 992 lb.
Performance: range 93 miles.

AA-? (AAM-L; KS-172)
This long-range AAM was shown in mockup form at the 1993 Moscow Air Show and is one of the weapons specified for the Su-37. It is a slim cylindrical missile with small cruciform tail control surfaces. Propulsion is by two-stage solid rocket. Guidance is inertial with midcourse update and active radar terminal homing. A range of 250 miles is claimed, against targets flying up to Mach 3.75 at heights from 10 ft to 98,000 ft. The HE fragmentation warhead has an estimated weight of 110 lb.
Dimensions: length 24 ft 3 in, body diameter 1 ft 7¾ in, finspan 2 ft 11½ in.
Weight: 1,650 lb.

SA-7, SA-14, SA-16, and SA-18
All of these man-portable SAMs have been adapted for air-to-air use on Mi-24 and other helicopters. Details in Surface-to-Air Missiles section.

Intercontinental Ballistic Missiles

The totals of operational ICBMs given in this section refer to the number deployed in Russia, Belarus, and Ukraine in 1995, the latest available strengths.

SS-18 (RS-20; NATO "Satan")
The SS-18 is the only Russian missile classified as a "heavy" ICBM in START terms. Under START I, the total deployed in converted SS-9 silos had to be reduced to 154 by 1998. In fact, only 150 remained in 1995, most with MIRV payloads of 10 reentry vehicles each. All SS-18s are intended to be eliminated by 2000 to 2003 under START II.
Launch Mode: silo-based; cold-launched.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: single nuclear (25 megatons in Mod 1, 20 megatons in Mod 3 and 6). Ten MIRVs (each 500 kilotons in Mod 2 and 4; 750 kilotons in Mod 5).
Dimensions: length 119 ft 9 in, body diameter 9 ft 10 in.
Launch Weight: 465,390 lb.
Performance: max range 6,200 miles (Mod 1), 6,835 miles (Mod 2 and 4), 8,075 miles (Mod 3). Throw weight 19,400 lb. CEP 820 ft.

SS-19 (RS-18; NATO "Stiletto")
The hot-launched SS-19 Mod 3 is a light ICBM, comparable in size to USAF's Peacekeeper. Although less accurate than the SS-18, it is reckoned to have significant capability against all but hardened silos. The 204 currently emplaced were expected to be deactivated under START II, but 105 of the missiles may now be kept, probably converted to single warheads.
Launch Mode: silo-based; hot-launched.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: six MIRVs (each 500 kilotons).
Dimensions: length 83 ft 7 in, max diameter 8 ft 2½ in.
Launch Weight: 232,305 lb.
Performance: range 6,200 miles. Throw weight 9,590 lb. CEP 985 ft.

SS-24 (RS-22; NATO "Scalpel")
The SS-24 is a highly accurate, Peacekeeper-sized, solid-propellant system intended for use against soft or semihardened targets. The Mod 1 version reflects the 1970s emphasis on survivability through weapon system mobility. The three rail-mobile garrisons for this system have the capability to roam more than 90,100 miles of track.
Thirty-six SS-24 Mod 1s were operational in 1995. The other 36 SS-24s were Mod 2s: 10 in Russia at Tatishchevo, the remainder in Ukraine, all in converted SS-17 silos. Ukraine's SS-24s are being deactivated; those in Russia should go by the end of the decade.
Launch Mode: rail-mobile (Mod 1) or silo-based (Mod 2); cold-launched.
Power Plant: three-stage solid-propellant.
Guidance: inertial.
Warhead: up to 10 MIRVs (each 300–500 kilotons).
Dimensions: length 78 ft 1 in, body diameter 7 ft 10½ in.
Launch Weight: 230,380 lb.
Performance: max range 6,200 miles. Throw weight 8,930 lb. CEP 660 ft.

SS-25 (RS-12M Topol; NATO "Sickle")
The number of operational road-mobile SS-25s increased by 45 to 363 in the year preceding issue of 1995 statistics. The total deployed could increase further to 588 under START I, 690 under START II. Ninety redundant SS-18 silos could be made available for nonmobile SS-25s under START II.
As the designation RS-12M implies, Moscow regards this Minuteman-sized ICBM as a direct modernization of the now-retired SS-13 (RS-12). This enables it to conform with restraints embodied in the SALT Treaty terms. Most operational SS-25 deployments are to former SS-20 IRBM bases eliminated under the INF Treaty. At each base, a number of garages with sliding roofs house the system's massive off-road, wheeled transporter-erector-launchers (TELs); other buildings shelter the mobile support equipment. The SS-25 is claimed to have a greater throw weight and nine times the accuracy of the SS-13, as well as greater survivability (because it is mobile in its basic form) and an inherent refire capability. The Topol-M upgraded version will replace the current version at the heart of Russia's strategic missile force.
Launch Mode: basically road-mobile, with operational launch from inside garage, or from silo; cold-launched.
Power Plant: three-stage solid-propellant.
Guidance: inertial.
Warhead: single RV (550 kilotons).
Dimensions: length 70 ft 6½ in, body diameter 5 ft 11 in.
Launch Weight: 99,425 lb.
Performance: range 6,525 miles. Throw weight 2,205 lb. CEP 660 ft.

Submarine-Launched Ballistic Missiles

SS-N-8 (RSM-48 Vysota; NATO "Sawfly")
This SLBM was deployed from 1971 on 18 (now seven) "Delta I" submarines, which are being paid off progressively. The number of missiles that can be carried in each ship is restricted to 12 but was restored to 16 in the four (now one) Delta IIs, which were built with a lengthened hull at the expense of a small speed reduction to 24 knots. *(Data for Mod 1.)*
Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: one RV (800 kilotons).
Dimensions: length 46 ft 7 in, body diameter 5 ft 10⅞ in.
Launch Weight: 73,410 lb.
Performance: max range 4,850 miles. CEP 1,315 ft.

SS-N-18 (RSM-50 Volna; NATO "Stingray")
The SS-N-18 introduced the first MIRVed warheads on a Russian SLBM. It was deployed on 14 (now 12) "Delta III" SSBNs, assigned to the Pacific and Northern Fleets, in 1976–82. Each ship carries 16 missiles, in two rows. Some are being replaced with SS-N-23 "Skiffs." *(Data for Mod 1.)*
Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: three MIRVs (each 200 kilotons).
Dimensions: length 51 ft 2¼ in, body diameter 5 ft 10⅞ in.
Launch Weight: 77,820 lb.
Performance: max range 4,040 miles. CEP 2,950 ft.

SS-N-20/28 (RSM-52; NATO "Sturgeon")
Largest and heaviest of Russian SLBMs, the **SS-N-20** is carried by "Typhoon" SSBNs. These are by far the biggest submarines ever put into service, with a length of 562 ft and displacement of 26,500 tons submerged. Six entered service in 1981–89; they are intended to launch their missiles from protected waters near Russia.
The SS-N-20 was the first Russian series-production solid-propellant SLBM. Twenty are loaded in each Typhoon in a unique configuration with the launch tubes forward of the sail. The submarines are being modified to take the **SS-N-28** improved "Sturgeon," with greater accuracy. *(Data for SS-N-20.)*
Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage solid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: ten MIRVs (each 200 kilotons). May be downloaded to six or four MIRVs under START II.
Dimensions: length 59 ft 0½ in, body diameter 7 ft 10½ in.
Launch Weight: 185,185 lb.
Performance: max range 5,150 miles. Throw weight 5,620 lb. CEP 1,640 ft.

SS-N-23 (RSM-54 Shetal; NATO "Skiff")
The SS-N-23 has liquid propulsion, suggesting that this is still preferred by Russia's submariners. To carry it, seven *Delphin*-class (NATO "Delta IV") submarines have been constructed at Severodvinsk, with a follow-on class planned. Each carries 16 SS-N-23s inside the conventional type of raised housing aft of the sail. They are based with the "Typhoon" class in the Kola Peninsula as part of the Northern Fleet. SS-N-23s are also replacing SS-N-18s in some "Delta III" SSBNs.
Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: four to 10 MIRVs (each 100 kilotons).
Dimensions: length 55 ft 1½ in, body diameter 6 ft 2¾ in.
Launch Weight: 88,845 lb.
Performance: max range 5,150 miles. Throw weight 6,175 lb. CEP 1,640 ft.

Surface-to-Air Missiles

SH-11 (UR-96; NATO "Gorgon")
Thirty-six silo-based Gorgon exoatmospheric intercept missiles form the long-range element of the world's only operational antiballistic missile (ABM) system, emplaced at eight sites around Moscow. Comprising the full 100 launchers permitted by the 1972 ABM Treaty, the ABM-3 system is considered capable of engaging small numbers of reentry vehicles approaching from any direction during an accidental or unauthorized launch against the city. It offers a dual-layered defense against ballistic missiles and some use against satellites in low-Earth orbit. A multifunctional "Pill Box" radar located at Pushkino, north of Moscow, has the task of identifying and tracking incoming reentry vehicles. These would then be intercepted at high altitude and over long ranges by Gorgon ABMs. Any that penetrated this layer of defense would be engaged by "Gazelle" ABMs within the atmosphere.
The following details of the original SH-01 "Galosh" ABM that Gorgon replaced provide an indication of its likely characteristics:
Type: silo-launched, exoatmospheric, antiballistic missile.
Power Plant: three-stage liquid-propellant.
Guidance: command.
Warhead: nuclear (one megaton).
Dimensions: length 65 ft, base diameter 8 ft 5 in.
Launch Weight: 72,750 lb.
Performance: range more than 200 miles.

SH-08 (NATO "Gazelle")
This quick-reaction, high-acceleration interceptor missile is designed to destroy in the atmosphere reentry vehicles that penetrate the outer layer of ABM defense. Up to 64 are silo-based around Moscow, as the second stage of the capital's ABM defenses. Gazelle is described as being similar in general configuration to the long-abandoned US Sprint, with a low-yield nuclear warhead. Like "Gorgon," it is command-guided from the ground via the "Pill Box" phased-array radar. The following data are estimated:
Type: silo-launched, endoatmospheric, antiballistic missile.
Power Plant: solid-propellant.
Guidance: command.
Warhead: nuclear (10 kilotons or less).
Dimensions: length 32 ft 10 in, max diameter 3 ft 3 in.
Launch Weight: 22,000 lb.
Performance: range 50 miles.

SA-2 (S-75 Dvina/Volkhov; NATO "Guideline")
This veteran SAM is land-transportable on a semi-trailer and can be transferred to the standard single-rd launcher in 12 minutes. Of six versions (**SA-2A/B**

Dvina, SA-2C to F Volkhov), only the **SA-2E** has alternative high-explosive (650 lb) or command-detonated nuclear (15 kiloton) warheads, in a more bulbous nose. Improved guidance on the **SA-2F** (S-75M) offers a home-on-jam capability. About 150 SA-2s are still in service with Air Defense Forces in Russia; replacement by SA-10s is expected to be complete by the end of this decade. **Volga-M** upgrade packages have introduced digital subsystems for improved accuracy, 60 percent less maintenance requirement, fully automatic launch operation, and increased range.

The SA-2's "Fan Song" radar, with a crew of four to six, operates in target-acquisition and automatic-tracking modes. It can track up to six targets simultaneously before switching to automatic tracking and missile guidance against the selected target. Launcher reload takes 12 minutes.

Type: low/high-altitude, transportable SAM.
Power Plant: storable liquid-propellant sustainer; solid-propellant booster.
Guidance: UHF radio command.
Warhead: HE fragmentation (430 lb, except on SA-2E), with proximity and/or command fuzing.
Dimensions (SA-2F): length 35 ft 5¼ in, body diameter (second stage) 1 ft 8 in, wingspan (second stage) 5 ft 7 in.
Launch Weight (SA-2F): 5,040 lb.
Performance (SA-2F): max speed Mach 3.5, slant range 3.7–18.6 miles (41 miles with Volga-M upgrade), effective ceiling 300–98,425 ft.

SA-3 (S-125 Neva; NATO "Goa")

About 100 SA-3 launchers remain operational in Russia, each carrying two or four SAMs. Current versions are the **SA-3A** and **SA-3B**, the latter with improved command guidance. Reload time on four rails is 50 minutes.

The system's P-15M "Squat Eye" early warning and target acquisition radar has a range of 130 miles and is supplemented by PRV-11 height-finding radar. "Low Blow" radar used for target monitoring and missile control has an acquisition range of 68 miles and a tracking range of 25–52 miles. Six targets can be tracked simultaneously and one or two missiles guided. During operations in a dense ECM environment, 15-mile-range TV cameras on the later Low Blow systems provide the fire-control team with the same information as that from the radar without affecting the command guidance function. *(Data for SA-3B.)*

Type: low/medium-altitude, transportable SAM.
Power Plant: two-stage solid-propellant.
Guidance: command.
Warhead: HE fragmentation (132 lb), with Doppler radar proximity and contact fuzing. Lethal burst radius 41 ft.
Dimensions: length 22 ft 0 in, body diameter (second stage, max) 1 ft 2½ in, wingspan (second stage) 4 ft 0 in.
Launch Weight: 2,095 lb.
Performance: max speed Mach 3.5, slant range 1.5–15.5 miles, effective ceiling 165–59,050 ft.

SA-5 (S-200 Angara; NATO "Gammon")

A total of 500 SA-5s are operational in Russia. They exist in three versions:

S-200. Initial production version with HE fragmentation warhead. Length 34 ft 5½ in. Ceiling 65,600 ft. Operational from 1966.

S-200V. As S-200 but with 25-kiloton nuclear warhead. Length 35 ft 5¼ in. Ceiling 95,150 ft. Entered service 1969–70.

S-200D. HE warhead. Length as S-200V. Improved ceiling and terminal guidance. Standard version from 1975.

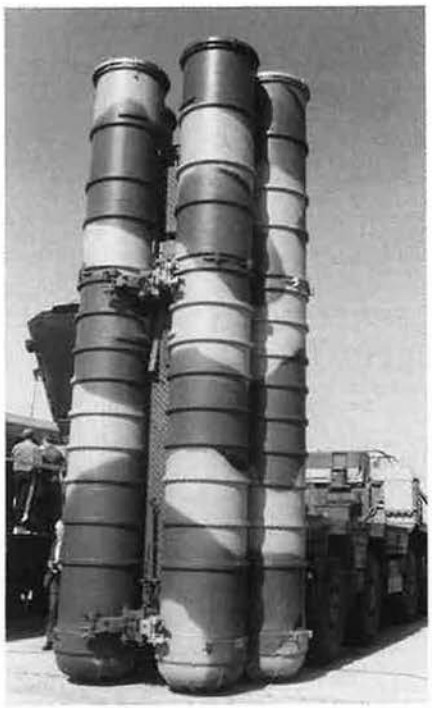
The Russian missiles are deployed in Air Defense Rocket Brigades, made up of battalions of SA-3 and SA-5 launchers, plus 23-mm or 57-mm antiaircraft guns. Each SA-5 battalion has a 200-mile-range P-35M "Bar Lock B" target search and acquisition radar with integral IFF, a 165-mile-range "Square Pair" missile guidance radar, and six single-rail missile launchers. *(Data for S-200D.)*

Type: low/high-altitude SAM.
Power Plant: dual-thrust solid-propellant sustainer; four wraparound solid-propellant boosters.
Guidance: radar command, with active radar terminal homing.
Warhead: HE fragmentation, with proximity and command fuzing.
Dimensions: length 35 ft 5¼ in, body diameter 2 ft 9½ in, wingspan 9 ft 4 in.
Launch Weight: 6,173 lb.
Performance: max speed above Mach 4, slant range 4.35–150 miles, effective ceiling 165–114,800 ft, max target engagement speed Mach 3.7.

SA-6 (3M9 Kub; NATO "Gainful")

The SA-6 self-propelled tactical SAM system consists of a tracked TEL carrying three missiles with integral solid rocket/ramjet propulsion. Many hundred

SA-3B (S-125 Neva-M "Goa")
(Piotr Butowski)



SA-10 (S-300P "Grumble")
(Paul Jackson)

TELs are deployed in Russian antiaircraft regiments, each of which consists of a headquarters with EW, IFF, and height-finding radars, and five SA-6 batteries. Each battery has a 1S91 "Straight Flush" fire-control radar, mounted on the same kind of tracked chassis as the TEL; four SA-6 TELs; and four ZIL 131 TZM reload vehicles, each carrying three missiles. Straight Flush has a surveillance range of 34–46 miles and engagement range of 18 miles. It performs IFF interrogation, target tracking and illumination, and missile radar command guidance functions. Up to three missiles can be guided toward the same target, with a TV tracker available to assist operation in a dense ECM environment. Reloading of the TEL takes 10 minutes. All elements of the SA-6 system are air-transportable.

Type: low/medium-altitude, mobile SAM.
Power Plant: solid-propellant booster; after burnout, its empty casing becomes a ramjet combustion chamber for ram air mixed with the exhaust from a solid-propellant gas generator.
Guidance: radar command; semiactive radar terminal homing.
Warhead: HE fragmentation (123 lb), with proximity and contact fuzing. Lethal burst radius 16 ft.
Dimensions: length 18 ft 8½ in, body diameter 1 ft 1¼ in, wingspan 4 ft 1 in.
Launch Weight: 1,320 lb.
Performance: max speed Mach 2.8, slant range 1.8–15 miles, effective ceiling 330–36,000 ft.

SA-7 (9M32 Strela-2; NATO "Grail")

The initial **SA-7A** version of the shoulder-fired, tube-launched, passive IR homing Grail could be fired only from behind a target at a very hot exhaust area, over a narrow field of fire. From 1971, the **SA-7B** Grail Mod 1 (**9M32M Strela-2M**) offered an extended field of fire of 30° each side of the target's tail, a seeker able to filter out spurious heat sources, including early IR decoys and flares, and an improved warhead. The operator could also have a small passive RF antenna fixed to his helmet, to provide audible warning of an approaching aircraft by picking up emissions from its radar and radar altimeter. Major version from the mid-1970s has been the **SA-7C** Grail Mod 2, with improved launcher and more effective RF detector, mounted forward of the gripstock. The second member of an SA-7 team carries a reload missile. Reload time is six seconds. *(Data for SA-7B.)*

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.5 lb) with contact and graze fuzing.
Dimensions: length 4 ft 8¾ in, body diameter 2⅞ in.
Launch Weight: 21.7 lb. Launcher: 10.9 lb.
Performance: max speed Mach 1.70, slant range 0.5–2.6 miles, effective ceiling 165–7,550 ft.

SA-8 (9M33 Romb; NATO "Gecko")

The original **SA-8A** Gecko Mod 0 (**9M33**) version of this entirely self-contained all-weather low-altitude SAM system carried two pairs of exposed single-stage missiles, ready to fire. The **SA-8B** Gecko Mod 1 (typically **9M33M3**) system has six dual-thrust, increased-performance missiles in launcher/containers. Fire-control equipment and launchers are mounted on a rotating turret, carried by a BAZ-5937 six-wheel, fully amphibious, all-terrain vehicle. The "Land Role" fire-control radar, to the rear of the one-man gunner/radar operator's position, has a 360° scan over a 22-mile range. It folds down behind the launcher, enabling the weapon system to be airlifted in An-22, An-124, and Il-76 transport aircraft. Range of the monopulse tracking radar is 15.5 miles. An LLLTV/optical system assists target tracking in low visibility and dense ECM. Reload time is five minutes.

In Iraqi service, SA-8s destroyed a number of Tomahawk cruise missiles during the Persian Gulf War. *(Data for SA-8A.)*

Type: low-altitude, self-contained, mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: radar command, permitting two missiles to be guided simultaneously against a single target, on different frequencies to complicate ECM.
Warhead: HE fragmentation (42 lb), with proximity and contact fuzing. Lethal burst radius 16 ft.
Dimensions: length 10 ft 4 in, body diameter 8¼ in, finspan 2 ft 1¼ in.
Launch Weight: 286 lb (SA-8B 375 lb).
Performance: max speed Mach 2.4, slant range SA-8A 0.9–7.5 miles, SA-8B 0.9–9.3 miles, effective ceiling 82–16,400 ft.

SA-10 (S-300P; NATO "Grumble")

This weapon is Russia's counterpart to the US Army's MIM-104 Patriot. About 2,075 were in service in 1995, and production is continuing. The SA-10 is effective against targets at heights up to 88,500 ft, including low-flying aircraft, cruise missiles, and reentry vehicles from ballistic missiles in the class of the Scuds used by Iraq in the Persian Gulf War. Deployment of the initial **SA-10A** (Grumble Mod 0) began in 1980. In its **S-300PT** towed form, a regiment comprises three batteries and an F-band 3-D surveillance and tracking radar ("Big Bird") at the command post for long-range target detection. Each battery has an engagement control center, a 3-D CW pulse-Doppler target acquisition radar ("Clam Shell"), an I-band phased-array engagement radar ("Flap Lid A"), and up to 12 four-rail container erector/launchers on semitrailers. These are positioned on concrete pads, and the 5V55K missiles are launched vertically, with ignition after launch. The track-via-missile system guidance enables up to six targets to be engaged simultaneously, with two missiles per target. A launcher can fire missiles at three-second intervals, against targets traveling at up to 2,610 mph. Max range of the SA-10A is 29 miles.

For improved mobility, the land-mobile **S-300PS** version was developed, with the same missiles carried by a four-axle, four-rd 5P85S TEL vehicle. Reload missiles and a "Flap Lid B" planar-array target-tracking and fire-control radar are carried on similar trucks. Readiness to fire is five minutes after the vehicles come to a halt.

Subsequent improvements increased the range of the missiles first to 56 miles with 5V55R missiles, in the **S-300PM/PMU** (**SA-10B** Grumble Mod 1), and then to 93 miles with 48N6 missiles, in the **S-300PMU1** (**SA-10C**), which can engage targets traveling at 6,200 mph. *(Data for SA-10B.)*

Type: all-altitude, fixed-site and mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: radar command and midcourse inertial, with semiactive radar terminal homing and proximity fuzing.
Warhead: HE fragmentation (285 lb).

Dimensions: length 23 ft 4 in, body diameter 1 ft 5¾ in, wingspan 3 ft 3½ in.
Launch Weight: 3,300 lb.
Performance: max speed Mach 6, range 3–56 miles, effective ceiling 80–88,500 ft.

SA-11 (9M38 Buk; NATO "Gadfly")

The SA-11 weapon system progressively replaced SA-4s in army-level missile brigades, and some SA-6As at divisional level, for defense against high-performance aircraft and cruise missiles at low to high altitudes. The 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.

An SA-11 regiment is made up of four batteries, each with six TELs, and similar GM-569 vehicles carrying the two 62-mile-range radars of the regimental target acquisition battery, and reload missiles. The same chassis carries the regiment's long-range early warning radar ("Snow Drift").

Type: low/high-altitude, mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: semiactive monopulse radar command.
Warhead: HE fragmentation (154 lb), with proximity and contact fuzing.
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 2.8, slant range 1.85–20 miles, effective ceiling 50–72,000 ft, max target engagement speed Mach 2.8 (approaching), Mach 1 (receding).

SA-12A (S-300V/9M83; NATO "Gladiator")

The land-mobile tactical SA-12A is intended primarily for use against aircraft and ASMs. All components of the system are based on the tracked MT-T chassis. The four batteries of a typical SA-12 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 headquarters level. Each SA-12A 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 conical SA-12A missile can be readied for launch in 15 seconds. It ignites at a height of about 165 ft after ejection from its launcher. One missile can be fired every 1.5 seconds by each TELAR, with either two missiles from one launcher or four missiles from two launchers directed at each target.

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: 5,300 lb.
Performance: max speed Mach 5.75, slant range 3.7–47 miles, effective ceiling 820–82,000 ft, max target engagement speed Mach 10.

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-rd 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: 10,140 lb.
Performance: max speed Mach 8, slant range 8–62 miles, effective ceiling 3,300–98,400 ft, max target engagement speed Mach 10.

SA-13 (9M37 Strela-10; NATO "Gopher")

SA-13 four-missile tracked launchers of the Russian Army and Naval Infantry were equipped initially with **9M37** missiles, followed by **9M37M Strela-10M2**s, with infrared homing seeker, and all-aspect and IR counter-countermeasures 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 "Dog Ear" acquisition/tracking radar vehicle of the earlier SA-9 missile system 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 well as from observation by UAVs. It has a dual-mode optical photocontrast/IR seeker to improve adverse weather operation. *(Data for 9M37M; 9M333 in parentheses.)*

Type: low-altitude, mobile SAM.
Power Plant: single-stage 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, max target engagement speed Mach 1.25 (Mach 1.6).

SA-14 (Strela-3; NATO "Gremlin")

Compared with the SA-7, the SA-14 shoulder-fired SAM has an uprated rocket motor 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. A second target can be engaged within 35 seconds of the first.

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.2 lb), with contact 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 0.31–2.8 miles, effective ceiling 50–9,840 ft, max target engagement speed Mach 0.9 (approaching), Mach 0.75 (receding).

SA-15 (9M330 Tor; NATO "Gauntlet")

The Tor-M1 highly automated mobile SAM system is immensely more formidable than the SA-8 it is replacing. 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 three-dimensional pulse-Doppler C-band surveillance radar able to detect up to 48 targets over a range of 15 miles. The radar 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 zero to 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, with a range of 12.4 miles, 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 and is supported by a wheeled loader/transporter with two four-rd reload packs that can be installed in less than 20 minutes. There are normally four launch vehicles in each battery.

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 0.9–7.5 miles, effective ceiling 33–19,700 ft, max target engagement speed Mach 2.

SA-16 (9M313 Igla-1; NATO "Gimlet")

The configuration of the third-generation SA-16 is similar to that of the SA-7 and SA-14, but this missile is an entirely new weapon with a conical rose. Deployment time is 13 seconds, and launch time from target acquisition is five seconds. The cooled infrared seeker improves resistance to countermeasures. Maximum target bearing angle for launch is ±40°.

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: HE fragmentation (2.7 lb), with contact 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 0.37–3.2 miles, effective ceiling 33–11,500 ft.

SA-17 (9M38M2 Buk-2M; NATO "Grizzly")

This low/medium-altitude SAM will eventually supersede the SA-11 ("Gadfly"). It has a similar configuration to the SA-11 and is based on a similar tracked vehicle in its domestic form. A major innovation is a new jam-resistant electronically scanned phased-array engagement radar known to NATO as "Chair Back," which has a range of 75 miles and enables four targets to be engaged simultaneously. Other vehicles in the SA-17 system, basically similar to the four-missile TEL, include a mount for the 100-mile range target acquisition radar and a loader/launcher carrying eight missiles but no radar.

Type: low/medium-altitude, mobile SAM.
Power Plant: two-phase solid-propellant.
Guidance: radar command, midcourse inertial, and semiactive radar homing.
Warhead: HE fragmentation (110–155 lb), with proximity and contact fuzing.
Dimensions: length 18 ft 0½ in, body diameter 1 ft 3¾ in.
Launch Weight: 1,587 lb.
Performance: max speed Mach 4, slant range 1.85–31 miles, effective ceiling 33–82,000 ft, max target engagement speed Mach 3.5 (approaching), Mach 1.18 (receding).

SA-18 (9K38 Igla; NATO "Grouse")

The basic **9K38 Igla** fourth-generation shoulder-fired SAM is designed to engage low-flying maneuverable and nonmaneuverable targets and hovering helicopters. Deployment time is 10 seconds, and launch time from target acquisition five seconds. Developed **Igla-2** versions are the **Igla-D** with improved performance and the **Igla-N** with improved lethality. *(Data for 9K38 Igla.)*

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: two-channel infrared passive homing.
Warhead: HE fragmentation (2.8 lb), with contact and graze fuzing.
Dimensions: length 5 ft 7 in, body diameter 2⅞ in.
Launch Weight: 23.4 lb. Launcher 16.4 lb.
Performance: slant range 0.31–3.2 miles, effective ceiling 33–11,500 ft, max target engagement speed Mach 1.18 (approaching), Mach 0.94 (receding).

SA-19 (9M311 Treugolnik; NATO "Grison")

This tube-launched missile forms one element of the 2S6M Tunguska gun/missile tracked regimental air-defense vehicle, designed primarily for use against antitank helicopters. Eight SA-19s are mounted in clusters of four on each side of a turret that also carries four 30-mm guns and "Hot Shot" surveillance, target acquisition, and fire-control radars. A crew of four is standard. Support vehicles include a resupply truck that can load eight missiles and 1,904 rds of 30-mm ammunition in 16 minutes.

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: HE fragmentation (19.8 lb).
Dimensions: length 8 ft 4¾ in, body diameter 6¾ in.
Launch Weight: 93 lb.
Performance: speed Mach 2.65, slant range 1.5–5 miles, effective ceiling 50–11,500 ft.

Pantzyr-S1

This new air defense system, mounted on a Ural 53234 (8x8) cross-country truck chassis, is reported to be ready for production and is offered for export. The truck bed supports a box-like shelter, above which is a 360° rotating turret. On each side of the turret is a cluster of six tube-launched missiles, developed from the SA-19 ("Grison"), and a Type 2A72 30-mm gun. Surveillance radar is carried on top of the turret, with tracking radar and an LLLTV/IR sensor package between the missile clusters. Engagement can be fully automatic, against two targets simultaneously.

Type: tube-launched, low/medium-altitude SAM.
Power Plant: two-stage solid-propellant.
Warhead: HE fragmentation (35 lb).
Dimensions: length 10 ft 6 in, body diameter 6¾ in.
Launch Weight: with container 198 lb.
Performance: speed Mach 3.25, slant range 4,900 ft to 7.5 miles, effective ceiling 10–19,680 ft. ■

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AFA/AEF National Report

By Frances McKenney, Assistant Managing Editor

Eaker Institute to Promote Airpower

At the AFA National Convention last September, the Aerospace Education Foundation's Board of Trustees voted to establish the Eaker Institute for Aerospace Concepts as AEF's policy and research arm, to focus and expand its educational and publishing efforts.

Backed by both AFA and AEF, the institute will promote aviation by hosting discussions among the nation's respected aerospace specialists. It will also publish a series of papers on defense and aerospace issues, conduct colloquia on America's security needs, engage in national policy debates, and sponsor studies on air- and spacepower topics.

According to Phillip E. Lacombe, managing director of AEF and the Eaker Institute, the new organization will fulfill at the national level AEF's mission of educating and informing the public in the same way that AEF has successfully reached schoolchildren through its educator grants and Visions of Exploration program with *USA Today*.

The institute will focus the efforts of AFA and AEF to engage in the public policy debate on critical defense and aerospace issues. To do this, the Eaker Institute will use AFA and AEF staff members and a group of senior fellows selected from the most prominent members of the aerospace community, both military and civilian. Walter E. Scott, AEF President, noted, "We will invite some of the best thinkers from the military, commercial, and civil aerospace communities to join the ranks of our senior fellows. This will be a small group of leaders who are well-known and widely recognized for their creative thinking about aerospace issues—and we will ask these people to address the most important issues facing the Air Force and the nation in defense, aviation, and space."

The institute "will seek to push the envelope of thinking about aerospace—not just informing the American people but giving some visibility to emerging ideas," Mr. Lacombe said. "Our national security, national role, and our leadership in the world are inextricably tied to primacy in the aerospace arena—and we expect to maintain that," he said. "We want to provide the intellectual capital to find the new, more efficient way to handle defense."

USAF photo by A1C Richard E. McSheffrey

AFA National President Doyle Larson (left) and AEF President Walter Scott (right) visited the Mazie V. Gilland Child Development Center at Scott AFB, Ill., highlighting AFA's work with Congress to increase funding for USAF's child development centers. Here, they question Shannon Dauber, a youth programs supervisor, about staff training and activities for the children.

Mr. Lacombe described the new institute's relationship to AEF and AFA as "an expression of our common mission to support the aerospace development of the nation. It is an especially important mission today as we look forward to a new national security era in which our Air Force, and our aerospace resources overall, offer America new, more effective, and more efficient means of accomplishing the national security mission. But we won't be properly postured to take advantage of the opportunities that aerospace will provide unless we have given the American people a chance to appreciate those opportunities."

Just as important, according to Mr. Lacombe, is the need to expand the thinking of the Air Force and other aerospace organizations. "Technology alone does not yield increased capabilities. We also need concepts and doctrine to support exploiting the tremendous advances that aerospace and information technologies are now making possible. And that's where the Eaker Institute will help—by providing a forum for . . . innovative ideas and discussions that will complement the work now being done in the Air Force and elsewhere. We hope to provide a means for developing ideas—a place where new concepts can be developed, articulated, and discussed in depth—and then to make those ideas available to the aerospace community through a special series of papers, which we will call the Eaker Papers. In effect, we intend to provide a forum where alternative discussions can take place."

The institute is named after Lt. Gen. Ira C. Eaker, who commanded Eighth Air Force in World War II and became Chief of the Air Staff in 1945. Before retiring from active duty in 1947, he

helped lay the foundation for the Air Force as a separate service.

Initial funding for the institute came from a $200,000 bequest to AEF from the Eaker estate.

AFA Executive Director John A. Shaud will also serve as the institute's executive director. An executive committee comprised of AEF President Scott, AEF Chairman of the Board Thomas J. McKee, AFA President Doyle E. Larson, and AFA Chairman of the Board Gene Smith will oversee the institute's operations.

Foreign Policy in Dayton

As part of a first-anniversary commemoration of the Dayton peace accord, Deputy Secretary of State Strobe Talbott and Assistant Secretary of State for European and Canadian Affairs John Kornblum served as principal speakers for a day-long foreign policy town meeting in November, sponsored by the **Wright Memorial (Ohio) Chapter,** the Dayton Council on World Affairs, and the University of Dayton.

In the morning session, Mr. Kornblum, who is successor to the chief negotiator of the Dayton peace agreement, Richard C. Holbrooke, recalled a 1988 NATO exercise that considered a theoretical breakup of the former Yugoslavia, an event that was predicted to lead to World War III.

Speaking at a luncheon session, Mr. Talbott shared his observations of the peace negotiations and stressed the importance of the State Department's relationship with the Defense Department.

An audience of 300, including diplomats, community leaders, and news media from around the world, attended the town meeting, held in the same Wright-Patterson AFB hotel ballroom where the historic peace agreement was initialed after 21 days of negotiations. AFA President Larson was among the AFA members present at the town meeting, and Lt. Gen. Lawrence P. Farrell, Jr., Air Force Materiel Command vice commander, represented AFMC.

On Acquisition Reform

Paul G. Kaminski, under secretary of defense for Acquisition and Technology, spoke to a dinner in Fort Worth, Tex., sponsored by the National Contract Management Association, the Navy League, and the **Fort Worth Chapter.**

According to Chapter President David Olson, Dr. Kaminski spoke about acquisition reform issues, including DoD's Block Change policy to streamline or eliminate multiple processes in business, manufacturing, and management and the single process initiative that implements Block Change proposals.

In addition to helping plan this event, a large contingent of chapter members were among the 300 guests at the dinner. They included Albert Leferink, Jr., treasurer; Jacob M. Huffman III, vice president for Aerospace Education; Clyde E. "Gene" Gulick, vice president for Membership. Bryan L. Murphy, Jr., National Director; L. B. "Buck" Webber, former National Vice President (Southwest Region); Charles G. Kucera, and Frederick R. Stephen.

Dr. Kaminski was in Fort Worth to meet with defense contractors and to take a firsthand look at Lockheed Martin Tactical Aircraft Systems, which has carried out seven Block Changes in such areas as software and military-quality system requirements.

Photo courtesy of Jim Wilson

National Director O. R. Crawford (left) helped gain official USAF award recognition for the Flying Tigers, including John Rossi (second from left) and David Lee "Tex" Hill (third from left). USAF Chief of Staff Gen. Ronald Fogleman (right) said he was honored to present the decorations.

Flying In for the Flying Tigers

In December, USAF Chief of Staff Gen. Ronald R. Fogleman attended a Flying Tigers reunion in Dallas, Tex., where he awarded Distinguished Flying Crosses to Flying Tigers pilots and Bronze Stars to their ground crew members.

The American Volunteer Group, nicknamed the "Flying Tigers" because of the tiger shark faces painted on their aircraft, was formed to defend the Burma Road as part of US military assistance to China in 1941. Hired on one-year contracts, the American pilots destroyed nearly 300 Japanese aircraft before being integrated into Fourteenth Air Force in July 1942.

USAF had not officially recognized the Flying Tigers' contributions because they were not originally a part of the US military, but that was

Rep. James Moran (D-Va.) and Thad Wolfe (right), chairman of AFA's Veterans/Retiree Council, met to discuss Mr. Moran's bill to extend the Federal Employees Health Benefits Program to eligible military retirees and their families. AFA supports seamless health-care benefits that do not end at age 65.

changed through the efforts of **Austin (Tex.) Chapter's** O. R. Crawford, a National Director and former AFA President and Chairman of the Board. In September 1995, he wrote a letter to Air Force Secretary Sheila E. Widnall, suggesting that the service honor the surviving Flying Tigers and their ground crews with an award. In April 1996, after the awards were approved, he also invited General Fogleman to the formal presentation.

Hosted by Flying Tigers veteran Charles R. Bond of the **Dallas Chapter,** the reunion featured, in the skies above the Cavanaugh Flight Museum in Dallas, a typical World War II interception: a Japanese Zero (Confederate Air Force replica) with two P-40 Warhawks on its tail. Mr. Crawford piloted a P-40 during one of these aerial demonstrations.

The awards presentation came at a gala held December 8. Along with more than 30 Flying Tigers veterans, Flying Tigers' spouses, children, and even grandchildren accepted the DFCs and Bronze Stars for deceased family members. The program also featured speeches by General Fogleman and by former Flying Tigers fighter pilot Gen. Bruce K. Holloway, USAF (Ret.).

Holloway Scholarship Awarded

In December, General Holloway presented a $1,000 Gen. Bruce K. Holloway Scholarship to AFROTC Cadet Katharine Weimer Wolf of Det. 159, University of Central Florida, in Orlando, Fla.

The scholarship is sponsored by the **Central Florida Chapter** as part of a $150,000 scholarship fund established in 1993. The fund provides for $12,000 annually to be given as scholarships to the detachment's cadets.

Cadet Wolf, who has since gone on active duty, was selected for the Holloway Scholarship because of her class rank, grade point average, leadership, and activities.

Following the presentation of the Holloway Scholarship at a change-of-command ceremony at the university, Richard A. Ortega, the chapter's vice president for Aerospace Education, awarded 11 scholarships to other detachment cadets. The unit averages 120 cadets during its fall semester.

Mr. Ortega also recently presented the AEF 1995–96 AFJROTC National Video Contest third-place award plaque to the AFJROTC unit of Forest High School in Ocala, Fla. Cadet Col. Benjamin Bristo, unit commander, and Lt. Col. Bronislaw F.

Information Please

Specific AFA departments are accessible through e-mail, using a department abbreviation followed by **afa.org.** Some examples of addresses are:

Membership Services.... **MbrServ@afa.org**

National Defense Issues..... **NDI@afa.org**

Communications..... **COM@afa.org**

Air Force Magazine..... **MAG@afa.org**

Now, AFA also has an e-mail address to use when you don't know exactly who can answer your question. AFA members can send e-mail to this address with the assurance that it will be promptly relayed to the right department:

information@afa.org

The latest recipient of the Gen. Bruce K. Holloway Scholarship, AFROTC Cadet Katharine Weimer Wolf (second from right), received congratulations from (left to right) Richard Ortega of the Central Florida Chapter, retired USAF General Holloway, and Lt. Col. Lee Glaser, AFROTC Det. 159 commander.

Wright Memorial (Ohio) Chapter President Ken Wheeler (center) thanked John Kornblum (right), assistant secretary of state for European and Canadian Affairs, and Deputy Secretary of State Strobe Talbott for participating in a foreign policy town meeting sponsored by the chapter and other organizations.

Baranowski, USAF (Ret.), the unit's aerospace science instructor, accepted the award at their annual military ball. The unit's winning video documented the cadets' 2,000 hours of community service, showing scenes from projects that included a "fun run" to raise money to send terminally ill children to camp, landscaping work at a Marion County, Fla., association, and construction on a Habitat for Humanity house.

Security Police at the Olympics

When a pipe bomb exploded at Centennial Olympic Park in Atlanta, Ga., on July 27, MSgt. Robert S. Hall was two blocks away, and though he had already been on duty with other Olympic security forces for 10 hours, he worked for another eight, helping with crowd control and evacuating thousands of people from a six- to eight-block area around the blast site.

Sergeant Hall and CMSgt. Oren W. McClure of the 147th Security Police Squadron, 147th Fighter Wing (ANG), at Ellington Field, Tex., recently spoke to a meeting of the **San Jacinto (Tex.) Chapter** about their experiences as SPs at the Olympics.

Now retired from a full-time ANG position as chief enlisted manager of the 147th Security Police Squadron, Chief McClure said he was chosen to develop the ANG portion of SP support for the Olympics because of his experience in helping to handle security for high-profile events, such as the Republican National Convention and visits to Houston by foreign dignitaries. For Chief McClure, the 1996 Olympics began in February, when he was sent to ANG headquarters in Arlington, Va., to find 1,200 SP volunteers from around the country. In-

cluding Chief McClure, 18 volunteers came from the 147th FW.

Security work included supporting the Atlanta police department by directing automobile and pedestrian traffic, keeping the crowd orderly in various event venues, incident control, and evacuating areas because of bomb threats, Sergeant Hall said.

Reunion at Carlsbad

In World War II, they had come from all points in the US for bombardier training at Carlsbad AAF, N. M. On December 7, 1996, more than two dozen of them gathered again at the old AAF site, now Cavern City Municipal Airport, to dedicate a display by the Carlsbad Museum and Art Center, commemorating their bombardier training in New Mexico from 1942 to 1945.

Photos by Kathy Snodgrass

Through the generosity of National Director Jack Gross, headquarters staff members (at top, l–r) Sherryl Coombs, Pam Braithwaite, Linda Swan, and Kevin Baker were honored as employees of the quarter in 1996. Ms. Coombs was also named employee of the year. The award program marked its fifth year in 1996. Ms. Coombs, David Huynh, Gilbert Burgess, Jancy Bell, and Doreatha Major (above, l–r) have each been an employee of the year, selected for job performance, initiative, cooperation, and teamwork.

Coming Events

March 22, **Lousiana State Convention,** Shreveport, La.; May 2–3, **South Carolina State Convention,** Clemson, S. C.; May 16–17, **Tennessee State Convention,** Chattanooga, Tenn.; May 30–31, **Alabama State Convention,** Birmingham, Ala.; June 6–8, **New York State Convention**, Niagara Falls, N. Y.; June 20–21, **Arkansas State Convention,** Hot Springs, Ark.; July 11–12, **Colorado State Convention,** Colorado Springs, Colo.; July 18–19, **Kansas State Convention,** McConnell AFB, Kan.; July 18–20, **Texas State Convention,** Fort Worth, Tex.; July 25–26, **Mississippi State Convention,** Biloxi, Miss.; July 25–27, **Florida State Convention,** Panama City, Fla.; July 25–27, **Pennsylvania State Convention,** Pittsburgh, Pa.; August 9–10, **Iowa State Convention,** Cedar Rapids, Iowa; August 14–17, **California State Convention,** Riverside, Calif.; August 15–16, **Oklahoma State Convention,** Oklahoma City, Okla.; August 16, **Connecticut State Convention,** East Hartford, Conn.; August 16, **Indiana State Convention,** Indianapolis, Ind.; September 15–17, **AFA National Convention and Aerospace Technology Exposition,** Washington, D. C.

Charles G. Thomas, New Mexico State President, arranged to have as guest speaker at the ceremony Maj. Gen. George B. Harrison, commander of the Air Force Operational Test and Evaluation Center at Kirtland AFB, N. M.

Carlsbad AAF bombardier graduates who gathered at the airport in December came from as far away as New Hampshire and Florida. They included Roger K. Myers from the **Fort Wayne (Ind.) Chapter,** Vincent T. Scarano from the **Bob Hope (Calif.) Chapter,** who donated copies of photographs he took at Carlsbad in 1944 and 1945 and a copy of his graduation announcement, and Arthur R. Thompson, Jr., from the **Austin (Tex.) Chapter.** After graduation from Carlsbad in 1944, Mr. Thompson went on to become a B-17 bombardier with the 351st Bomb Squadron, 100th Bomb Group, in the UK. He donated two yearbooks, photos, and other memorabilia to the display.

Museum board member Melvin M. Vuk of the **Fran Parker (N. M.) Chapter** said the bombardier display is a large, glass-enclosed case located in the airport's waiting room. In the case is a life-size model of a bombardier in

World War II flying clothes, hunched over a Norden bombsight, a blue practice bomb that the students trained with, an AT-11 model, instruction manuals, yearbooks, uniform items, photos, and other memorabilia.

Visions in South Carolina

The **Columbia (S. C.) Chapter** recently received a packet of 30 thank-you notes from fourth grade students at Lexington (S. C.) Elementary School, who are participating in the *USA Today*–AEF Visions of Exploration program.

Chapter President Roger Rucker, an aerospace science instructor at Lexington High School, said the students wrote about how the Visions activities enlivened their school routine and about how much they enjoyed reading the newspaper and *Air Force* Magazine, which he forwards to the classrooms each month.

The chapter first started the Visions program in fall 1995 with five classrooms. This year, 15 classrooms of 350 fourth and fifth graders are participating. Mr. Rucker plans to sponsor the program at a second school this year. He said Visions of Exploration allows his chapter to "get the word out in the community about AFA and the Air Force." By direct contact with young students, he said, AFA "plants the seed early."

Appreciation for the ANG

At a formation of the 107th Air Control Squadron (ANG) in Phoenix, Ariz., in December, Arthur W. Gigax, **Phoenix Sky Harbor (Ariz.) Chapter** president; Tom Molloy, state vice president; and Glenn O. Plaumann, state vice president for communications, presented Lt. Col. Michael G. Colangelo, the unit commander, with a plaque of appreciation. The award recognized the squadron's part in Operation Deny Flight, enforcing the no-fly zone over Bosnia-Hercegovina.

The 107th had just begun operation of a radar surveillance and electronic data-processing site at Jacotenente, Italy, in June 1995 when Capt. Scott F. O'Grady's F-16 was shot down by a Bosnian Serb platform-launched SA-6 antiaircraft missile during a Deny Flight mission. The 107th was responsible for cycling fighter and tanker aircraft over the Adriatic where they loitered during the six days before Captain O'Grady was rescued.

Also in December, Mr. Gigax, Mr. Plaumann, and State President Raymond D. Chuvala helped the 161st Air Refueling Wing (ANG) of Sky Harbor IAP, Ariz., celebrate its fiftieth anniversary by presenting its commander, Col. William R. Sherer, with a plaque of appreciation. More than 500 guests attended the celebration.

The 161st ARW was the lead unit for aerial refueling of aircraft on Deny Flight missions during June and July 1995. Operating out of Pisa, Italy, the unit flew 197.4 hours.

More Chapter News

Now they can drive it. Last fall, the Oklahoma state legislature authorized license plates decorated with the AFA logo and emblazoned with "Oklahoma Air Force Association." The **Tulsa (Okla.) Chapter's** Vice President for Government Affairs Charles R. Ford, who is also a state senator, lobbied successfully to get the state to adopt this license plate option. George Briedenback, the chapter's vice president for Communications, designed the tag. It will cost $7 above the basic license plate fee. At the National Convention last September, Oklahoma's representatives, including former AFA National President Harold C. Stuart, showed off the plate to Secretary of the Air Force Sheila E. Widnall and AFA Chairman of the Board Gene Smith.

The **Panhandle AFA (Tex.) Chap-**

ter recently presented two replica ceremonial rifles to the AFJROTC unit of Palo Doro High School in Amarillo, Tex. The rifles will be used for cadet training. The unit's aerospace science instructor, chapter member Donald P. Chapman, said the chapter has been a strong supporter of the cadets, donating aircraft models to the school, inviting the color guard to perform at chapter functions, and sponsoring cadets at awards banquets. Chapter President Guy W. Leach and Barry L. Smith presented the rifles to JROTC Cadet 1st Lt. José Serrano.

Nine high schools competed in the second annual statewide Eagle Drill Classic, sponsored by the **Delaware Galaxy Chapter** in November. This time, the event took place at the Dover AFB Museum and included armed and unarmed regulation drill, an inspection and color guard competition, and a knockout drill. A Navy JROTC unit from Newark High School in Newark, Del., took home the trophy for the competition's overall winner.

Last summer, Civil Air Patrol Lt. Col. Samuel S. Conte of the **Fort Wayne (Ind.) Chapter** was readying his CAP cadets to march in a parade when a horse in their assembly area became skittish. During efforts to calm the animal, the 72-year-old woman who owned the horse got tangled in its reins as she stood on the ground. Mr. Conte ran over and cut the woman free with a knife, but then the horse reared and kicked him in the head. He was knocked to the ground when the horse landed. For his quick thinking, Mr. Conte received a plaque at the chapter's awards banquet.

One of USAF's 12 Outstanding Airmen for 1996, SSgt. Brian D. Lavoie, spoke to the **Central Oklahoma (Gerrity) Chapter** in November, describing his activity-filled week at the National Convention in September. This was the second consecutive year a chapter member won an Outstanding Airman award. TSgt. Frederick W. Green of the 772d Civil Engineering Squadron was among those receiving the honor in 1995. ■

Unit Reunions

AIRBALTAP (Allied Air Forces, Baltic Approaches) personnel, 1960s. September 9–14, 1997, in Viborg, Denmark. **Contact:** Daniel F. Anderson, 148 Bay Dr., Hendersonville, TN 37075. Phone: (615) 824-4361.

Air Force Navigators/Observers Ass'n. October 1–5, 1997, at the Best Western Le Baron Hotel in Colorado Springs, Colo. **Contacts:** Philip W. Foster, 14535 Timberedge Lane, Colorado Springs, CO 80921-2963. Phone: (719) 488-2670. Van A. Keriakos, 47644 Sandbank Sq., Sterling, VA 20165-7464. Phone: (703) 404-0530.

Anzio Beachhead Veterans, all services (World War II). April 30–May 3, 1997, at the Hilton Hotel in Jacksonville, Fla. **Contact:** John Hohl, 2633 Loretto Rd., Jacksonville, FL 32223-1318. Phone: (904) 268-5002.

Aviano Reunion Ass'n. August 12–14, 1997, in Cheyenne, Wyo. **Contact:** Brice Headley, 4509 Southampton Ct., Tampa, FL 33624-4363. Phone: (813) 961-1418.

B-52 Stratofortress Ass'n. September 20, 1997, in Atwater, Calif. **Contact:** Col. Wayne C. Pittman, Jr., USAF (Ret.), 498 Carthage Dr., Beavercreek, OH 45434-5865.

"Coconut Heads" and "Gooney Hens," Christmas Island (World War II). September 11–14, 1997, in Livermore, Calif. **Contact:** D. C. Allen, 1076 Via Madrid, Livermore, CA 94550. Phone: (510) 447-6096.

F-86 Sabre Pilots, N. C. ANG. June 20–21, 1997, in Charlotte, N. C. **Contact:** Lt. Col. Bill Allen, USAF (Ret.), 3318 Woodleaf Rd., Charlotte, NC 28205. Phone: (704) 536-3170.

"Flying Tigers," American Volunteer Group (1941–42), China Air Task Force (1942–43), and 14th Air Force (1943–45). June 5–8, 1997, at the Marriott Crystal Gateway in Arlington, Va. **Contact:** Robert M. Lee, 717 19th St. S., Arlington, VA 22202-2704. Phone: (703) 920-8384.

Santa Ana AAB Wing (World War II). April 26, 1997, at Orange Coast College in Costa Mesa, Calif. Personnel, former cadets, friends, and guests are welcome. **Contact:** SAAAB Wing, P. O. Box 1764, Costa Mesa, CA 92628. Phone: (714) 631-5918.

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.

Sequoia and Rankin Fields, Calif. May 30–June 1, 1997, at the Visalia Convention Center, Sequoia and Rankin Fields, and Mooney Grove Park, Calif. Cadets, flight instructors, and support personnel involved in the World War II pilot training programs at these fields are invited. **Contacts:** Bill Borrego, 17182 Barcelona Lane, Huntington Beach, CA 92647. Phone: (714) 842-2042 (Rankin alumni). Bruce Baird, 9322 Melba Dr., Garden Grove, CA 92841. Phone: (714) 539-9747 (Sequoia alumni).

Base Air Depot 2 Ass'n, Warton, UK (1942–46). October 23–26, 1997, in Fort Worth, Tex. **Contact:** Dick McClune, 527 Quarterfield Rd., Newport News, VA 23602-6140. Phone: (804) 877-3826.

2d Air Division Ass'n, 8th Air Force. May 23–26, 1997, at the Hyatt Regency Irvine in Irvine, Calif. **Contact:** Evelyn Cohen, 06-410 Delaire Landing Rd., Philadelphia, PA 19114. Phone: (215) 632-3992.

9th Photoreconnaissance Squadron, CBI (World War II). September 17–21, 1997, in Houston, Tex. **Contact:** Philip O. Robertson, 1950 Universal City Blvd. #911, Universal City, TX 78148-3347.

20th Fighter Wing. October 1–5, 1997, in Myrtle Beach, S. C., **Contact:** Robert "Nub" Shofner, 118 Reynolds Rd., Sumter, SC 29150. Phone: (803) 773-7060.

20th and 81st Tactical Fighter Wings, RAF Woodbridge, UK (1950–70). October 9–11, 1997, in Dayton, Ohio. **Contact:** Donald Reno, 14226 Lithgow St., Dearborn, MI 48126. Phone: (313) 945-6228.

27th Air Transport Group, including 310th, 311th, 312th, and 325th Ferrying Squadrons; 86th, 87th, 320th, and 321st Transport Squadrons; and 519th and 520th Service Squadrons. September 25–27, 1997, in Warner Robins, Ga. **Contact:** Fred Garcia, 11903 N. 77th Dr., Peoria, AZ 85345. Phone: (602) 878-7007.

31st Fighter Officers Ass'n. April 23–26, 1997, at the Palace Station Hotel and Casino in Las Vegas, Nev. **Contact:** Richard A. "Rocky" Eubank, 10515 River Plantation Dr., Austin, TX 78747. Phone: (512) 282-1077.

Aviation Cadet Classes 52-14C and 52-I (Ellington and Waco Fields, Tex., and Mather AFB, Calif.). September 4–7, 1997, in Pittsburgh, Pa. **Contact:** Robert L. Etter, 2386 Jenkinson Dr., Pittsburgh, PA 15237-6620. Phone: (412) 366-6132.

76th Troop Carrier Squadron (World War II). September 25–29, 1997, at the Best Western Hanalei Hotel in San Diego, Calif. Other squadrons of the 435th Troop Carrier Group are welcome. **Contact:** Al A. Forbes, 1614-B Berwick Ct., Palm Harbor, FL 34684. Phone: (813) 785-6075.

78th Fighter Squadron (World War II). July 11–15, 1997, in Milwaukee, Wis. **Contact:** Kenneth J. Sweet, 4045 S. 54th St., Milwaukee, WI 53220. Phone: (414) 541-4015.

140th Aeromedical Evacuation Squadron, 148th Fighter Squadron, 168th Air Transport Group, 193d Tactical Electronic Warfare Group, and 193d Special Operations Wing, fiftieth anniversary. May 2–3, 1997, in Reading and Harrisburg, Pa. **Contact:** Kris Kollar, 193d SOW, 81 Constellation Ct., Middletown, PA 17057. Phone: (717) 948-2320.

310th Pursuit and Fighter Squadrons (World War II), 310th Fighter-Bomber Squadron (Korea), and 310th Fighter Squadron (Luke AFB,

Unit Reunions

Ariz.). June 19–22, 1997, in San Diego, Calif. **Contact:** Tom Wellbaum, 8444 W. Seldon Ave., Peoria, AZ 85345-7935. Phone: (602) 878-7461.

368th Fighter Group (World War II). October 13–17, 1997, at Fort Magruder Inn in Williamsburg, Va. **Contact:** Randolph Goulding, 2000 Clearview Ave. N. E., Atlanta, GA 30340. Phone: (770) 455-8555 or fax: (770) 455-7391.

388th Bomb Group Ass'n, 3d Air Division, 8th Air Force, Station 136, Knettishall, UK (1943–45). September 17–20, 1997, in Savannah, Ga. **Contact:** Lt. Col. Robert E. Simmon, USAF (Ret.), 101 Charlotte Dr., Cabot, AR 72023-8847. Phone: (501) 988-1486.

394th Bomb Group (World War II). September 17–21, 1997, in Colorado Springs, Colo. **Contact:** John C. Beale, 4206 Shadow Oak Woods, San Antonio, TX 78249-2038. Phone: (210) 493-0221.

398th Bomb Group Memorial Ass'n, 1st Air Division, 8th Air Force, Nuthampstead, UK. July 16–19, 1997, in Spokane, Wash. **Contact:** George R. Hilliard, 7841 Quartermaine Ave., Cincinnati, OH 45236-2313.

433d Troop Carrier Group, including the 65th, 66th, 67th, 68th, 69th, and 70th Troop Carrier Squadrons, 5th Air Force. September 30–October 4, 1997, at the Embassy Suites in Colorado Springs, Colo. **Contact:** Ted Casper, 4164 Inverrary Dr., #12-414, Lauderhill, FL 33319. Phone: (954) 484-7230.

446th Bomb Group, 8th Air Force, UK (World War II). May 7–11, 1997, at The Menger Hotel in San Antonio, Tex. **Contact:** John F. White, 408 Willow Ridge Rd., Fort Worth, TX 76103. Phone: (817) 457-5715.

467th Bomb Group Ass'n. September 23–28, 1997, at the Nevele Hotel in Ellenville, N. Y. **Contact:** Walter J. Mundy, 24030 Basin Harbor Ct., Tehachapi, CA 93561. Phone and fax: (805) 821-5816.

483d Bomb Group Ass'n and 566th Air Engineers (World War II). September 3–7, 1997, in Atlanta, Ga. **Contact:** J. Adair McCord, 3102 Stewart Ave., Hapeville, GA 30354. Phone: (404) 767-1546 or fax: (404) 767-1588.

622d Air Refueling Squadron, England AFB, La. May 1–3, 1997, at the Holiday Inn in Fort Walton Beach, Fla. **Contact:** Maurice E. Ray, 2428 Edgewater Dr., Niceville, FL 32578-2305. Phone: (904) 678-3028.

7167th Special Air Missions Squadron and associated air evacuation personnel. October 19–22, 1997, at the Golden Nugget Hotel and Casino in Las Vegas, Nev. **Contact:** Neil Ferryman, 2432 Legacy Island Cir., Henderson, NV 89014. Phone: (702) 897-1593.

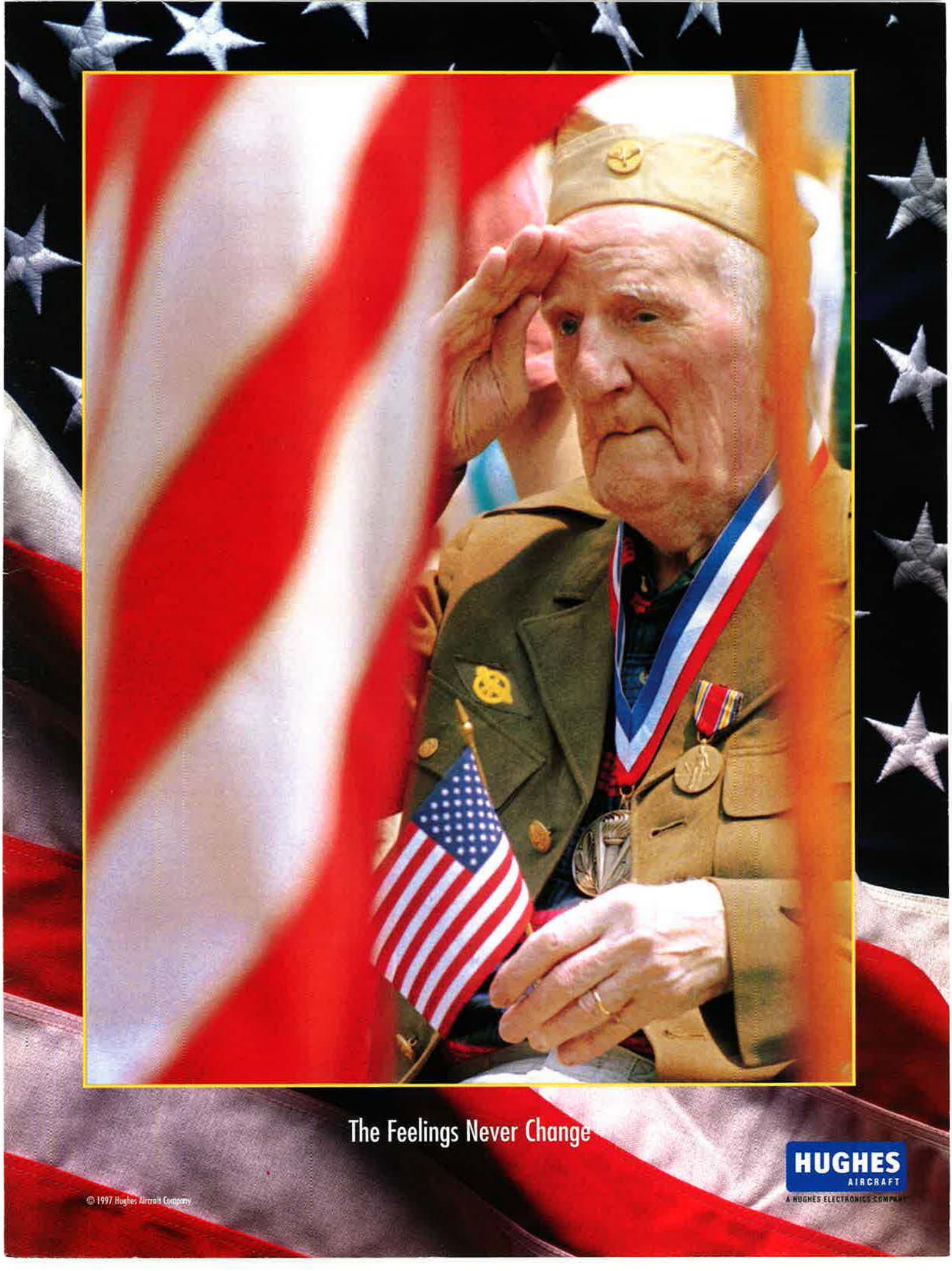
USAF Security Service Communications Security squadrons. Seeking personnel who served in COMSEC, which was assigned to USAF Security Service (USAFSS), to compile a membership or reunion roster. **Contact:** Richard J. White, 5301 Northwood Lake Dr. W., Northport, AL 35476. Phone: (205) 339-2519.

Pilot Class 58-G, Bryan AFB, Tex. Seeking members for a reunion in October 1997 at Kelly AFB, Tex. **Contact:** Loring R. Astorino, 1395 Fruitland Ave., Atwater, CA 95301. ■

Photography by Paul Kennedy

On Wings of Mercy

Starting in December 1942, flight nurses were trained at what was to become the Army Air Forces School of Air Evacuation, Bowman Field, Ky., and promptly deployed to every theater where American soldiers were fighting the enemy. Transport and cargo aircraft often would fly in with troops and be rapidly converted for air medevac. Because these planes had no medical markings, they were fair game to the enemy on their return trip. In their mission to care for the wounded and the dying, AAF flight nurses wore regular-issue khakis, flew "the Hump," were shot at, and survived crash-landings. With bravery and dedication, they helped pave the way for all women in uniform.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