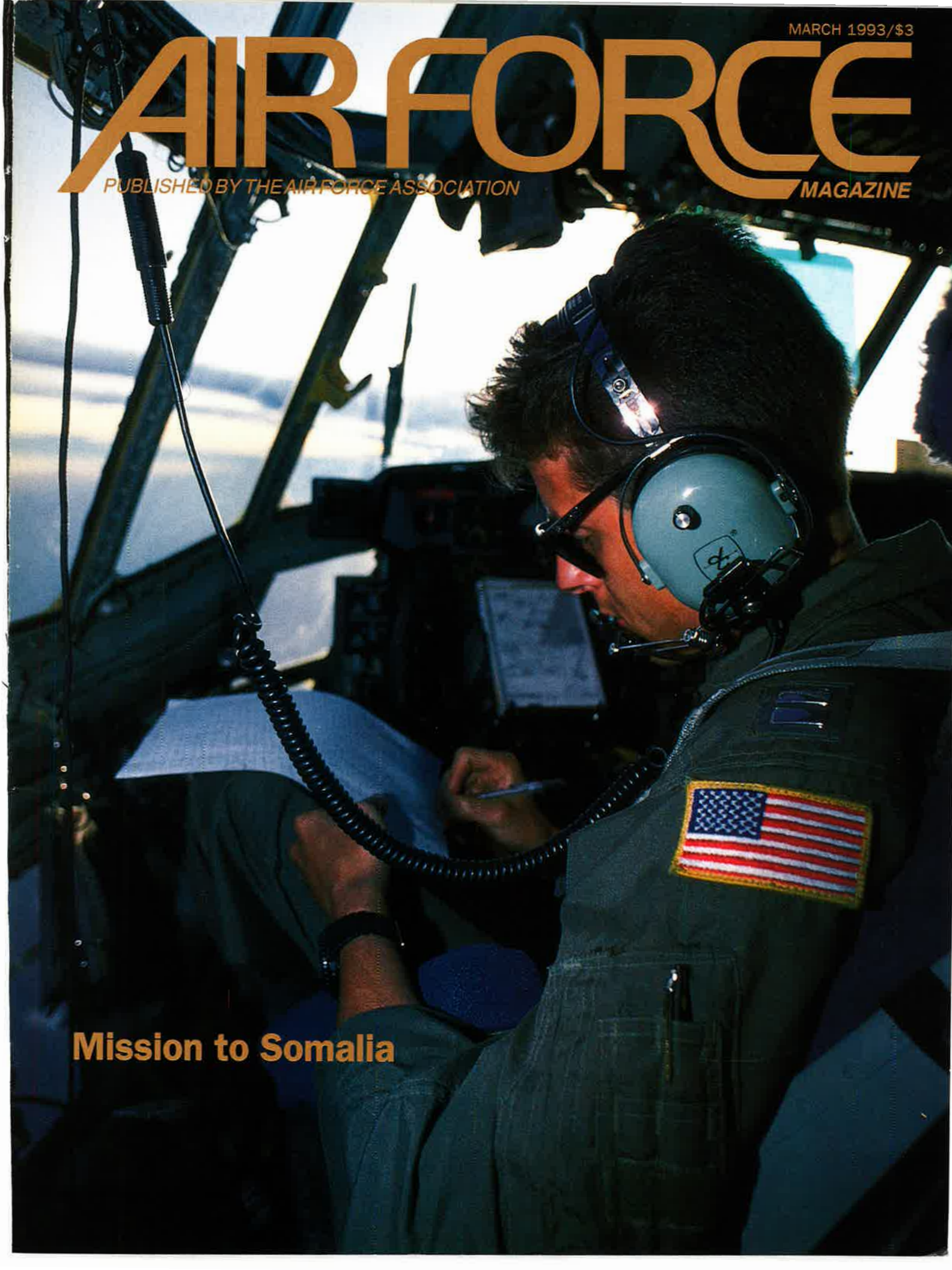
MARCH 1993/$3

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



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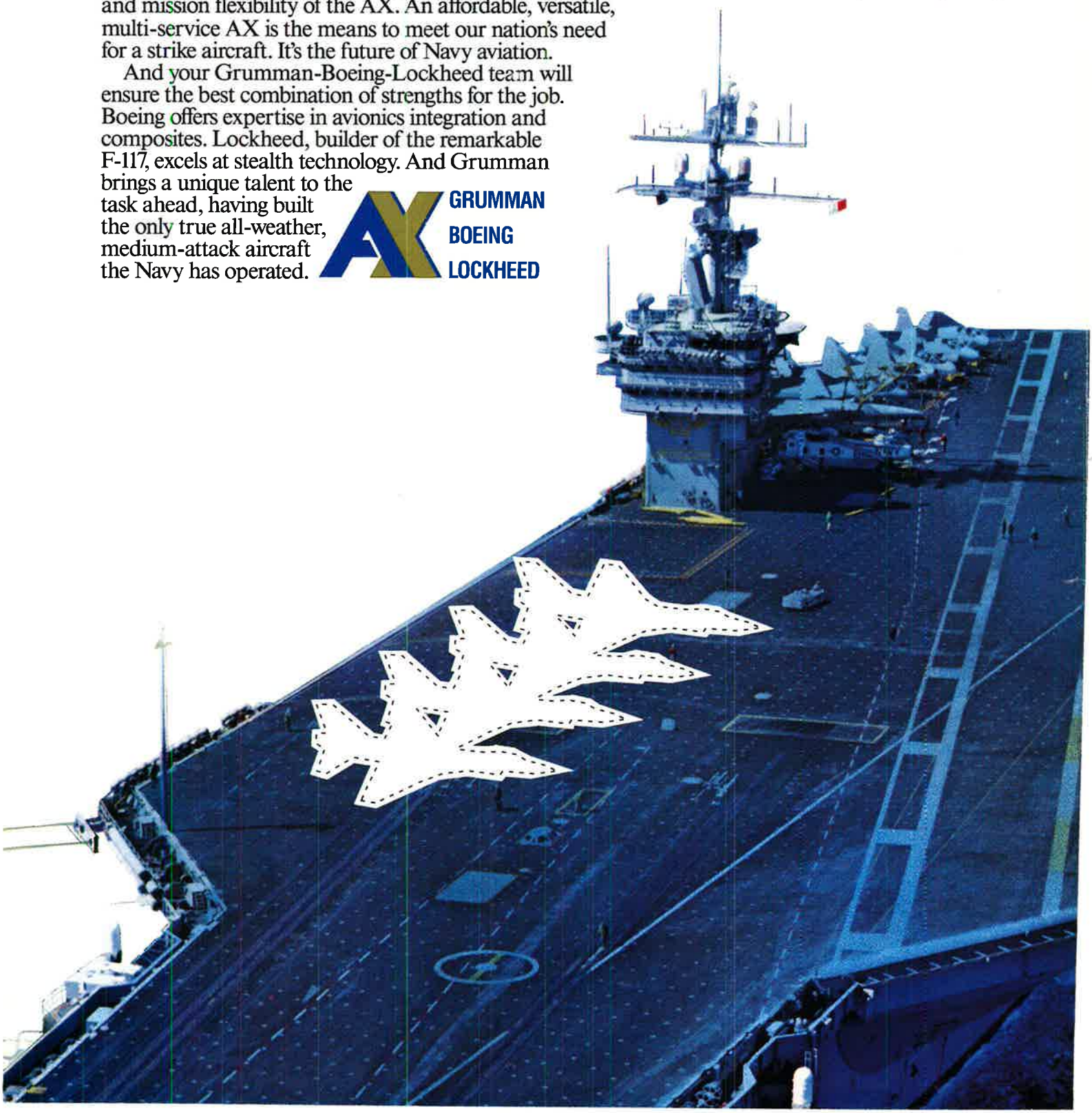

March 1993, Vol. 76, No. 3

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

About the cover: Capt. Courtney J. Arnold of the 772d Airlift Squadron, 463d Airlift Wing, Dyess AFB, Tex., completes a checklist en route to Baidoa, Somalia.

AIR FORCE Magazine (ISSN 0730-6784) March 1993 (Vol. 76, No. 3) is published monthly by the Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Phone (703) 247-5800. Second-class postage paid at Arlington, Va., and additional mailing offices. **Membership Rate:** $25 per year; $60 for three-year membership. **Life Membership:** $400 single payment, $420 extended payments. **Subscription Rate:** $25 per year; $25 per year additional for postage to foreign addresses (except Canada and Mexico, which are $3 per year additional). Regular issues $3 each. Special issues (USAF Almanac issue and Anniversary issue) $5 each. **Change of address** requires four weeks' notice. Please include mailing label. **POSTMASTER:** Send changes of address to Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. Publisher assumes no responsibility for unsolicited material.

Editorial

By John T. Correll, Editor in Chief

Battle of the Ban

Three days before his inauguration, Bill Clinton met with his aides to approve a strategy to allow declared homosexuals in the armed forces. Within the week, however, the plan, drafted by Defense Secretary designate Les Aspin, leaked to the press.

Public protest was immediate. It swept virtually everything else off the agenda in official Washington. Telephone calls—hundreds of thousands of them, overwhelmingly in disagreement with the President—swamped White House and Capitol Hill switchboards. Democratic leaders in Congress warned Mr. Clinton that legislative support for his plan would be thin.

The blow the Administration felt most was from Sen. Sam Nunn (D-Ga.), chairman of the Armed Services Committee. In a ringing speech to the Senate, he recited a long list of unanswered questions about the effect on military readiness, morale, discipline, recruiting, and retention. He said he would hold hearings in March and that "the people who will be most directly affected," men and women from the ranks of the armed forces, would have a chance to state their views.

President Clinton has modified his tactics. The ban on gays in the military remains in effect (although recruits will not be asked about their sexual orientation) for six months while "practical problems" are explored. By July 15, Secretary Aspin is to submit a draft executive order that would lift the ban. Mr. Clinton, demonstrably grieved by the compromise, declared, "I haven't given up on my real goals."

Military leaders have told the President that they believe removing the ban will do enormous damage to troop morale and unit integrity. Veterans groups, representing millions of people who have served in the military, have cautioned Mr. Clinton that he is building a disaster.

To a degree that nonveterans may not comprehend, military life is different from a civilian job. The government determines where the troops go, where they can reside, and, in many instances, with whom they share close quarters. Unlike civilian workers, they cannot quit and leave, no matter how intolerable they find the circumstances. "What accommodation, if any, should be made to a heterosexual who objects to rooming or sharing bathroom facilities with a homosexual?" Senator Nunn asked.

Lifting the ban on gays would knock the armed forces for a very big loop for a very long time.

No one seriously doubts the importance of morale and unit integrity. It is also generally recognized that the cohesiveness of a military unit depends principally on the loyalty and regard that members have for each other. President Clinton seems ready to sacrifice these considerations for what he perceives as a greater good.

As President Clinton, Senator Nunn, and others remind us, homosexuals have served and are serving today in the armed forces. Few of them, however, insisted on announcing their orientation. It was not a big issue. Mr. Clinton's determination to lift the ban is converting a lot of people from passive acceptance to active opposition. They aren't sure where his policy is heading, and they don't believe that he is sure either.

Mr. Clinton emphasizes that the only change he proposes is freedom for homosexuals to declare themselves. Rep. Barney Frank (D-Mass.) says that "there are not going to be gay pride parades on bases." These assurances are not convincing.

Mr. Clinton insists that homosexual rights are fundamental and undeniable. If so, on what basis will he abridge them? If the right is that fundamental, then what precludes gay pride parades? How could homosexuals be prohibited from public displays of affection of the kind allowed for heterosexuals? If homosexual partnerships have legal standing—and in some jurisdictions they do—is there an entitlement to family housing?

Gay rights activists sneer at questions like these, but a mainstream objective of the gay rights movement in society at large is the securing of precisely such rights. Furthermore, the real reason why many activists are attacking the military ban is to advance that broader gay movement, not to establish their right to bear arms in the nation's defense. A January 14 Congressional Research Service report noted the "argument" that "recognition by a major federal institution, *i.e.,* the military, would enhance and provide support for greater recognition of homosexuals' rights."

Admission to the armed forces is not automatic for all citizens. The Air Force, for example, accepts only about a third of those who seek enlistment. The services cannot—and do not—violate legitimate civil rights in deciding which applicants to turn away. In Mr. Clinton's view, homosexual discrimination is on a par with racial discrimination. That, however, is a political assumption, not a principle that has been either established or accepted by the public.

To still the protest and avoid a defeat by Congress, Mr. Clinton will now study the kinds of questions posed by Senator Nunn, but he does not seem very interested in the answers. The new President has yet to demonstrate convincingly that defense and the armed forces count for much in his estimation.

Senator Nunn put it well: "When the interests of some individuals bear upon the cohesion and effectiveness of an institution on which our national security depends, we must move very cautiously." If the President refuses to heed that warning, he is going to knock the armed forces for a very big loop for a very long time. Once the damage is done and apparent, the opportunity to avoid it will have passed. ■

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Letters

Limited Objectives

Mr. Correll made many cogent points in "Tinkering With Deadly Force" *[January 1993 "Editorial," p. 2],* but they had little to do with Rep. [now DoD Secretary] Les Aspin's equally sensible remarks. Mr. Correll's fear seems based more on how people might misinterpret the Limited Objectives idea than on the idea itself. It's good to warn us against dirty bath water, but let's not throw out the baby.

The Persian Gulf War, which Mr. Correll cites as an exemplar of the Weinberger criteria, is also a classic case of limited objectives. We did not seek to conquer Iraq, only to expel the Iraqis from Kuwait and to cripple their offensive capability.

Fortunately, the Limited Objectives idea is not inherently incompatible with Weinberger's criteria, as Mr. Correll implies.

"Limited objectives" need not be code for casual or reckless warfighting. Limited objectives need not be fuzzy ones, and they are less likely to spawn "open-ended commitment" than unlimited ones are. (One beauty of airpower and seapower lies precisely in our ability to use them without getting locked in.)

Mr. Correll cites the Bay of Pigs, Vietnam, and Desert One as failures of the Limited Objectives school of thought. Let's also remember the Berlin Airlift, Lebanon 1958, the Congo 1962, and Libya 1986, not to mention such foreign examples as the Entebbe rescue.

In *The Conduct of War, 1789–1961,* J. F. C. Fuller demonstrated convincingly that only limited wars are genuinely winnable. Les Aspin may be wrong to say the US military has forgotten this, but he is surely not wrong to insist that we remember it.

Harry F. Noyes III
San Antonio, Tex.

It was with trepidation that I read "Tinkering With Deadly Force." Although I share many of Mr. Correll's concerns about the incoming Administration, I cannot share his evaluation of airpower.

The Air Force struggled to gain its independence from the Army in large part because the prophets of airpower believed that our medium was unique. The "Strategic Bombing" doctrine—which is still expressed in much of our thinking—was not only the independent application of airpower but also the application of independent airpower. . . .

In every conflict prior to Desert Storm, US airmen labored under the yoke of Army management. Unfortunately, the Air Force also suffered from years of self-imposed dogma. Our failure to understand airpower thoroughly and to live up to our claims in World War II, Korea, and Vietnam bred skepticism. Was this because of poorly defined ends or poorly defined means?

President Bush and Secretary Cheney kept their hands off nuts-and-bolts military issues, but it was more important that we were led by Gen. H. Norman Schwarzkopf, an Army officer who understood and appreciated airpower. Equally important, the Air Force finally gathered thinkers and planners who understood the application of independent airpower. In short, the US Air Force finally lived up to its claims.

Where do we go from here, Mr. Correll? Since the end of World War II, we've operated with limited objectives—don't go north of the Yalu, no B-52 strikes in North Vietnam—imposed by elected officials and military leaders alike. Most likely, unless unconditional surrender is the objective, all future wars will have limited objectives.

Since 1776, the Army, the Navy, and the Marine Corps have been sent into harm's way in response to national leaders' calls to obtain limited objectives. Excursions, from minor ones, such as the 1919 Marine landing to guard the US Consulate during the Greek occupation of Constantinople, to major ones, like the 1950–53 Korean War, have tapped US forces to obtain limited objectives. An honest assessment will show successes and failures. The lesson is that our sister services have served as instruments of diplomacy. They benefited from centuries of tradition and a penetrating knowledge of their own means.

The Air Force must prepare itself to face any task, despite severe cutbacks and unhealthy force reductions. We must understand our means to achieve limited objectives or unconditional surrender. We must not stray from the reality of the application of independent airpower.

Maj. George R. Gagnon, USAF
Montgomery, Ala.

Bravo to John Correll for "Tinkering With Deadly Force." The misperceptions people have about military professionals boggle my mind.

I have been questioning co-workers about their reactions to the media scene on the beach in Somalia as our troops came ashore. Nearly everyone agreed the press looked stupid, but many people blame the military in words that I find surprising and worrisome.

These people are quick to assert that the military manipulates the truth. Some said the military staged the event in prime time to earn brownie points at budget crunch time. Others wanted the military brass in Washington court-martialed for manipulating the press. . . .

I find this kind of attitude prevalent in a wide range of discussions about foreign policy and international security. People are prone to go to extremes right away and very slow to acknowledge that most military planning is done at a far remove from the extremes. Too many people have seen

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

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BPA Circulation audited by Business Publication Audit

Letters

too many B movies and soap operas, and too few have seen the realities of military planning and operations.

This lack of experience ought to be considered. Our military leadership is well advised to speak up and speak out at every opportunity. Our military leaders should not sit back and think that the word has gotten out.

Edward S. Marek
Reston, Va.

Homosexuals in the Military

I am concerned about the situation highlighted under the subhead "Controversy Grows About Gays in the Military." "Aerospace World" in the January 1993 issue *[see p. 15]* listed the reasoned objections of General Powell and Senator Nunn to lifting the homosexual ban, but their concerns may fall on deaf ears. I believe this issue is more potentially devastating than the new Administration realizes.

President Clinton has assembled a political team that he feels is qualified to address and remedy all the concerns he listed during his campaign. At his inauguration, he also inherited another team, the US armed forces. It is not a new, untested team. It has been looking after the most critical national concerns of all—national security and survival—for more than 200 years and has done an admirable job. On January 20, the armed forces became President Clinton's to command.

Our armed forces, built with carefully selected, high-grade, American ore, have always become the finest steel when subjected to the intense heat of battle. The team is in place, it is equipped, it is trained, and it is combat-tested. The team offers its new commander in chief its dedication, its valor, and the lives of its members, if necessary. It asks in turn that he not force into its makeup the unpredictable homosexual ingredient that will be extremely difficult to blend and may in fact seriously flaw the entire force.

We should all urge the new President to listen to the wise counsel of his seasoned and successful military commanders and to the voices of some eight million concerned veterans. We must implore him not to politically accommodate a small minority of homosexual activists at the expense of the sterling team he found at the ramparts as he took his oath of office.

Victor R. Kregel
Colorado Springs, Colo.

A Sad Commentary

In the December 1992 issue of AIR FORCE Magazine, Editor in Chief John T. Correll wrote an editorial that I can only hope was read by every thinking person in the United States *["On Mr. Clinton's Watch," p. 2]*. The key sentence was, "An unduly degraded US military posture could even be a factor in stimulating crisis." In truth, this is a frightening future potential, but I fear Mr. Clinton will not be listening to those who know best. . . . To me, this is a sad commentary on the political and mental outlook of so many citizens of this country.

I can only hope that our new President will look for advice not from those whose only aim is to bring down the military but to the whole broad scope of those who know what is right for the US and its military future.

Maj. Robert E. Donegan, Sr., USAF (Ret.)
Charleston, S. C.

Currie Seconded

Three cheers for Maj. Gen. James B. Currie's letter in the December 1992 issue discussing "The Aggressors' Demise" *[p. 7]*.

General Currie's thoughts are right on target. I was privileged to serve with this outstanding officer on two separate occasions, including in Vietnam. I consider General Currie a true military professional in every respect. Like him, I am a complete believer that the USAF mission is—and will continue to be—as vividly stated on that wonderful huge plaque on the entrance door to the Chief of Staff's office in the Pentagon, which read, "The mission of the Air Force is to fly and to fight—don't you forget it." That mission statement certainly provided me a constant reminder of why I chose the military, and USAF in particular, as my profession and lifelong career.

Come on, USAF leadership, wake up! Cut out the "window dressing" and phony image-making. Our great service deserves your full understanding and support of the real USAF mission so it can be further enhanced and pursued as General Currie has suggested. I also "am trying to be loyal" to the USAF. Each day, however, I find it is becoming more and more difficult.

Col. Charles L. Wilmot, Jr., USAF (Ret.)
Winchester, Va.

More Air Races

I can't believe Robert E. van Patten completely omitted information about the Mitchell Trophy Races in "Legacy of the Air Racers" *[December 1992, p. 76]*.

He wrote, "The 1930 Thompson Race was the last closed-course race

in which a serving US officer flew a military aircraft."

On November 17, 1934, at Selfridge Field, Mich., two closed-course races were held. The Mitchell Trophy Race was described as "Four laps over a twenty-mile closed-course. Ten Boeing P-26A airplanes racing for the John L. Mitchell Trophy presented by Brig. Gen. William Mitchell to be competed for by pilots of the 1st Pursuit Group." That year, it was won by Capt. Fred C. Nelson at 216.8 mph.

The Curtiss-Wright Trophy Race was described as "Four laps over a twenty-mile course for a distance of eighty miles, open to pilots of the 8th Pursuit Group, Langley Field, Va. Six Curtiss P-6 airplanes are expected to compete in this eighty-mile race." I quote from the race's souvenir program.

On October 19, 1935, both races were again held at Selfridge, but the Mitchell was increased to five laps. The eligibility qualifications stated that the pilot must belong to the 1st Pursuit Group, have 1,000 hours' flying time, be stationed at Selfridge for a year, be a regular Army officer, and be a first-time participant.

On October 17, 1936, the Mitchell was held again and the Curtiss-Wright was omitted, but the Boeing Trophy Race was added. That was described as a closed-course race of 9.8 miles open to first lieutenants or lower ranks. P-26 aircraft were flown, but I have no information on winner or speed. . . .

Col. Robert A. Stone,
USAF (Ret.)
Mount Clemens, Mich.

Saddam's Tracers

When Capt. Tim Bennett, surprised by the volume of AAA fire coming at him, thought to himself, "And I'm only seeing every eighth bullet!" he was thinking operationally, like the fighter pilot he is *["Tim Bennett's War," January 1993, p. 34]*. However, Saddam Hussein doesn't always think that way.

Saddam not only wanted to shoot down any hostiles that came at him; he also wanted to impress his people. Anybody who saw the televised display that accompanied the defense of Baghdad might be forgiven for thinking that the one-in-eight ratio of tracer to nontracer may have been modified for propaganda effect.

As I write, Saddam's plan is to play off the US against the UN. While having his emplacements in the no-fly zones to provoke US attacks and denying that any provocation took place, he has instructed his people to give the UN teams sent to neutralize Iraq's chemical warfare capability anything they want. That way, the question of whether he is cooperating with the UN is reduced to the word of a few pilots against a roomful of UN inspectors.

For the moment, this ploy seems to be working: The Arabs are uneasy, the Turks want the Americans to lay off, even the French are getting restive.

How long this will last is anybody's guess. If history is a guide, Saddam will have a new policy in a few weeks.

Frank V. Holan
Putney, Vt.

The RAF's F-4s

I would like to make two clarifications to the caption describing RAF Wattisham F-4s in the December 1992 "Aerospace World" *[p. 14]*. As participants in the Tiger Meet and "F-4 Out" No. 74 Squadron hosted on September 14–17, 1992, we witnessed the fate of the RAF's last F-4Ms. They were being cut up and sold for scrap.

Second, we saw No. 74's banner pass on to RAF Valley Hawks, a training squadron at another base. No F-4s went to the Reserve, nor did No. 74 make the transition to Tornados.

Maj. George A. Pavlicin,
108th ARW, N. J. ANG
McGuire AFB, N. J.

The Chart Page

By Tamar A. Mehuron, Associate Editor

Airlifters Lend a Hand

Humanitarian Missions in 1992–93

Air Mobility Command demonstrated the humanitarian uses of power projection forces in 1992. In September 1992 alone, AMC ran seven relief missions concurrently. The relief missions for Hurricane Andrew, Typhoon Omar, and Hurricane Iniki ended in 1992. Provide Hope II, Provide Comfort, Provide Promise, and Restore Hope are ongoing. The dates given for these missions show the periods for which figures are available. AMC's fleet of C-141s, C-5s, and C-130s provided the airlift. The aircraft have seen heavy duty since the beginning of the Persian Gulf buildup in 1990.

cargo tons delivered
passengers transported
missions

Provide Hope II

Former Soviet Union,
June 1–November 30, 1992

cargo tons delivered	1,772
passengers transported	1,347
missions	65

Provide Comfort

Iraq, June 1–December 31, 1992

cargo tons delivered	11,987
passengers transported	8,485
missions	688

Provide Promise

Bosnia-Hercegovina,
July 15, 1992–January 14, 1993

cargo tons delivered	2,348
passengers transported	10,788
missions	356

Provide Relief [1]

Somalia/Kenya,
August 21, 1992–January 13, 1993

cargo tons delivered	26,736
passengers transported	1,019
missions	2,338

Hurricane Andrew

Florida, August 26–October 28, 1992

cargo tons delivered	21,349
passengers transported	15,433
missions	724

Typhoon Omar

Guam, September 1–25, 1992

cargo tons delivered	1,998
passengers transported	750
missions	59

Hurricane Iniki

Hawaii,
September 12–October 18, 1992

cargo tons delivered	7,800
passengers transported	8,579
missions	257

Restore Hope [2]

Somalia,
December 9, 1992–January 14, 1993

cargo tons delivered	24,041
passengers transported	23,400
missions	741

Total Airlift

cargo tons delivered	98,031
passengers transported	69,801
missions	5,228

[1] On December 18, 1992, Operation Provide Relief was subsumed into Restore Hope and became Task Force Mombasa under US Central Command. Shown here through January 13 as Provide Relief for simplicity.

[2] Air refueling first constituted a major part of AMC humanitarian missions in Operation Restore Hope. As of January 14, 1993, KC-135 Stratotankers had flown 964 refueling missions and transferred 67,560,000 pounds of aviation fuel to military cargo planes to and from Somalia.

Sources: Air Mobility Command Hq., Public Affairs Office, and USAF Update Report "Global Reach, Global Power," December 1992.

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Aerospace World

By Frank Oliveri, Associate Editor

First Armed Action of Clinton Administration

Shortly after the new US president was sworn in, an F-16C and F-4G Wild Weasel of the US Air Force attacked an air defense site in northern Iraq. The January 21 operation was the first time that US forces went into action in President Clinton's term.

The attack took place only a few hours after Baghdad had unilaterally declared a cease-fire. The two US planes had been escorting a French Mirage F1-CR reconnaissance plane over the northern "no-fly" zone when they were illuminated by an Iraqi air defense radar. The warplanes then attacked the radar facility with AGM-88 high-speed antiradiation missiles (HARMs) and cluster bombs. One day later, a second F-4G Wild Weasel engaged the northern radar that had illuminated the US plane. The Weasel fired two HARMs at the site.

Even before taking office, President Clinton had supported a series of attacks against Iraq and pledged to uphold US policy toward Baghdad.

Reuters / Bellmann

President Bill Clinton was quickly initiated as Commander in Chief of US forces when US warplanes attacked air defense sites in northern Iraq shortly after his inauguration. The new President opted not to change US policy in the region immediately, continuing to enforce the southern and northern no-fly zones over Iraq.

The Coalition Strikes Back

Led by US forces, the United Nations–backed Gulf War coalition took steps in January to punish Iraq for its refusal to respond to UN demands and honor the terms of the 1991 Persian Gulf War cease-fire agreement.

The attacks were initiated by President Bush in the last days of his presidency. They came after an early January UN order to Iraq to remove surface-to-air missiles from locations south of the thirty-second parallel and to stop sending aircraft into a no-fly zone south of the thirty-second parallel.

In early January, US F-16C and F-15C fighters shot down at least two Iraqi MiG fighters that had entered the no-fly zone.

On January 13, a combination of coalition and USAF and Navy aircraft bombed several SAM sites south of the thirty-second parallel. Coalition fighters also attacked several SAM sites in the northern no-fly zone above the thirty-sixth parallel.

On January 17, US Navy warships launched Tomahawk cruise missiles against an Iraqi factory suspected of fabricating parts for building nuclear weapons. Pentagon officials said that, of about forty-five Tomahawks launched at the plant, thirty-seven missiles hit target areas.

More air attacks took place on January 18.

Aspin Takes Reins of DoD

The Senate swiftly confirmed Les Aspin as President Clinton's Secretary of Defense. Mr. Aspin, chairman of the House Armed Services Committee from 1985 to 1993, took office January 20.

At his confirmation hearing, Secretary Aspin said that he could cut the defense budget by an additional $60 billion over five years and still finance his Option C force-structure plan. During the presidential campaign, Mr. Clinton promised to make the additional $60 billion in cuts.

Mr. Aspin said that he has long supported placing women in combat aircraft but that he would have to confer with members of the presidential Commission on the Assignment of Women in the Armed Forces before staking out a position.

Senate Examines Impact of Gays in Armed Services

Sen. Sam Nunn (D-Ga.), chairman of the Senate Armed Services Committee, says committee hearings in March will explore unanswered questions about the Clinton Administration's plan to drop the ban on homosexuals in the armed forces.

"When the interests of some individuals bear upon the cohesion and effectiveness of an institution upon which our national security depends, we must move very cautiously," Senator Nunn declared in a major speech January 27.

The senator expressed concern about the impact on recruiting, retention, morale, and discipline. He said that members of the armed forces cannot control the units, duties, or living quarters to which they are assigned and that they often live and work with little or no privacy. "What accommodation, if any, should be

Ericsson Radar Electronics of Sweden will supply its pod-mounted Erijammer A100 ECM training system to the Swiss Defense Technology and Procurement Agency and to the Swedish Defense Materiel Administration. In the Swiss Air Force, the A100 pod will be carried on the F-5F Tiger II and Pilatus PC-9 (above).

made to a heterosexual who objects to rooming or sharing bathroom facilities with a homosexual?" he asked.

Senator Nunn presented a list of other questions, including, for example, what sorts of public displays of affection would be prohibited and what protection would be required against harassment on the basis of sexual orientation. Another category of questions covered what entitlements would accrue to homosexual couples and whether partners of homosexual military members would become eligible for such benefits as housing and medical care.

Declaring that "these are not frivolous questions," Senator Nunn said it was important to listen carefully to the answers of all concerned, including "the people who will be most directly affected by any change in the current policy, the men and women serving in the ranks of all the military services."

B-2 Program Advances

The B-2 bomber program met two challenges in December and January. The Air Force saw successful completion of static load testing and selected a remedy for a low-observable anomaly that was discovered in flight testing.

In December, the Air Force intentionally broke a full-scale structural testing airframe under 1.6 times the maximum stress the B-2 is expected to see in actual flight operations.

Two aircraft were subjected to varied structured loads created by massive hydraulic test fixtures at Air Force Plant 42 at Palmdale, Calif. One airframe endured the equivalent of two lifetimes of typical flight stresses. The other, which was eventually broken, had previously withstood stress loads up to 150 percent of those expected during B-2 operations. The bomber is built primarily of composite materials, which are lightweight and require less maintenance.

In January, former Air Force Secretary Donald Rice said the service had decided how to fix a problem with the plane's stealthiness in one frequency. The option calls for changing some surfaces and treatments of the aircraft. The remedy, said Dr. Rice, can be funded out of the existing $44.5 billion B-2 budget.

Dress Uniform Changes

Gen. Merrill A. McPeak, the Air Force Chief of Staff, announced the service's final decision to switch to a new wool blend service dress uniform. Name tags, epaulets, metal rank insignia, and collar insignia have been eliminated.

For the past year, the Air Force has been testing the uniform at locations around the country. Air Force officials characterized the response of the troops as "positive."

One controversy concerned the use of braided sleeve rank insignia for officers. This was proposed in 1946 by Gen. Carl A. "Tooey" Spaatz and Gen. James H. Doolittle. Some service personnel complained that the new version looked too much like the dress uniform of the US Navy. General McPeak said that "the new service dress uniform is a clean, streamlined design" and the service had "returned to our founders for basic ideas."

Enlisted members' rank insignia will return to tradition with the addition of the star to all chevrons. The stripes will be larger. Standard four-inch chevrons will be worn on outer garments and three-and-one-half-inch chevrons on shirts.

Women will be authorized to wear four-inch or three-and-one-half-inch insignia on the service jacket. The new chevrons will also be worn on service dress and mess dress uniforms, eliminating the need for a separate, expensive mess dress chevron.

The new uniform will be offered initially by the Army and Air Force Exchange Service as an optional garment in 1994. Air Force uniforms will arrive in late 1995, and the new mandatory wear date will be late 1999.

US Presence Peaks in Somalia

Operation Restore Hope, the US humanitarian mission in Somalia, began tapering off in January. The US troop presence in the African nation peaked at 24,700. The Pentagon announced first withdrawals at the end of the month.

In the first six weeks of the operation, two US Marines were killed by sniper fire. Two others were wounded.

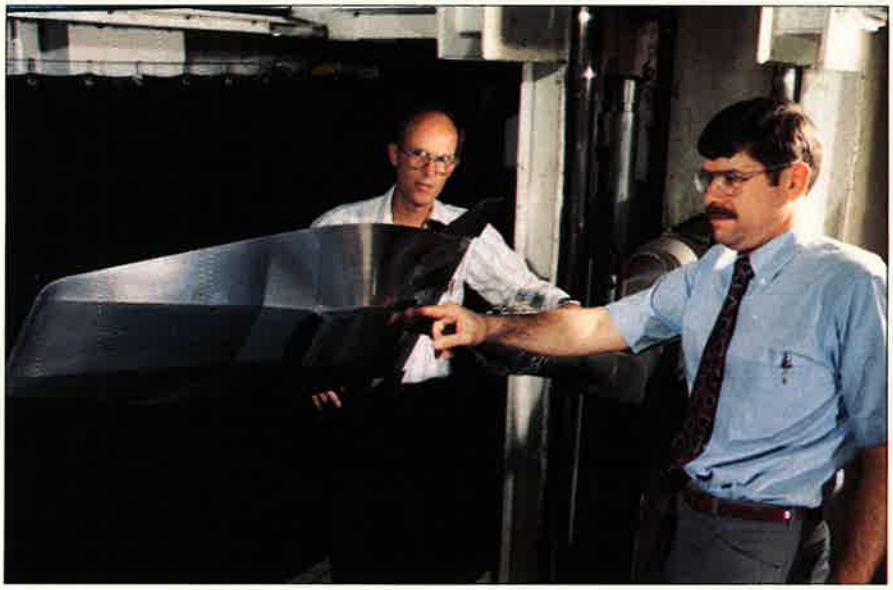
Air Force C-130, C-141, C-5, and KC-10 aircraft transported tons of food and equipment to the area and brought personnel into and out of the area *[see "Chart Page," p. 8]*. As of January 21, US airlifters, flying as part of Operation Provide Relief, had logged 1,763 flights while delivering 20,717 metric tons of supplies for the UN's fight against famine.

Air Force Rephases F-22 Program

Shortly before leaving office in January, Air Force Secretary Donald B. Rice approved a rephasing of the F-22 fighter program to adjust to funding shortages, the Air Force said.

The service said the shortage of $750 million requires phasing the funding profile over a longer period. The Air Force cited a $285 million program cut imposed by Congress, increased contractor overhead expenses totaling some $278 million, $97 million to account for risk factors in F-22 technical development, $45 million in defense management charges, and $45 million for inflation in future years.

The Air Force said there will be no change in the total amount budgeted



Engineers Rick Norris (left) of Wright Laboratory, Wright-Patterson AFB, Ohio, and Wayne Hawkins of Calspan Corp. examine a scale model of a hypersonic cruise aircraft at Arnold AFB, Tenn. The model was tested in one of Arnold Engineering Development Center's supersonic wind tunnels.

for the ten-year engineering and manufacturing development phase. The rephasing stretches the schedule of the program by one year in order to maintain the level of concurrency.

The F-22's critical design review will be delayed by six months, and the first EMD flight will be delayed by eleven months. The first production aircraft deliveries and the Milestone 3 high-rate production decision will also be moved eleven months.

Military Accident Rate Drops

The Pentagon announced in December that Fiscal 1992 was the safest year ever for the US military. Accidental deaths totaled 747. Defense Secretary Dick Cheney reported that DoD's aviation accident rate for Fiscal 1992 was 2.09 per 100,000 flying hours.

The Army posted an all-time low aviation accident rate of 1.58 major accidents per 100,000 flying hours. The Air Force's rate was 1.67, and the Navy's was 2.93. A major accident is one that causes a fatality or damage of at least $1 million.

The greatest single threat to US military personnel remains the private motor vehicle, reports the Pentagon.

USAF Confirms ATC-AU Merger

The Air Force disclosed that it will merge Air Training Command and Air University to create Air Education and Training Command (AETC). The service will officially establish the new organization on July 1. It will be headquartered at Randolph AFB, Tex.

AETC will have authority over AU and two numbered air forces. One numbered air force, which will be headquartered at Keesler AFB, Miss., will manage technical training. The other air force will be headquartered at Randolph AFB and will manage flight training.

Air University will remain at Maxwell AFB, Ala., managing professional military education, legal and chaplain training, and the first sergeant academy.

Guard, Reserve to Get Bombers?

In January, the Air Force initiated a process to move some active-duty B-1B and B-52 bombers to the Air National Guard and Air Force Reserve. Some Air Reserve Component units will convert from their current aircraft to heavy conventional bombers in a move that Air Force officials said reflects support of the Total Force policy.

Timing for the move, types of aircraft involved, and locations will be determined later, the service said. Final decisions are not expected until environmental analyses have been completed.

Space-Available Flight Now Free

Passengers can now travel free of charge on a space-available basis aboard aircraft owned or controlled by the Defense Department.

The policy that required a $10 fee for space-available flight has been rescinded by the Defense Secretary. The move was recommended by Commander in Chief of US Transportation Command Gen. Ronald R. Fogleman and was agreed to by Chairman of the Joint Chiefs of Staff Gen. Colin L. Powell.

"As we draw down, space-available travel is one of the benefits that makes the turbulence of service life more tolerable," General Powell said.

Active-duty members make up sixty-five percent of all space-available passengers. Twenty-three percent are dependents, and twelve percent are retired personnel.

Boeing Defense & Space Group, Military Airplanes Division, is developing a new approach for carrying weapons on existing and future tactical aircraft under a $1.7 million contract with the Armament Directorate of Wright Laboratory, Eglin AFB, Fla. Here, a Multirole Fighter concept is shown with a common weapons carriage system.

USAF photo by SSgt. Mark Bucher

A1C Aaron Scanlon of the 32d Security Police Flight, Soesterberg AB, the Netherlands, has a cup of tea with a child at a refugee shelter in Leersum, near Soesterberg. The 32d SPF collected nearly 1,100 toys during its sixth annual toys-for-tots drive and donated them to the shelter.

Early Release of Officers Continues

Under the terms of the Officer Early Release program, more than 500 officers will be able to separate early, though the Air Force achieved the bulk of its Fiscal 1993 force reductions last year.

Maj. Gen. Michael McGinty, commander of Air Force Military Personnel Center, said that reductions this year will not be as great as in 1992 but that the drawdown is not over and the Air Force is still seeking voluntary reductions.

Not all are free to leave. Officers not eligible to apply for early release are pilots filling cockpits in the C-130, C-5, F-4G, F-15E, and E-3. Also barred are F-15E weapon officers and C-130 navigators.

More Oversight for Special Access Programs

A Government Accounting Office study, "Defense Acquisition: Oversight of Special Access Programs Has Increased," says that, despite the increase, the Department of Defense still provides less oversight to special access programs than to other programs. DoD used waivers and exemptions to limit review, documentation, and reporting requirements, according to the study report.

GAO found that, "although financial information about special access programs is disguised in public documents, these programs are subject to the same resource justification, execution, review processes, and reprogramming rules as non-special access DoD acquisition programs."

Surprisingly, GAO found no major differences between the cost, schedule, and performance results of the special access programs it looked at and those of non-special access acquisition programs.

It is widely believed that special access programs perform better because they receive less scrutiny. However, cost growth, schedule slippage, and performance shortfalls are similar to those in the non-special access programs.

Voluntary Assignment Works

The Air Force reports that its Officer Voluntary Assignment System has led to the assignment of 17,000 officers since its inception in April 1991.

The system was begun first for operations officers. Support officers were added in August 1991. Of 17,000 reassigned officers, about 8,000 went to rated officer assignments, 2,000 to nonrated operations officer assignments, and the remaining 7,000 to support officer assignments.

The Air Force said informal surveys indicate that more than ninety-five percent of those recently reassigned are either satisfied or highly satisfied with their new jobs. Col. Norman F. Rathje, director of assignments at the Air Force Military Personnel Center, said nearly all officer vacancies are advertised on an electronic bulletin board accessible worldwide.

NCOs Risk Involuntary Retraining

About 600 career noncommissioned officers will be at risk for involuntary retraining in the third phase of the Fiscal 1993 NCO Retraining Program, the Air Force said in January.

The program began in early August with a goal of retraining 1,900 staff, technical, and master sergeants. The first two stages succeeded in gaining 1,300 new retraining applications, but fifteen career fields came up short of their goals.

C-141 in Precarious Position

Though the C-141 airlifter performed well in Operations Desert Shield and Desert Storm, some aircraft in the fleet are approaching an average of 45,000 "damage hours" and are experiencing serious technical and structural problems, claims a new report prepared by the Government Accounting Office.

GAO said that the Air Force's ongoing Service Life Extension Program (SLEP) is being delayed because other projects have higher priority.

Damage hours are calculated by multiplying regular service hours by a factor reflecting the severity of stress on the aircraft of different types of flying. The deterioration of the C-141 and the slow pace of the SLEP will reduce airlift capability, GAO said in its report, "Military Airlift: Structural Problems Did Not Hamper C-141 Success in Desert Shield/Storm."

The problem is aggravated by delays in the C-17 production program. The new lifter will not come into service in significant numbers until the late 1990s.

The Air Force hopes to keep the C-141 in the inventory until at least 2010. Major work will be necessary to prevent continued deterioration and may require severe constraints on the use of C-141s, GAO said.

KC-135R Displays Global Reach

On December 19, an Air Mobility Command KC-135 completed a record flight from Kadena AB, Japan, to McGuire AFB, N. J., flying seventeen hours and thirty-one minutes nonstop. The journey of the KC-135R Stratotanker from the 97th Air Mobility Wing, Altus AFB, Okla., set a new record for a nonstop, nonrefueled flight.

The flight was held in conjunction with a regularly scheduled Pacific Tanker Task Force redeployment mission and set the record for aircraft in the gross weight category of 220,460 to 330,690 pounds.

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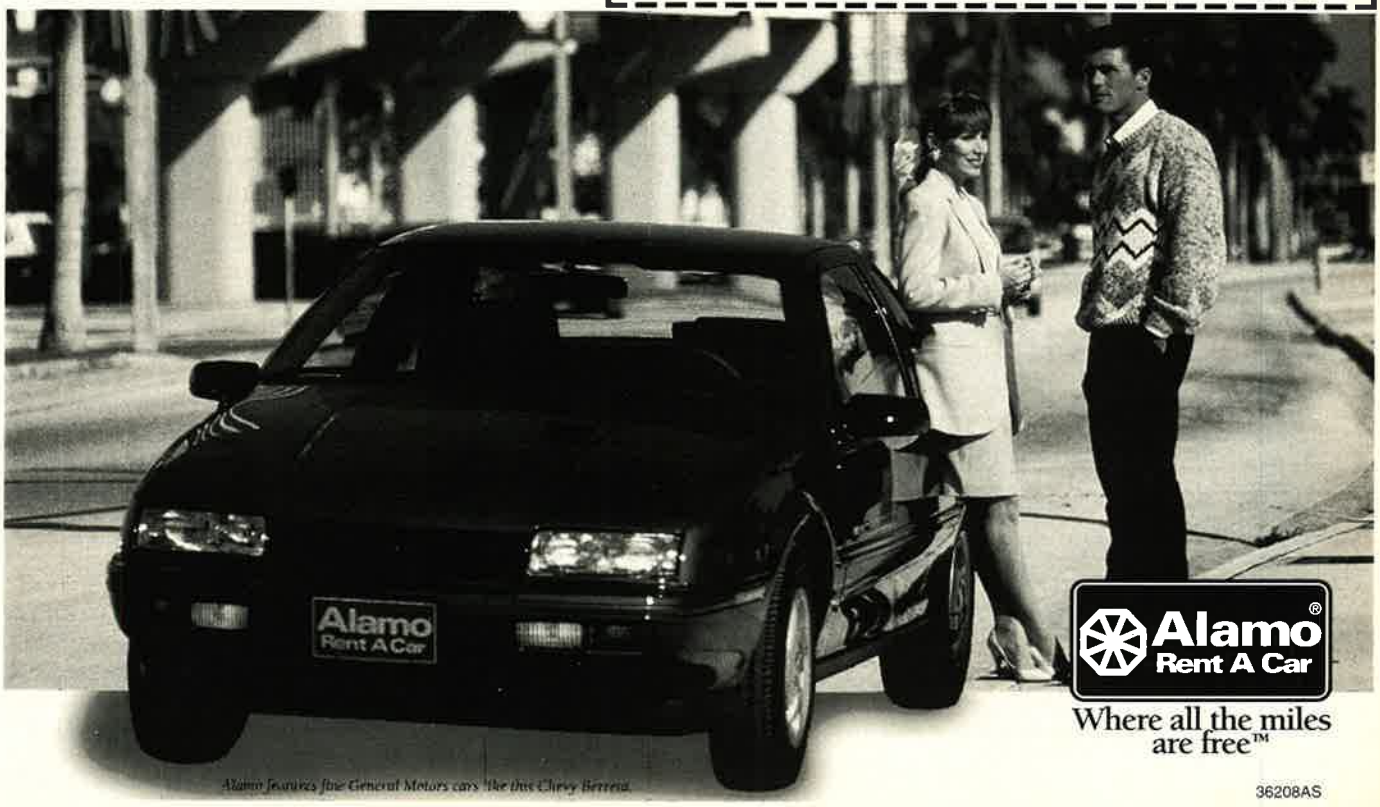

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the aircraft departed with a maximum gross weight of 322,500 pounds—195,000 pounds of fuel, 5,000 pounds of mission-essential cargo, and the flight crew.

Included in the crew were Capt. Jeff Kennedy, mission commander/instructor pilot; Capt. Robert Kilgore, aircraft commander; 1st Lt. John Isakson, pilot; Capt. Mark Hostetter, instructor navigator; 2d Lt. Robert Fischer, navigator; MSgt. Temur "Tim" Ablay, instructor boom operator; SMSgt. Daniel Deloy, instructor boom operator; Sgt. Steven Rowland, crew chief; SrA. Andrew Haynes, crew chief; and A1C Jason Houk, crew chief.

C-17 Sets Seven Records

The C-17 broke seven world records in December in a 6.2-hour flight test over Edwards AFB, Calif.

"P-2," the second production C-17 built, was flying a routine test mission, evaluating the heavyweight-cruise performance of the C-17 while establishing the records in the category of aircraft with gross weight between 250,000 and 300,000 kilograms, or 551,150–661,300 pounds. Aircraft gross weight is the sum of the aircraft, fuel, and payload weights.

The seven records were set by flying a takeoff gross weight of 576,870 pounds, including a 133,422-pound payload, to an altitude of 36,653 feet. The C-17 also set the record for the heaviest load carried to 6,600 feet. The record was previously set at 67,177 pounds by the former Soviet Union using a Tupolev Tu-160 "Backfire" bomber in 1989.

In Class C-1.S, Group III, Heavy Airplanes, the C-17 broke the following former records: altitude with 77,000 pounds, 36,653 feet; altitude with 88,000 pounds, 36,653 feet; altitude with 99,000 pounds, 36,653 feet; altitude with 110,000 pounds, 36,653 feet; altitude with 121,000 pounds, 36,653 feet; altitude with 132,000 pounds, 36,653 feet; and greatest load carried to 2,000 meters, 133,422 pounds.

944th Moves to Provide Comfort

The 944th Fighter Group from Luke AFB, Ariz., deployed its F-16C fighters to Incirlik AB, Turkey, to support Operation Provide Comfort. It was the first Reserve unit to participate with the coalition task force, the Air Force said.

As a part of the task force, the 944th's mission is to enforce the provisions of UN Security Council Resolution 688, issued in April 1991. The resolution demands that Irac end the repression of its own people and outlines military protection and humanitarian relief. In November, about 100 maintenance, aircrew, and support personnel deployed with F-16C aircraft from Luke to join the operation.

The unit provided relief to active-duty forces who have maintained an air umbrella over the area since April 11, 1991.

AFIT Students Excel

Three students from the Air Force Institute of Technology (AFIT) School of Engineering and two from its School of Logistics and Acquisition Management received awards in December.

Engineering student Capt. Cynthia Anderson was selected for the Aldrin Award for demonstrating strong personal leadership and accomplishing the educational objectives of AFIT in an outstanding manner. Capt. Bruce Anderson received the School of Engineering's Commandant's Award, which goes to the graduating student demonstrating the most exceptional individual master's thesis research. Captain Anderson's thesis developed an original concept for analyzing patterns associated with infrared imagery, speech, and biomedical and radar signals.

Capt. Timothy Murphy was named the recipient of the Mervin Gross Award, presented to the exceptional scholar of the School of Engineering. Captain Murphy maintained a perfect 4.0 grade point average.

The Commandant's Award winners from the School of Logistics and Acquisition Management were Capt. David Schaaf and Capt. Carl Scott, for their thesis designing, developing, and testing a prototype system to enhance the conduct and management of research in the school.

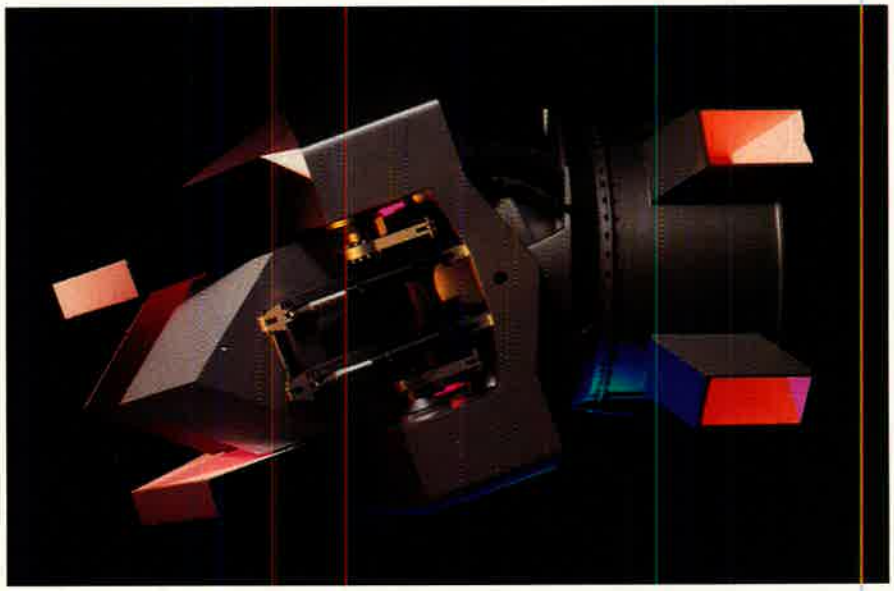
LANTIRN Upgrade Sought

Aeronautical Systems Center's Wright Laboratory is testing an improved forward-looking infrared (FLIR) for the Low-Altitude Navigation and Targeting Infrared for Night pod, according to the Air Force. The proposed LANTIRN modification will begin flight testing on an F-16 early this year at Eglin AFB, Fla.

The Air Force said that, while the existing LANTIRN has given pilots tremendous advantages, the proposed modifications, called FLIR and Automatic Cuer Technology Insertion into LANTIRN, or FRACTIL, would provide a higher-resolution FLIR and reduce pilot work load by computer-assisting target characterization and identification. In-house Test Director Fred Heitkamp said, "Combining an advanced, more sensitive FLIR with an automatic target cuer would improve the quality of the cockpit displays' images and increase target detection ranges."

START II Signed

President Bush and Russian President Boris Yeltsin signed START II in January. The radically new arms agreement would reduce US and Russian inventories of strategic nuclear war-



Pratt & Whitney's new spherical convergent flap nozzle is being developed at P&W's Government Engines & Space Propulsion Unit as part of the DoD-NASA IHPTET program. The thrust-vectoring nozzle has potential applications for the Navy-USAF A-X and the Air Force's Multirole Fighter and STOVL fighter.

Col. Marcus J. Boyle (left) is congratulated by Maj. Gen. William K. James, director of the Defense Mapping Agency, on Colonel Boyle's completion of a three-and-a-half-year tour of duty as director of DMA's Aerospace Center, Saint Louis, Mo. The center will be headed by a civilian for the first time in more than 165 years.

heads from roughly 10,000 today to 3,500 for the US and 3,000 for Russia by 2003.

Both nations will eliminate multiple warheads on their landbased missiles and nearly halve US deployments of warheads on sea-launched ballistic missiles to 1,750. In addition, reductions in strategic nuclear warheads, as well as removal of multiple reentry vehicles from ICBMs, may be achieved by downloading warheads from missiles.

The number of weapons counted for heavy bombers will be the number that each bomber is actually equipped to carry—a substantial change from START I, where each bomber was counted as one weapon.

The treaty also requires that bombers never be equipped for long-range, nuclear, air-launched cruise missiles. Up to 100 heavy bombers may be configured to conventional roles and will not count against the overall limits.

The US will have 500 Minuteman III missiles with single warheads, 768 Trident I C4 missiles, and 960 Trident II D5 missiles. In addition, it will have 272 warheads set aside for the B-2 and 1,000 warheads for the B-52H bomber.

The US will likely reduce its Trident missiles' warheads from eight to four, while the Minuteman IIs will carry a single warhead each. The treaty also assumes that the B-1B will be oriented solely to a conventional mission.

Russia will have 504 SS-25 missile warheads, in addition to 576 SS-N-18, 720 SS-N-20, and 448 SS-N-23 warheads. Russian Bear-H bombers will also be allowed to carry 752 warheads.

The SS-N-20 load will be reduced from ten warheads to six each. In addition, the agreement assumes that Ukraine will not return sixteen operational Blackjack bombers now based there to Russia.

CRAF Carriers Want Changes

Civil Reserve Air Fleet (CRAF) carriers have identified a number of problems with the CRAF system, and some have indicated they may reduce future participation unless changes are made, GAO said in December.

In its report, "Military Airlift: Changes Underway to Ensure Continued Success of Civil Reserve Air Fleet," GAO said that the Air Force is currently working to solve those problems in negotiating the next series of CRAF contracts.

The CRAF program was designed to provide DoD with access to commercial aircraft to augment military airlift during emergencies. If used fully, CRAF could provide nearly thirty percent of the service's cargo capability and over ninety percent of its passenger airlift.

Because of the success of the first wartime activation of CRAF (in Operations Desert Shield and Desert Storm), carriers believe that future CRAF activations are more likely, according to GAO. The Air Force estimates that the number of aircraft volunteered will meet or even exceed most of DoD's requirements.

Carriers have participated for years

in the CRAF program, which guaranteed them a share of DoD's peacetime business with minimal chance of being activated. The Desert Storm activation brought some things to light. For example, there were business losses during activation, compensation for extraordinary expenses and underutilization of the aircraft, war risk insurance language, and joint venture liability.

Air Mobility Command has proposed to increase the number of aircraft included in Phases I and II of a CRAF activation. Passenger aircraft would be heavily used in the early part of an activation. In Phase II, more cargo aircraft would be used and passenger planes would be reduced.

GAO said that Air Force officials believe this change would more readily accommodate the future threat scenario, which they see as similar to Operations Desert Shield and Desert Storm but with a shorter time frame.

Photo © Nathan Leong

The Air Force will keep one squadron of about twenty F-4G Wild Weasel defense-suppression aircraft on active duty at Nellis AFB, Nev. The Weasels will not be replaced until the Air Force has another system that can do the Wild Weasel job. This could be an F-16 or F-15E variant equipped with antiradar weapons.

Senior Staff Changes

RETIREMENT: B/G Jean E. **Klick**.

PROMOTIONS: To be **Lieutenant General:** Albert J. **Edmonds,** Eugene E. **Habiger,** Carl G. **O'Berry.**

To be **Brigadier General:** Maxwell C. **Bailey,** Robert P. **Belihar,** Claude M. **Bolton,** Jr., Frank B. **Campbell,** Thomas R. **Case,** Donald G. **Cook,** Charles H. **Coolidge,** Jr., Andrew M. **Egeland,** Jr., Richard L. **Engel,** Robert E. **Gatliff,** William M. **Guth,** Michael V. **Hayden,** Charles R. **Henderson,** William R. **Hodges,** Peter F. **Hoffman,** Robert A. **Hoffmann,** Charles R. **Holland,** Raymond P. **Huot,** Howard J. **Ingersoll,** James A. **Jaeger,** Ronald T. **Kadish,** Thomas J. **Keck,** Orest L. **Kohut,** George P. **Lampe,** James D. **Latham,** Ronald C. **Marcotte,** Richard C. **Marr,** Gregory S. **Martin,** David J. **McCloud,** John F. **Miller,** Jr., Michael A. **Moffitt,** William F. **Moore,** Thomas H. **Neary,** Charles H. **Perez,** Jeffrey S. **Pilkington,** Stephen B. **Plummer,** Karen S. **Rankin,** Thomas J. **Scanlan,** Jr., George T. **Stringer,** Lansford E. **Trapp,** Jr., Arthur S. **Thomas,** Gary A. **Voellger,** Buford R. **Witt.**

To be **AFRES Major General:** Nora A. **Astafan,** Gerald F. **Crump,** Esker K. **Davis,** David C. **Gildart,** William R. **Willoughby.**

To be **AFRES Brigadier General:** Alan H. **Bruce,** Jim L. **Folsom,** Danny A. **Hogan,** Michael J. **Quarnaccio,** Keith T. **Reiling,** Jerry **Scott,** Donald B. **Stokes,** James L. **Turner,** Ralph M. **Utterback,** Jr., Leonard D. **Williams,** Robert J. **Winner.**

CHANGES: B/G James L. **Higham,** from Cmdr., 542d CTW, AMC, Kirtland AFB, N. M., to Cmdr., 377th ABW, AFMC, Kirtland AFB, N. M. . . . B/G Thomas J. **Lennon,** from Exec. Officer to Dep. USCINCEUR, Hq. USEUCOM, Stuttgart-Vaihingen, Germany, to Dep. Dir., Military-to-Military Contacts, Hq. USEUCOM, Stuttgart-Vaihingen, Germany . . . B/G Donald L. **Peterson,** from Cmdr., 12th FTW, Hq. ATC, Randolph AFB, Tex., to Comd. Dir., NORAD Combat Ops. Staff, Cheyenne Mountain AFB, Colo., replacing B/G James S. Savarda.

SENIOR EXECUTIVE SERVICE (SES) Retirement: Daniel S. **Rak.**

SES CHANGES: Darleen A. **Druyun,** from C/S, NASA, Washington, D. C., to Dep. Ass't Sec'y of the Air Force (Acquisition), OSAF, Washington, D. C., replacing Daniel S. Rak . . . Diann L. **McCoy,** from Dir., Corp. Integration, Hq. AFMC, Wright-Patterson AFB, Ohio, to Dir., Std. Sys. Ctr., AFMC, Gunter AFB, Ala., replacing S. W. Hall, Jr. ■

News Notes

■ The Air Force will keep one squadron of F-4G aircraft on active duty at Nellis AFB, Nev., to make sure that the US has a Wild Weasel capability until a suitable replacement is available. The 561st Fighter Squadron will be activated at Nellis, and twenty F-4Gs will begin arriving early this year.

■ McDonnell Douglas will build sixty percent of all US Navy Tomahawk sea-launched cruise missiles included in the 1993 purchase. General Dynamics will build the remainder.

■ Kirtland AFB, N. M., was transferred from Air Mobility Command to Air Force Materiel Command January 1. The newly activated 377th Air Base Wing will take command of all base support responsibilities, including civil engineering, mission support, and morale, welfare, and recreation activities. This consolidates all mission-support functions needed for the largest organization at Kirtland—Phillips Laboratory. This action will have no impact financially or on personnel.

■ Former Secretary of Defense Dick Cheney approved in January the establishment of a bronze "M" device for reserve component medals. The device, the Reserve Component Mobilization Appurtenance to Reserve Medals, will identify past, current, or future service members of the National Guard and Reserve who volunteer or are called to active duty in certain circumstances.

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Backed by Lockheed mission planners, pilots flying F-117 stealth fighters in Desert Storm rewrote the book on aerial warfare. Air Force Special Ops Forces also rely on Sanders expertise, using our strategic/tactical mission planning system. And, we have delivered upgrade kits for mission support systems for composite wings throughout the United States Air Force.

For the future, we're building the next generation mission support system (AFMSS) for the Air Force—the most sophisticated, flexible and effective mission planner ever conceived. We're also an integral part of the Air Force's F-22 team, with development of that 21st century fighter's mission support element already under way.

And, Sanders' Special Operations Forces Planning and Rehearsal System will enable Navy SEALS and Army Special Forces to apply the latest automation technology to their unique and intensely demanding missions.

Strengthened by 40 years of defense electronics experience, Sanders delivers innovative, affordable mission planning systems—land, sea and air. That's how we became the industry's preferred supplier; and how we intend to stay that way.

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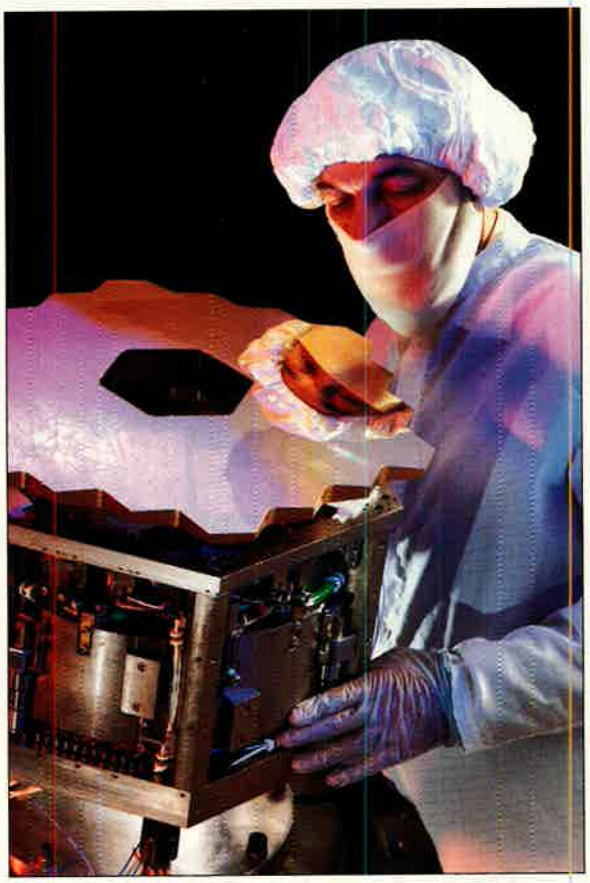

Lockheed engineer Greg Feher inspects the infrared chopping secondary mirror drive system for the W. M. Keck Telescope, the world's largest telescope, to be built on Mauna Kea, Hawaii. The mirror will be a key component enabling the telescope's users on Earth to study infrared stellar objects.

■ Pratt & Whitney began testing the first production version of the F119-PW-100 F-22 fighter engine in January. The engine is undergoing sea-level testing at the firm's West Palm Beach, Fla., facility. P&W plans to test three development engines through 1994 to verify that the design meets performance requirements and to accumulate data for development and production planning. The first F119 is scheduled to be delivered in 1998.

■ DoD announced in January that, in accordance with the Panama Canal Treaty Implementation Plan, the number of US military personnel assigned to Panama will be reduced to about 6,000 by the end of 1995. Current troop levels are at about 10,000. The cut will be achieved through unit reductions, relocations, and inactivations.

■ Acting Under Secretary of Defense for Acquisition Donald C. Fraser approved in December the Army's plans to upgrade the M1 main battle tank to the M1A2 configuration.

■ The Reserve Officers Association of the US named Sen. Daniel Inouye (D-Hawaii) the Minuteman of the Year for 1993. The award takes note of the senator's thirty-four years of congressional service.

■ In January, using the ROSAT X-ray observatory, astronomers discovered a huge concentration of dark matter, which appears to confirm theories that most of the mass of the universe consists of dark matter. The precise nature of dark matter is unknown.

■ The Hellenic Air Force selected GE's F110-GE-129 fighter engine in January to power forty F-16C/D aircraft purchased as a part of Greece's Peace Xenia II defense initiative. The deal is worth approximately $200 million and entails the delivery of forty-six engines from 1996 through 1998.

■ The Joint Systems Program Office for the Advanced Medium-Range Air-to-Air Missile won the Gen. Bernard A. Schriever Trophy in January for superior program management and for work that has greatly benefited Air Force Materiel Command and the Air Force. General Schriever commanded Air Force Systems Command from 1959 to 1966.

Purchases

The Air Force awarded Northrop a $246 million face-value increase to a fixed-price incentive firm contract for funding for the last five B-2 production aircraft. Expected completion: May 1996.

The Air Force awarded General Electric a $185 million firm fixed-price contract for a total of fifty-six F110-GE-100 engines, applicable to the F-16C/D aircraft. Expected completion: July 1994.

The Air Force awarded Lockheed a $1.2 billion face-value increase to a cost plus award fee contract for a rephased schedule for the F-22 air vehicle program. Expected completion: July 2001.

The Air Force awarded Martin Marietta a $72.1 million face-value increase to a firm fixed-price contract for twenty LANTIRN pod sets and associated spares for use on F-16C/D aircraft. Expected completion: October 1994. ■

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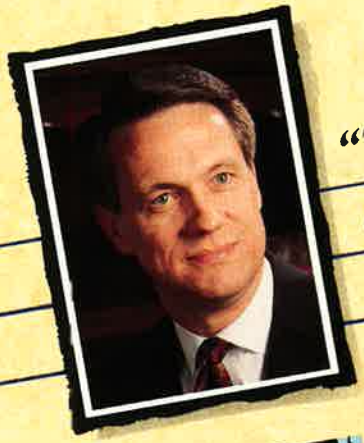

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A forward-looking retrospective from the immediate past Secretary of the Air Force.

DoD photo by Hon Hall

Check Twelve

By Donald B. Rice

With my term as Secretary of the Air Force at an end, I want to share some personal thoughts about my stewardship of the service and on some of the challenges and opportunities that are hovering just beyond the horizon. I trust I leave the institution better than I found it. I am certain I am leaving it in the competent hands of the finest group of professionals with which any Secretary has had the honor to serve.

At times like this, it is comfortable for one to say that he took over an institution on the verge of failure and moved it back from the brink of catastrophe. In my case, however, that simply wouldn't be true. The Air Force I inherited in 1989 was the most proficient in the world, the deterrer of our enemies and the envy of our friends.

I found that the Air Force, despite its obvious excellence, was strangely ill equipped to articulate or exploit the excellence it had developed and even less prepared to adapt that excellence to changing fiscal and global realities. If I have had any success, it has been in helping the institution think about itself and the growing role of airpower. If any one area needs more attention and energy, it is how we as a nation think about warfare in the late twentieth century. If we throw off old templates, we can make the nation even more secure and save money in the process.

A Strategic Planning Framework

In 1989, the Air Force was plagued by patterns of thought and a decades-long history that divided airpower and airmen into separate communities. A few months before I became Secretary, a *samizdat* white paper was being circulated among senior Air Force officers. Describing an institution "under siege," the paper claimed that, "despite a widely respected tactical, technological, and managerial efficiency, the Air Force has lost a sense of its own identity and of the unique contribution airpower makes to warfighting." It talked of an organization of "separate baronies, each competing with the others for systems, manpower, and resources."

I had not seen the paper before I assumed office, but its judgments mirrored those I had formed while watching the Air Force for seventeen years from RAND Corp. I concentrated on developing a strategic planning framework for the Air Force as a whole,

a framework that would cut across and unite these individual packets of excellence by focusing the institution on *airpower*'s inherent strengths—speed, range, flexibility, precision, and lethality—and on what the Air Force needed to do collectively to create and nurture these strengths. We called this unified vision "Global Reach, Global Power," and issued it as a white paper in June 1990.

Global Reach, Global Power is more than a bumper-sticker slogan. The Chief of Staff and I have used its framework as a license to "kill off" some of the old barons and redistribute their estates. Last June, Strategic Air Command, Tactical Air Command, and Military Airlift Command passed into history and were replaced by Air Combat Command and Air Mobility Command. Air Combat Command blends the winged firepower in the Air Force into one organization—Global Power. Air Mobility Command lines up most of the mobility and refueling assets on the same team—Global Reach. We now also build the Air Force program and budget within the mission areas that Global Reach, Global Power defines. This structure allowed me to make trade-offs more clearly *within* a mission area like "control the high ground"—as I did among global warning systems in developing this year's budget—and *between* mission areas—as when I directed that all bombers be moved from "sustain deterrence" to "power projection."

Modern Management Principles

The strategic planning framework was a necessary first step, but it soon became clear that the Air Force would need an infusion of modern management principles if it were to fully unleash the extraordinary talent of its people. The Air Force of the future would have to be more agile from bottom to top.

Over the past three years, the Chief and I have streamlined and delayered organizations, removed roadblocks to improvement, empowered people, and emphasized quality throughout. The newly created Air Force Materiel Command—the integration of the old Air Force Systems Command and Air Force Logistics Command and big enough to be in the *Fortune* 500's top five in revenues if it were private—is the flagship of many of these changes. We have also cut headquarters staffs, eliminated whole layers of command, consolidated labs, restructured our fighting units, and started a long list of bases toward closure.

All of these things made good sense, but we were also motivated by a need to offset disproportionate budget losses laid on the Air Force. When the Department of Defense (DoD) laid out its fiscal superstructure in 1989–90, Air Force strategic and airlift forces were properly set aside and a particular calculus was applied to them. The rest of the Air Force, however, was packaged with the Army, and dollar cuts were tied to ratio reductions in Army divisions and Air Force wings.

That not only ignored any changed relationship between air and ground power but also implied that we would cut space, command and control, surveillance, tanker, and other national and joint support assets at the same rate we lost Army divisions, even though these forces are largely insensitive to the size of the Army. Much of the restructuring and streamlining within the Air Force has served to free up resources to compensate for this. Any future division of the pie needs to reflect the efforts the Air Force has already made. Indeed, it may be time to recalculate fiscal allocations in light of the Persian Gulf War experience and the continuing changes in the world.

Right for the Times

I was confident that—by planning within our Global Reach, Global Power framework and managing wisely—we could build a program well suited for what the nation needs and can afford for the future. This is the leaner, meaner Air Force that I have often referred to. In peacetime, the Air Force will be more efficient; in crisis and war, more effective.

Air Force people often talk about the need to "lead turn" an adversary—to point your jet where your adversary *will be*, not where he *is*. We were able to "lead turn" a lot of the changes coming our way, including rationally reducing the size of the force. Any new initiatives within DoD need to be sensitive to this. The various departments are not at the same baseline.

With regard to size, when people talk of the Base Force, they often speak of the Air Force as 26.5 fighter wing equivalents. Actually, that number includes both active and reserve units, but it still accounts for less than twenty-five percent of the force structure. It ignores space wings, bomber wings, airlift wings, special operations wings, refueling wings, and so on. The Air Force once had 205 active-duty wings. By 1995 the total will be 100—reduced through elimination and consolidation.

In other words, using actual wings as the metric, the 1995 active-duty Air Force will have *less than half* the number of its late-1980s predecessor. In terms of personnel, measured from 1988, near the end-strength peak, one in three Air Force people will be gone by 1995 and not replaced. The Air Force is already down twenty-four percent, the largest percentage cut of any of the services to date.

We've been careful not to "peanut butter" these cuts across the board. Asymmetrical reductions reflect conscious adjustments to a new security environment. Shooters—fighters, bombers, and intercontinental ballistic missiles (ICBMs)—have been cut far more than those elements that give our forces agility and global awareness—tankers, transports, and surveillance and control systems.

These cuts and the changes the Air Force has already undergone are a down payment on an even brighter future. With marginal programs jettisoned, what remains is only a few major modernization efforts: the B-2 bomber to lash up range and payload with stealth, the F-22 fighter to retain America's essential and unquestioned command of the skies, the C-17 transport aircraft for mobility. These programs are combined with a few advanced conventional munitions for increased productivity from all air forces and upgrades to a few older platforms to leave the Air Force with a scrubbed and balanced investment account, at less than half the cold war purchasing power.

Equally important, we also rethought how existing systems should be used. To meet the challenges of the new security environment—fewer forces overall, fewer deployed overseas, the location of threats difficult to predict—the long-range bomber will have unmatched potential to respond to regional crises around the globe. With several new precision *conventional* weapons, the bomber force can strike critical targets in the first days of any campaign. The new B-2 mission statement that I issued early in 1992 underscores the primacy of the conventional role for this precious asset.

The Road Ahead

There is still much to be done *within* the Air Force. Ongoing acquisition programs need continuing attention. The better part of the restructuring is behind us, but there are powerful reasons to move the ICBM force into Air Force Space Command, where both communities would benefit. The new commands we've created must grow into true mergers. Continuing effort in military education will nurture the concepts of integrated airpower as they become part of the institution's collective psyche.

The Air Force must continue to work on these, but the real innovations to be harvested in the future lie in areas beyond the Air Force—in how the Air Force and airpower are understood by and relate to other elements of DoD. The Air Force should welcome a roles and missions review.

As I mentioned earlier, we have refocused the bomber force to a precision, conventional role, yet—as near as I can tell—theater commanders are only now waking up to what long-range airpower can do for them in the early hours and days of a conflict. I guess they all grew up when SAC owned the long-range aircraft and dedicated them to the nuclear mission. Sadly, in the last years of the twentieth century, some people still conceive of power projection as being limited to putting a division on a boat. That mold needs to be broken.

In more general terms, we all need to break the mold on how to think about the various elements of the nation's military strength. Modern aircraft and precision weapons have transformed the battlefield and the relative value of weapon systems. Modern airpower can undercut the enemy's basic ability to wage war and can deny opposing ground forces the ability to execute their scheme of maneuver—while also inflicting heavy attrition on those forces, sitting still or on the move. The most significant "ground" battle of the Gulf War may have been the second battle of Khafji. That's the battle that didn't occur because Iraqi armor—which up to that point had fought with discipline and tenacity—was detected while forming up and was destroyed by airpower before it reached the battlefield.

The Air Force has been routinely accused of "abandoning" the close air support mission to do something "more glamorous." I believe that something close to the reverse may be true. Airpower—through all its capabilities—can so greatly affect the ground battle that there is considerably less for ground forces to do than was previously assumed. This should be welcome news for a nation so casualty-averse as our own, for a nation that often defines military success not in the achievement of objectives (which is often taken for granted) but in what it costs us. This should be reflected in DoD-wide planning, investment, and force structure, but we are not there quite yet.

Emphasize Complementarities

The thinking about land- and seabased aviation should also be adjusted, making them less competitive for the same missions and stressing their *complementarities*. Deep strike is better left to landbased air, with seabased aviation tasked to protect the fleet and attack the littoral and sweeping the seas a joint mission. Navy Secretary Sean O'Keefe made good progress in better focusing naval aviation on the littoral and other areas of special expertise, but more can be done. The Marines, for example, can be brought more into joint warfare. Why do they need to supplement their helicopters and Harriers with F/A-18s and A-6s? These latter assets have to operate from carriers or runways, pointing to a compelling argument for the use of carrier air wing or Air Force aircraft.

At a more general level, the US Air Force is America's primary air force and, therefore, the legitimate operator of all aviation capabilities except those that must be organic to other services in order for them to prosecute their surface warfare missions. Any other approach increases the likelihood of needless overlap and invites criticism that we are wasting resources and fragmenting military power.

Although DoD can probably live with four properly restructured air forces, the nation will not profit if we continue to construct three space forces. We need to draw the line now and let this mission reside where the infrastructure, personnel, and experience already rest—in the Air Force. Ninety-three percent of the personnel in US Space Command are Air Force, as are all of the major and three-fourths of the minor installations. The Air Force spends four out of five DoD space dollars. The Air Force didn't build a navy when it needed sealift. It can and should step up to launch and on-orbit support for all of DoD.

Air and missile defense also deserve another look, integrating as fully as possible the surface and aerospace systems on which our joint forces depend. The need to fully integrate detection, tracking, identification, and destruction (by whatever means) argues for single-service responsibility. Out of the top air defense systems in the world, the US stands nearly alone in dividing area SAMs from air-superiority aircraft in different institutions. We are in the process—out of habit, I fear—of extending this flawed structure to the ballistic missile defense of our deployed forces and of the US itself. We don't need two or three services sorting out who's got the ball during missile time of flight.

There are efficiencies to be harvested in the support arena as well. The general downsizing of forces is creating excess capacity throughout the Department of Defense in depots, test ranges, training facilities, and elsewhere. If we break old mindsets, we can cut overhead, ensure responsiveness, and protect the future. The default option for DoD is often to organize "like activities" under large defense agencies. We should be skeptical of such proposals. Large bureaucracies—especially those removed from the operations they oversee—drive up costs and drive down performance. A single-service lead can improve efficiency and preserve readiness. The Air Force should continue to push hard for the services to resolve these issues between and among themselves.

In depots, for example, a single service could manage equipment of a particular type—watercraft in the Navy, ground vehicles in the Army, and fixed-wing aircraft in the Air Force. It should also be possible for a single service to manage investment and scheduling for all existing facilities for flight test and evaluation, linking Air Force and Navy ranges in the western US into a common complex. Even though the Navy and the Air Force have traditionally conducted separate training programs for their pilots, basic airmanship skills are common to both services and could be taught in a common program. It may even be possible to merge various elements of advanced training. In each of these cases, proposed solutions are already on the table and under discussion; they need continued support,

especially from senior leadership, to reach closure.

Breaking Free From the Past

Landscape changes, both international and domestic, have transformed the environment within which we will develop security policy. The greatest danger before us is the erosion of international cooperation in the face of such common threats as proliferation of weapons of mass destruction, environmental degradation, regional conflict, and the destruction of governance in democracies not yet firmly established. The challenge before us is to preserve collective security in a splintering world.

As we face this, be open to new formulas. Be sure that, in the effort to preserve our strength, we are not just preserving our past. Let me offer some specifics.

The first is the call to retain superpower status. Clearly, we need to be able to defend our national interests, but retaining "superpower status" is a very abstract target. I am painfully aware of the dangers of incrementally diminishing our military strength below some critical level. But we are not a superpower because we have fourteen carrier battle groups rather than ten, or seventy-five B-2s as opposed to twenty, or twelve active divisions instead of nine or ten. We are a superpower because we are the only nation on the planet whose political, economic, ideological, and military reach is truly global. It is this aggregate strength that we need to protect.

The types of military forces we retain must be appropriate for the international challenges we could confront, and not just smaller versions of the ones we maintained at the height of the cold war. I would advise everyone to be especially wary of a new culture within the Pentagon that some members of my staff liked to call "joint political correctness"—a culture that attempts to see that resources and roles are shared "equitably" rather than intelligently. The true meaning of jointness is one team employing the right tool at the right time. Be wary of operational choices that seem to use the various services in equal measure or budget options that seem to apply symmetrically across services. They will almost always be wrong.

As a nation, we need to sort out what we really need from forward presence. It is our continued *engagement*—the reality and the perception that the US is committed and involved—that should be protected, not necessarily the permanent (or even transient) deployment of our forces. In some cases, presence—understood in the traditional sense of forward deployments—will still be required. The Air Force's record on fighting for a base in southern Italy to cover NATO's southern region and keep other hot spots within easy reach is proof enough of that. But the US has other tools to build the network of relationships that guarantee global access and influence. In much of the world, the United States can rely on exercises, periodic deployments, arms sales programs, combined planning, support agreements, and similar types of activities to show US concern and involvement.

The emerging democracies in central Europe and in the successor states to the old Soviet Union are a special case for "presence." Since the US is most secure in a world where ideas, people, and goods move freely, the democratization of this region is a genuine security issue and our military has much to share with the armed forces of these societies. The new democracies of central Europe are already clamoring for opportunities to see how a society can be both free and secure. Let's open the door to them and others and allow such contacts to expand and become core to DoD's activities. An intense and diverse program of military contacts can be the *engagement* (née "forward presence") of the 1990s and beyond.

A Useful Calculus

In essence, the new Administration faces two challenges as it sorts out the competing demands within DoD and between defense and domestic priorities. The first is to retain the ability to deal with residual threats to US interests around the world, even though the location, dimension, timing, and technology level of these threats will be difficult to predict. A second challenge—perhaps more difficult than keeping sufficient military power in being—is to create, slowly and affordably, the backbone of US forces for after the year 2000.

A calculus I have found useful in sorting out the needed from the merely useful is the concept of core capabilities. Core capabilities are those things that ensure that *no* potential aggressor can rapidly close the gap between him and us. They are the things we would rely on in a conflict, the capabilities the US is uniquely qualified to contribute to a coalition undertaking. To be enduring, they must exploit our inherent strengths as a nation, our distinctive competencies. In my mind these include the ability to:

- Maintain global situational awareness.
- Inflict strategic and operational paralysis on any adversary by striking key nodes in his war-making potential.
- Hold emerging strategic capabilities in threatening states at risk, while being prepared to defend against limited missile attack.
- Deploy sufficient, high-quality forces worldwide to be able to deter or defend.
- Assure access to any region via air, maritime, and space supremacy.
- Assist international efforts for relief, peacekeeping, and drug interdiction.
- Sustain a research and industrial base sufficient to keep our technology edge.

These demands play to the inherent strengths of air- and spacepower. In an age of uncertainty, with the location and direction of future challenges almost impossible to predict, space forces allow us to monitor activities around the world and to know the battlefield even before forces arrive. With smaller forces overall and fewer deployed overseas, airpower's ability to respond rapidly—within hours—and with precision and effect will be invaluable and a capability that will be America's alone. Ours will be the air force of first and last resort. I should also add that a response does not have to be lethal. A helping hand, watchful eye, or clenched fist—airpower can, and has, delivered them all.

My deepest thanks for the opportunity to have served with the world's most respected air and space force and for the cooperation and support I have received from its members. My sincere best wishes for continued success.

"Check twelve." ■

Donald B. Rice was Secretary of the Air Force from May 22, 1989, to January 20, 1993.

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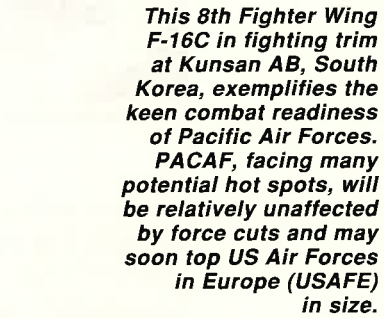
The pressures have not diminished along the Asian rim, where Air Force presence may soon be larger than in Europe.

Flexible Reach in the Pacific

By David J. Lynch



This 8th Fighter Wing F-16C in fighting trim at Kunsan AB, South Korea, exemplifies the keen combat readiness of Pacific Air Forces. PACAF, facing many potential hot spots, will be relatively unaffected by force cuts and may soon top US Air Forces in Europe (USAFE) in size.

ONCE A bristling Pacific military power, the Soviet Union sank without a trace, but the same cannot be said of the American defense system originally built to contain Soviet might. The big Philippine bases are gone. Otherwise, US air, sea, and land deployments, stretching from Alaska to Guam, have changed very little since the height of the cold war.

This is especially true of the Air Force presence, which is slated to remain robust indefinitely. When planned force cuts are completed, Pacific Air Forces (PACAF) will have lost fifteen percent of its cold war strength—about half a fighter wing. By contrast, US Air Forces in Europe (USAFE) will have lost sixty percent, four and a half wings. PACAF, headquartered at Hickam AFB, Hawaii, may soon overtake USAFE in size for the first time.

The disparity in outcomes reflects a key difference between the Pacific and European theaters. In the cold war, the threat in Europe was Soviet attack, pure and simple. In the Pacific, this was not the case. Soviet power was potentially lethal, but there were always explosive regional dangers. There still are.

The Pacific region is not blessed with a shortage of potential flash points. Run your finger across a map, and they leap out—in North Korea, signs of a nasty, violent succession crisis; in China, a saber-rattling regime bent on acquiring advanced Russian arms at bargain prices; in Japan, evidence of budding, long-term foreign ambitions with unclear consequences; in the South China sea, a multisided but deadly serious dispute over the Spratly Islands.

Then there is Russia, heir to the Soviet Union's military legacy. Gen. Robert Rutherford, the newly installed commander of PACAF, dismisses the notion that much has changed in that gigantic country since the August 1991 coup in the Kremlin. "We had known for some time that the Soviet economy

Photo © Randy G. Jolly / Arms Communications

These fighters and their companion tanker belong to the composite 18th Wing at Kadena AB, Japan. Composed of highly diverse aircraft, the versatile, flexible 18th Wing seems tailor-made for far-flung missions all across the Pacific.

was in trouble," said General Rutherford. "Nonetheless, we considered them a major world power. Those elements still exist. They've got the equipment. For sure, they've got the manpower. I think things . . . bear watching, and . . . that's what we're doing."

RAND Corp., which recently completed a major Pacific assessment for the Defense Department, identified another candidate: "The biggest 'threat' is the uncertainty inherent in a multipolar international system, most of whose members are on the move economically and who leave the underwriting of regional stability to others."

To an American public weary of international burdens, none of these hazy dangers is likely to seem compelling. Gen. Jimmie Adams, former commander of Pacific Air Forces, preferred to concentrate on the magnitude of US interests, frequently noting that US trade in the Pacific is fifty percent greater than trade with Europe. Adm. Charles R. Larson, commander in chief of US Pacific Command, offers another compelling statistic: 2.5 million US jobs depend on Asian trade.

Korea Remains Hot

As Pacific officers see it, the heavily armed Korean peninsula continues to be the one spot where no one would be surprised to see a major war erupt on short notice. While most of PACAF's cold war–era war plans have been shelved, the one drawn up for a Korean war remains "operative," said Maj. Gen. Ronald Iverson, deputy chief of staff for Operations at PACAF headquarters.

Intelligence officers in the region note that within the last ten years North Korea has moved sixty percent of its massive one-million-man military force to within twenty-five miles of the Demilitarized Zone. Kim Il Sung, North Korea's aged Communist ruler, pointedly has refused to rule out a forceful reunification of the peninsula. His son, the designated heir, has been even more intransigent and prone to draw attention to Pyongyang's military power.

"With that kind of capability, it's real and it's threatening," maintains Col. Bill Hudson, the PACAF director of Intelligence Plans, Programs, and Policy. "If something flashes, North Korea is in a position to respond in twelve to twenty-four hours."

US officers are confident that, if North Korea kicked off a war, the US and its South Korean ally would enjoy complete air superiority from the earliest moments of any battle. North Korean pilots would be hampered by a lack of training. US intelligence reports suggest that the monthly sortie numbers for Pyongang's best units are absurdly low. "It's our estimate we'd sweep them from the sky," said Colonel Hudson.

For PACAF, the real challenge would be to support the outgunned US and South Korean troops on the ground. Disrupting the North Korean thrust south and preventing reinforcements would be essential, as would maintaining effective resupply via airlift.

General Rutherford deflects questions about the quality of North Korean ground troops by saying "they haven't been tested since [the Korean War] . . . and I don't want to find out." Other analysts say Kim Il Sung has assembled a tough, dedicated army blessed with especially crafty

Photo © Randy G. Jolly / Arms Communications

PACAF is on the lookout for trouble in potentially explosive Korea. This well-armed, mission-ready F-16C waits at Osan AB. Nearly two-thirds of North Korea's massive military force is poised within twenty-five miles of the Demilitarized Zone.

and dangerous special operations units.

A key question would be the North Koreans' ability to operate in large units. For a variety of reasons, North Korea has not practiced large-scale military operations. They burn up too much scarce petroleum and cost too much for the North's tottering economy, intelligence analysts believe. Whether Kim might think otherwise or lash out irrationally, however, can't be predicted with any degree of confidence.

"The problem isn't 'Will they win?' " observes Colonel Hudson. "The problem is 'Will they try?' "

The command structure needed to fight a second Korean War is well established. Last year, a Korean general assumed command of the allied forces in Seoul, an important diplomatic first.

Photo © Randy G. Jolly / Arms Communications

This AWACS E-3 Sentry of the 18th Wing at Kadena AB is a prime means of airborne command and control, essential for regional air operations. PACAF has authority over AWACS planes at Kadena and at Elmendorf AFB, Alaska.

A New Strategy

For other, as yet unimagined, conflicts in the region, Admiral Larson has drafted a new US warfighting strategy. If trouble threatened in, say, the Spratly Islands or off the Chinese mainland, CINCPAC would quickly establish a joint task force commander to direct the US response. Reporting directly to Admiral Larson, this general officer would command all of the American military assets engaged in the crisis.

To implement Admiral Larson's blueprint, PACAF drew up plans last year for what General Adams called a "flexible, deployable command-and-control" capability that would link field commanders with their rear-echelon bosses. That capability will be exercised for the first time this summer, according to the recently retired PACAF commander.

Admiral Larson has already tested the overall concept in peacetime operations, including disaster relief efforts during a 1991 storm in Bangladesh and joint exercises in California. In summer 1992, 22,000 troops, representing special operations teams, Army paratroopers, and Navy submarine forces, exercised under the command of the Third Fleet commander in and around California.

"It was a remarkable exercise, with Army operators in Navy combat information centers aboard ship and Air Force planners scheduling Navy carrier strikes," said Admiral Larson.

His strategic approach reflects the dramatic changes that have occurred on the international scene, but quieter changes have been remaking the forces at PACAF's disposal. Some are the product of ongoing modernization programs that have given the command's combat units greater lethality and the ability to fight at night. Others are the offspring of USAF-wide initiatives designed to provide the theater commanders greater control over the forces they need to fight.

Over the past four years, PACAF has fielded new F-15E dual-role fighters and Low-Altitude Navigation and Targeting Infrared for Night pods for its F-16s. Gone are the vintage F-4 Phantoms formerly based at Clark AB, the Philippines. Force structure reductions in 1993 will claim eighteen F-15s based at Kadena AB, Japan—a fairly modest hit considering the service-wide shrinkage under way.

PACAF is looking ahead to continuing block modernization programs for its F-16s, a move that includes a push toward greater commonality in engines. Likewise, its F-15s are slated for a Multistage Improvement Program that will mean new avionics, missiles, and countermeasures gear. The aircraft is overdue for a face-lift: A key maintenance worry for PACAF hangar bosses is the plane's rudder, which is suffering age- and stress-related cracking and debonding.

PACAF officers cite the availability of Air National Guard assets from Alaska and Hawaii as evidence of increased combat capability. Under newly enacted voluntary programs, PACAF could call on C-130s from Alaska and F-15s from Hawaii without having to wait for the formal federalization of those forces. The change would boost PACAF's immediate punch in dealing with short-lived flare-ups.

Meanwhile, many are cheered by Chief of Staff Gen. Merrill A. McPeak's move to give authority over all systems in the theater to a single commander. That innovation has put PACAF in charge of E-3 Airborne Warning and Control System planes at Kadena and at Elmendorf AFB, Alaska; C-130 airlifters at Yokota AB, Japan; and KC-135R tankers at Kadena. On January 1, a small fleet of rescue helicopters joined the mix. In the next several years, PACAF is looking to trade up from its current mix of C-130E and H models to an all-H force that will have longer range and more efficient fuel consumption. The KC-135Rs are also slated to be outfitted with new engines that promise to increase the range of PACAF aircraft substantially.

The Importance of Exercises

Exercises are a key component of the US Pacific strategy. Unlike Europe, where the US and its chief allies are linked in a formal multilateral structure, the Pacific is a welter of bilateral ties. "We think the forces are about right," said Maj. Gen. Joseph

Staff photo by Guy Aceto

F-16C fighters take off from Eielson AFB to show their stuff over Alaska in Cope Thunder, an annual PACAF training exercise once conducted in Philippine airspace. PACAF, gone from the Philippines, has added spacious Alaska to its fold.

Redden, PACAF's deputy chief of staff for Plans. "Our challenge is to exercise them."

Officers at both PACAF and Pacific Command are drawing up plans for ambitious multilateral exercises. The immediate prompting for the shift was the US withdrawal from its Philippine bases last year. Clark AB and the Subic Bay naval complex were important for geostrategic reasons, but the US presence in the Philippines had another crucial aspect. The Crow Valley exercise range allowed the US and its regional allies to train together in the annual Cope Thunder exercise. PACAF has relocated Cope Thunder to Alaska.

The small southeast Asian nations that routinely practiced with the US in the Philippines are unable to get their fighters to Alaska. They lack refueling capability, and PACAF by law can't provide free fill-ups.

As a result, US officers are discussing with the governments of Thailand and Australia the possibility of holding multilateral exercises in those countries. Such a regional forum would duplicate the key attribute of the former Philippine exercises. For now, PACAF officials tiptoe around the diplomatic issues associated with the subject. New multilateral exercises probably won't materialize for two to five years.

Cope Thunder is only one of some fifty annual exercises PACAF conducts. These range from deployments of four to six fighters to Malaysia to the massive joint exercise in Korea called Team Spirit. Others are Full Eagle, a test of special operations and base defense capabilities in Korea; Keen Edge, a joint exercise in Japan; and Pitch Black, held in Australia. General Rutherford sees the multilateral exercises as a key step in weaving a regional web of stability.

The withdrawal from the Philippines and the reductions in USAF budgets seem to be reshaping PACAF's exercise plans to a far greater extent than has the collapse of the Soviet Union.

In part, that's because Russia retains impressive military capabilities, which continue to grow as older aircraft in the Far Eastern Military District are replaced by newer models withdrawn from Europe. It's also because "Soviet-style" tactics and arms have been exported to countries like China and North Korea, General Iverson said.

Lower budgets across the board are generating a green-eyeshade approach to training. General Iverson faces tough choices on the specific training programs to abandon, which he likened to a father's decision on "which kid would you want to throw away?"

The General says PACAF's training programs will survive Fiscal 1993 in relatively good shape, but the year after that is beginning to have an ominous look. "I'm very concerned about '94," General Iverson said. "It's not good."

PACAF has responded to the budgetary crunch by trimming some training for F-16 pilots on such secondary missions as air defense. Overall monthly sortie rates for the F-16 are slated to fall about ten percent next year, said General Iverson, but with the average number of crews assigned to each plane falling from 1.34 to 1.25, that decrease in total training is not expected to cost individual pilots much training time.

General Iverson has been forced to

Photo © Randy G. Jolly / Arms Communications

PACAF search-and-rescue forces practice for the ever-possible real thing. Tight budgets have forced PACAF to cut back on training. Some secondary missions, including air defense, have also been trimmed.

redirect spending on exercises. The overall exercise budget has declined roughly five percent. Spending on joint exercises is increasing by a few million dollars while a nominal freeze is in place for USAF-only exercises. Exercising with Navy and Army units is viewed as more important now because of Admiral Larson's two-tier warfighting concept.

War Game Simulations

Pacific Air Forces is considering adding war game simulations modeled on the Blue Flag system at Eglin AFB, Fla., and USAFE's Warrior Preparation Center near Ramstein AB, Germany. The system, which would be designed primarily to simulate various Korean contingencies, is seen as a distributed, open-architecture computer network linking commanders in the field with Pacific Command and PACAF commanders in Hawaii. Planning remains in the early stages, with initial funding earmarked. There is not enough to complete the program, however.

For now, PACAF readiness looks strong. Col. Dick May, PACAF's deputy chief of staff for Logistics, is particularly heartened by data showing that PACAF's mission capable rate of 90.8 percent exceeds both USAFE and Air Combat Command averages. "I have considerable concern about maintaining" the figures, he said, citing budget woes. General Rutherford said he was worried by "disturbing signs we may not have the parts and pieces to maintain high readiness" in the future. PACAF's cannibalization rates have already begun creeping up, he noted.

Hanging over all of PACAF's preparations are unresolved questions about the long-range ambitions of the Pacific region's two powers, Japan and China. Both countries remain enigmatic. China presents the more immediate challenge. It appears destined to acquire impressive power projection capabilities left over from the Soviet Union's collapse, perhaps including a half-finished Soviet aircraft carrier, as well as Russian technical specialists. At the same time, brushing aside proliferation concerns, China is helping to arm a variety of unsavory regimes with missiles and other advanced weapons.

Photo © Randy G. Jolly / Arms Communications

In a typically oceanic PACAF setting, F-15Cs of the 18th Wing at Kadena AB wheel in tight formation above the Pacific. Looking to its future, PACAF is left to ponder unanswered questions about the ambitions of Japan and China.

The concern over China has come to a head because of an archipelago in the South China Sea called the Spratly Islands. Half a dozen nations, including China, assert sovereignty over some or all of this area. Chinese and Vietnamese soldiers have traded gunfire over their competing claims. US analysts expect further skirmishing.

Potentially lucrative oil deposits are at stake. For each country involved, access to the Spratly oil fields offers independence from Middle Eastern oil supplies as well as access to hard currency earnings. As the rivals jockey for position, the possibility of armed conflict is ever-present. China, which enjoys unquestioned local military superiority in the Spratlys, has conducted test drilling in areas claimed by Vietnam and has threatened to bomb its competitors.

The "Japan question" is more complex. At issue is whether the four-decade-old US-Japan security alliance will survive current trade frictions between the two countries. US officers point to Japan's uniquely high, multibillion-dollar, host nation support as a sign of Tokyo's willingness to share Pacific security burdens. By 1995, for example, Japan will pay 100 percent of the utilities bill for US forces based there, including for off-base housing. Tokyo also pays the salaries of 22,675 Japanese workers on US facilities.

Even within PACAF, opinions are divided on how serious the prospect is of a militarily independent Japan. To some, the danger is not that Japan intends to strike out on its own and rearm. Like most other nations in the region, Japan wants a continued US presence to preserve regional stability, according to this view. Rather, there is the risk that Tokyo could lose faith in US willingness to remain engaged in Far East security arrangements and could feel pressured to enter some kind of arrangement with China.

Others, including General Rutherford, acknowledge the potential for Japan to shift course as it reexamines the primary assumptions of its cold war security policies. "It's of some concern," conceded General Rutherford. "Where are they going? Only the Japanese people know for sure, and they'll decide."

If the US maintains its forward presence in the Pacific, these dangers can be managed, say US officials. "In the long term," said Admiral Larson, "my major worry is about the military scramble which would surely follow if we destabilized the region by withdrawing our forward presence." ■

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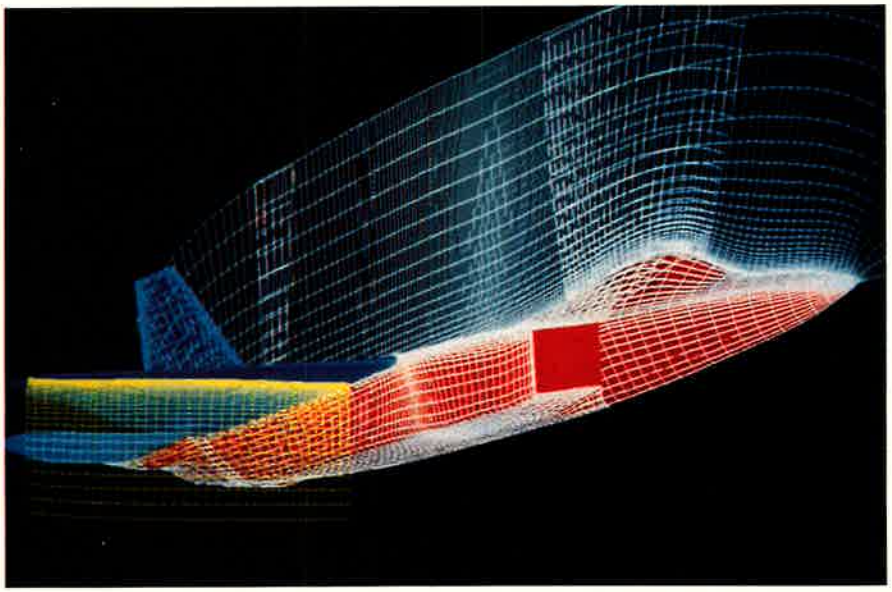
The new fighter is hitting its marks on weight and capability. Cost is still in question.

The F-22's Triple Challenge

By Frank Oliveri, Associate Editor



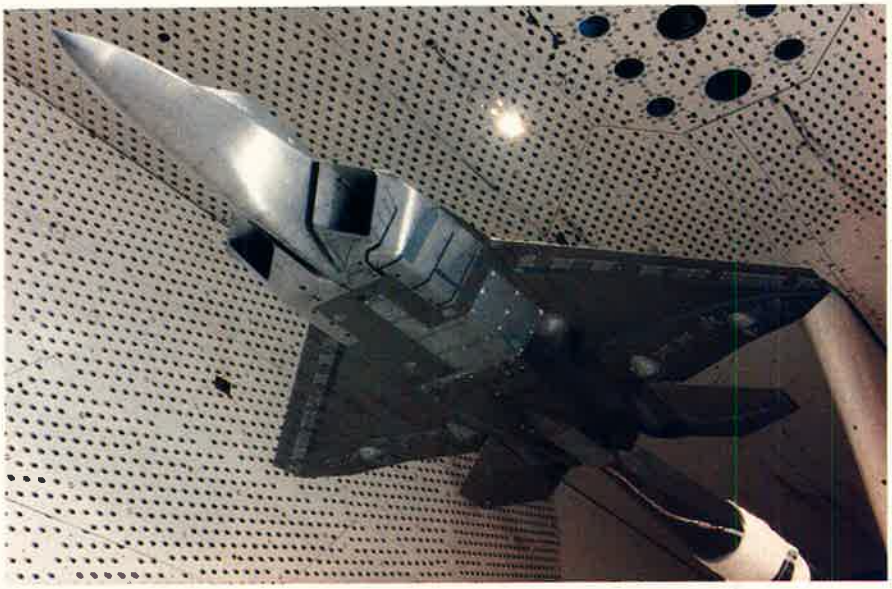
The YF-22 prototype (oppcsite) helped the Air Force and its contractor team collect data on the flying characteristics of the aircraft and refine the design of the production F-22. Computational fluid dynamics tests (above) at Arnold Engineering Development Center (AEDC), Arnold AFB, Tenn., provide data on the F-22's production configuration.

In its push to bring the F-22 fighter to the flight line, the Air Force confronts three severe challenges—keeping the fighter's weight down, giving it overwhelming power relative to its adversaries, and holding the line on costs.

The Air Force has been able so far to master the first two. Nobody is ready to declare ultimate victory, and problems could still crop up, but the service and its contractors have a good grip on the weight and combat power of the fighter. The third issue—cost—generates great uncertainty.

That, in a nutshell, is the status of the advanced fighter development effort as related by Brig. Gen. Robert Raggio, F-22 program director at Air Force Materiel Command's Aeronautical Systems Center, Wright-Patterson AFB, Ohio. Other officials and members of the F-22 team generally echo his assessment.

Despite the collapse of the Soviet adversary, the Air Force is determined to build an F-22 with a level of performance that approaches that originally planned for the airplane. General Raggio, who assumed command of the high-profile aircraft program last summer, says that the Air Force won't



Extensive testing can be done on the production-configured F-22 by way of simulation. Here a model of the production-configured F-22 is tested at AEDC, which boasts the nation's largest complex of wind tunnels, jet and rocket engine test cells, space simulation chambers, and hyperballistic ranges.

compromise on the F-22's air-to-air power and that it hasn't dropped any major capabilities.

"The things we are measured on—the requirements—haven't changed," declares the General. "If there have been changes, they have been on the margin. The requirements that have been dictated for the F-22 have not been changed."

However, the service constantly updates the systems threat assessment report (STAR). The most recent STAR looked at the existing threat and proposed capability adjustments that should or could be made. These types of adjustments will be incorporated into the airplane prior to the preliminary design review, due to be completed in April. Eric Abell, the F-22 program's technical director and chief engineer, asserts, "I don't see it making a significant change in the overall capability of the fighter."

Less Back-End Stealth?

The service is considering making changes at the margin of the program, however. One example concerns new thinking about the aircraft's thrust-vectoring system. The production F-22 will incorporate thrust-vectoring nozzles into its engines. F-22 designers will continue to analyze the threat and, presumably, leave the door open for producing a less robust, less costly system.

The F-22 System Program Office at Wright-Patterson is conducting a "trade study" on stealth, assessing what kinds of capabilities can be traded off against stealth, at what cost in performance. The main point of the study will be to examine whether the Air Force must pursue high levels of stealth in the rear of the aircraft as aggressively as it once did, given the radical change in the threat and budget levels.

The design difficulty comes in trying to match the thrust-vectoring nozzle to the back of the airframe and make the seals work. Experts note that, if the Air Force slightly relaxed its stealth criterion, it could reap major cost savings.

Mr. Abell says the Air Force never expected the back end of the aircraft to be as stealthy as the front. He explains that the difference in the two versions of the aircraft would not be "Here I am invisible, and here I'm as big as a barn," but just "tuning on the margins."

The F-22's planned suite of avionics has also been changing marginally. Electrical power has been reduced. Studies show that the lower power level will be sufficient to run all initial functions and all planned future functions. The avionics package, say officials, could easily handle such items as the infrared search and track system and the side-aspect radar system, both of which are preplanned product improvements.

Originally, "it looked like we were going to have to put the Hoover Dam in there to generate the power," Mr. Abell says. "So what we did was refine the concept of the operations, in a technical sense."

The integrated avionics suite is the heart and soul of the F-22. For a fighter, the level of integration is unprecedented, and all seems to be going as planned. The goal is to acquire, fuse, and analyze data entering from sensors distributed around the aircraft.

Mr. Abell says the object is to "correlate all of that information coming in from all those signals and tell the

Though it was not required of the prototype, the YF-22 fired an AMRAAM during testing. The F-22 might not carry as many missiles as was originally planned. All will be carried internally to preserve stealthiness.

pilot that the airplane believes that there is one [enemy aircraft] here based on everything it knows of the situation around it. It can tell what kind he is, where he is, maybe what his intent is, and, using the power of that fusion of information, present information to the pilot, instead of data, which is what he gets now."

What the pilot gets is location, type of aircraft, whether the aircraft is looking at him, and what it might do. The system provides the pilot with alternatives. Five liquid crystal flat-panel displays will provide the needed symbology more efficiently than in any aircraft in history.

Fewer Air-to-Air Missiles

The F-22 fighter is designed to carry its complement of eight air-to-air missiles internally. (The F-15 carries up to eight externally.)

The Air Force apparently looked long and hard at the issue during the F-22's demonstration/validation phase. Surprisingly, say program officials, the service found that increasing the number of missiles beyond eight only increased the chance of losing the F-22 in combat because, says Mr. Abell, "you stayed in the fight longer." The Air Force decided to go with a six- to eight-missile capacity. Still, the F-22 is expected to have a kill ratio over enemy aircraft about five times that of its predecessor, the F-15.

The Air Force set high goals for the F-22 in reliability, maintainability, and supportability. Compared to the F-15 it would replace, the F-22 was supposed to require half as many support personnel and fewer than half as many C-141 airlifters to haul the necessary equipment for a squadron deployment.

General Raggio says these goals and others are being met, but the task has not been easy. One question was whether to put an auxiliary power unit (APU) on the F-22. Dropping it would save weight but would have created a requirement for ground-based APU carts. The carts would have to fit on C-141 aircraft in support of a squadron. The Air Force decided to keep an APU on board the plane.

Lockheed performed an integrity analysis to ensure that every part would perform as it should. It found and rectified a number of potential problems. One example is a basic electronic connector, which, the analysis found, would have started to fail at about 200 hours of flying time. Lockheed decided to switch to a different connector that is expected to last 8,000 hours. "That could have been a billion-dollar problem," says James A. "Micky" Blackwell, Lockheed's F-22 program manager. "We're doing [quality analysis] in every part of this airplane."

The F-22 will have unprecedented fighting range. Its supercruising engines allow it to cruise at supersonic speeds without afterburner, making it highly fuel-efficient.

Another boost to the supportability aspect of the program is that, as Lockheed designs the tooling, it builds two sets of tools—one for itself and one for the Air Force's logistics depot. Thus, when the depot needs to replace a worn part, it can manufacture it and avoid paying a contractor for the job.

In 1986, when two industrial teams began the five-year demonstration/validation portion of the program, the Air Force said it was shooting to produce a highly capable airplane weighing no more than 50,000 pounds, with a maximum unit flyaway cost of $35 million (1985 dollars). The cost figure assumed a production run of 750 aircraft built at a rate of forty-eight planes per year.

The weight goal was set "kind of in the blind," remarks Gen. John Michael Loh, commander of Air Combat Command and former commander of ASC, where for several years he was deeply involved in the Advanced Tactical Fighter program, the precursor of the F-22 effort. He notes that one builds a fighter not to meet a specific weight but to do a specific job or jobs, and that the F-22 will do the job.

General Loh says he believes the production F-22 probably will weigh "in the high fifties"—close to 60,000 pounds. He points out that the projected weight is still under that of the F-15E and the F-14, two older aircraft with air-superiority missions.

Weight has been a major concern of this program from the outset. Mr. Blackwell says, "We actually had to go on a crisis footing to get down to our proposal weight. We had to do a lot of focus and attitude changing of all our designers."

Weight was not a contract item in the engineering and manufacturing development (EMD) stage, but designers and program officers pay close attention because it severely affects the performance of the aircraft. Moreover, greater weight usually equals greater cost.

General Raggio says that the F-22's weight is some 100 pounds below the contractors' proposal weight. In this

regard, the Lockheed-led team has racked up no small achievement; weight growth, rather than loss, is the norm in this phase of the program.

Gaining 400 Pounds?

The contractor team managed one weight-creating USAF order without ill effect. The service wanted to increase the plane's ability to withstand G forces, the better to avoid the kind of wing cracks unexpectedly being found in some other USAF aircraft. This change added some 200 to 400 pounds. The aircraft still came in under weight, and the change is considered well worth the extra pounds.

for example, avionics. Mr. Abell says that decreasing the electrical power requirement within the system lowered the temperature of the avionics, which in turn reduced the requirement for cooling. Many of the avionics modules on the F-22 will be made of composite materials rather than metal, further reducing weight. Overall, the weight of the avionics suite in the F-22 will come in about ten percent lower than that of today's suites, according to Mr. Blackwell.

Mr. Abell says that significant weight savings were gained just by looking at "how you stuff the airplanes" with all of the components it must have.

"You've got all this bridge work called the airframe, bulkheads, frames, and spars, and you have to put things in them. Packaging it the wrong way puts a hell of a lot of wire [on board]. If you can rearrange the way you're going to do that . . . you can make some significant amounts of weight savings in just how the wire bundles run through the airplane."

Looking at how the aircraft takes on loads also led to weight reduction. In the demonstration/validation phase, the contractor teams flew actual prototypes and learned much about predictions made from wind tunnel testing. Armed with that information, engineers and designers strengthened areas that needed support but cut weight in areas of reduced strain.

The problem of how to cope with the danger of birdstrikes provides another example of weight trimming. Lockheed's Mr. Blackwell says that the contractor team was able to demonstrate inherent rigidity in the design of the canopy; thus, it could reduce the thickness of the canopy, saving a few pounds without sacrificing any performance.

The F-22 will reach extreme angles of attack (the YF-22 above is merely climbing). Its phased-array radar (antenna below) will be highly reliable. Provisions are being made, in a P³I program, for a side-aspect radar.

Cost, the Greatest Hurdle

All agree that the greatest hurdle that the program will have to clear is cost. It goes to the heart of the F-22's affordability at a time of defense austerity. The problem has hit the F-22 hard, but it is bigger than a single program; it afflicts the entire defense aerospace industry.

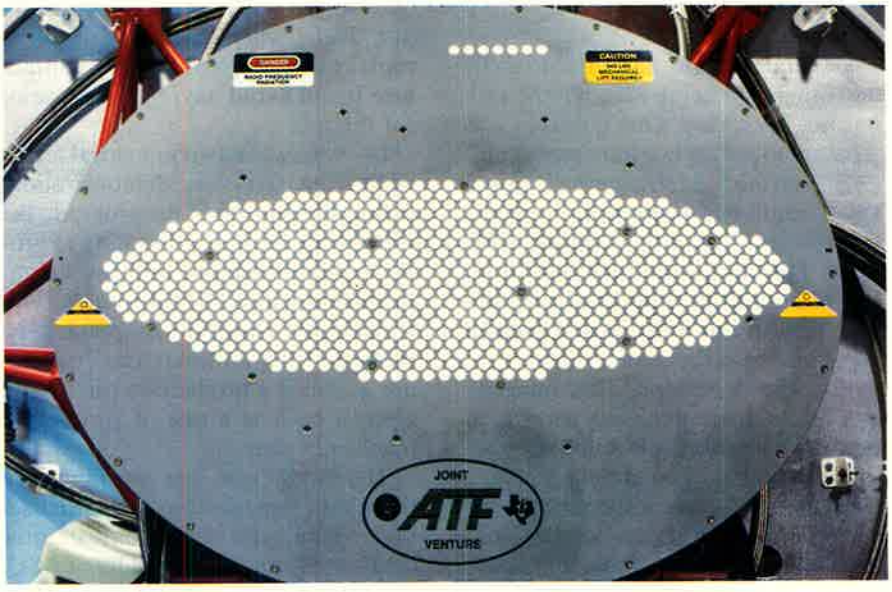
Because of the decline in government purchasing of military hardware,

"This fighter is going to be around for fifty years," says General Raggio. "It must be robust." By that he means that the F-22 will have a G tolerance much superior to that of the F-15s and F-16s in today's fighter fleet.

Much of the weight-control success can be attributed to integrated product teams (IPTs), which are responsible for every aspect of the fighter from the full design to the smallest functions.

"The IPTs go down to a level where each of [them] is responsible for its part of the plane," General Raggio says. "Every single person takes a hand in this. The IPT chief is responsible for weight and costs."

Mr. Abell cites a number of areas where weight savings were achieved—



contractors' general overhead costs are becoming a significant problem for those specific programs still under way. Overhead increases occur primarily when other programs the contractor carries decline or are terminated.

The Lockheed/Boeing/General Dynamics F-22 team is a prime example of this process at work. When the B-2 program ended and SRAM II was terminated, Boeing's overhead costs—relative to total business—soared. General Dynamics suffered an increase when prospects for F-16 sales declined.

"When the business base goes down, if the overhead doesn't come down commensurately, the overhead is shared by the remaining programs," General Raggio says.

He explains that overhead is a tough thing for a company to bring down because the contractor has to concede that there is no future business for which it will need additional capacity. "If they cut back on capacity, they're also cutting back on their ability to get the next contract—if there is a next contract," the General says.

The overhead problem is the primary reason the F-22 program was recently rephased. Essentially, the Air Force stretched the program by eleven months, put off the first flight of the F-22 to mid-1996, and reduced the number of EMD aircraft from eleven to nine. General Raggio warns that this kind of rephasing problem could plague the program indefinitely unless the team takes aggressive steps to get overhead under control. To do that, the contractors will have to reduce capital investment, sell buildings and equipment, or cut the work force to reduce labor costs.

There are some success stories. Pratt & Whitney, builder of the F-22's new F119 engine, has been relentlessly cutting back on labor and plant cost, and its estimate of completion of the engine for EMD is lower than the original proposal.

Mr. Blackwell says that all three firms are undergoing a reengineering program to reduce overhead costs. By purchasing General Dynamics' Fort Worth facilities, Lockheed hopes to reduce overhead through consolidation. General Loh, among others, believes that this "certainly" will be the case.

The cost problem doesn't end there. Congress reduced the Fiscal 1993 request for the program by $285 million, which forced the rephasing. Contractor overhead expenses total $278 million; risk factors for technical development will cost $97 million. Defense management and a downward adjustment for inflation will add another $90 million. The total shortage in 1993 will be $750 million. These additional costs, however, will not require an increase of funds for the ten-year phase.

Air superiority is essential to the success of a modern military campaign. The F-22 would have unmatched air-to-air capabilities and could be given a formidable strike capability. However, the F-22 may face its greatest challenges—financial ones—before it takes to the skies.

The slip in the schedule will increase the total program cost. It will take an additional year to buy the full planned complement of 648 F-22s (the Pentagon discarded the 750-plane plan in 1990). That delay will increase the total cost of the program by the amount of inflation on the purchase for that one year, a sizable amount of money.

Efficiency could be increased in the unlikely event that the F-22 does double duty. Questions have been raised in recent months about the inherent strike capability of the F-22 and how it could be exploited if the future Navy-USAF A/F-X fighter program should run afoul of budget or development problems. Former Air Force Secretary Donald Rice declared in December that a strike variant of the F-22 was one potential USAF fallback position. Current plans call for the Air Force to use a variant of the A/F-X to replace its F-111s, F-15Es, and F-117s.

Mr. Blackwell makes it plain that Lockheed and its partners (Boeing and General Dynamics) were not under contract to provide anything related to strike capability. However, he asserts that the fighter was "beautifully positioned" for that role and that it will not take much in the way of modifications to make the F-22 a strike fighter.

"I want to build as much growth in this airplane as I can," says Mr. Blackwell, "and it looks to me like, as a result of Desert Storm, this airplane needs to at least have the ability to grow into that." He says that an F-22 strike variant would require additional avionics, as well as a forward-looking infrared system and a laser designator, but that those development costs would have to be borne even in an A/F-X program.

"We have looked at what it would take to put a certain size munition in the airplane to make sure that we didn't have a problem," Mr. Blackwell says. "If the Air Force decides at a later date that it wants to move this airplane in that direction, we can do it at a minimum cost." ■

It has modern equipment, first-rate training, and flying princes.

The Stalwart Saudi Air Force

By Michael Collins Dunn

A Royal Saudi Air Force F-15 refuels over the Persian Gulf during Operation Desert Storm. In that conflict, an RSAF F-15 pilot shot down two Iraqi Mirage F1s. Since the Saudis began purchasing F-15s in 1978, the fighter has been an important RSAF asset.

On January 24, 1991, Capt. Ayedh Salah al-Shamrani of the Royal Saudi Air Force shot down two Iraqi Mirage F1s. The young F-15C pilot, somewhere over the Persian Gulf, blasted the Mirages out of the sky with AIM-9M Sidewinder missiles.

Captain Shamrani's picture graced the front pages of most of the next day's Saudi newspapers, and with reason. The aerial kills were the first—and, as it turned out, only—victories scored by an Arab member of the anti-Iraq coalition.

Those two shoot-downs were the first Saudi victories in six and a half years. To find another, one must go back to June 5, 1984, when E-3 Airborne Warning and Control System (AWACS) planes detected two Iranian Air Force F-4s headed for the coastal town of Dhahran, in the heart of Saudi oil country. RSAF jets scrambled, intercepted the F-4s, and downed at least one.

The RSAF has notched few air-to-air kills, and this leads some to question Riyadh's heavy outlay for modern weaponry during the 1980s. The tab, once the backlog is paid off, could well reach $100 billion. Some say the purchases have been a waste of money, but US and other analysts vigorously challenge that claim.

They note that Saudi rulers always intended to wield the RSAF as a deterrent, and a deterrent is doing its best work when it is not fighting at all. They further point out that, in Operation Desert Storm, though the Saudis may have claimed only two kills, the RSAF flew many missions over Kuwait, including combat air patrol. Its AWACS aircraft worked closely with their USAF counterparts to provide constant coverage of the battlefield, and Saudi tankers, reconnaissance aircraft, and other elements played important roles. The Saudi communications system was at the service of the coalition. The RSAF deploys F-15s and Tornados, providing considerable interoperability with US and British forces flying missions from Saudi bases.

Bases and Prepositioned Equipment

Most important, Saudi Arabia had at the ready a number of modern, well-equipped, and hardened air bases in forward areas, capable of easily accepting American and coalition aircraft. Some equipment almost certainly had been prepositioned for use by others. RSAF officers may insist that the air bases were built purely for future growth by the RSAF itself—its force of 18,000 or so men is expected to grow to somewhere above 21,000—but some suspect that they were always intended, at least in part, as bases for over-the-horizon Western forces.

Many sources—official and unofficial—offered their assessments of the RSAF for this article, though all wished to go unnamed to avoid giving offense to the Saudi rulers. Many said it is too early to declare the RSAF a truly modern force. Some training and assimilation problems have cropped up, not to mention a problem with combining US and British aircraft.

The consensus is that the RSAF is the best-trained air force in the Middle

East (Israel excepted) and one of the best equipped. Its infrastructure is the best in the region. Some of the new air bases are said to be hardened better than any in NATO's inventory. The RSAF, a force multiplier for the relatively weak Saudi ground forces, is an elite service, the only one that consistently attracts princes of the House of Al Saud, the nation's royal family.

Riyadh's specific defense condition is unusual. The kingdom controls at least one-fourth of the world's proven oil reserves, likelier more. Saudi Arabia is big, covering some 839,000 square miles. The Saudi nation has 2,700 miles of territorial borders. It has 1,500 miles of sea coast on two bodies of water, the Red Sea to the west and the Persian Gulf to the east.

Saudi officials estimate the population of the kingdom at some fourteen million, but few believe it. Some say there are fewer than eight million Saudis, once one has factored out large numbers of guest workers and long-resident Palestinians.

Trouble in All Directions

The upshot is that Riyadh has lots of wealth and territory to defend and few people to do it. Airpower advocates flourish in such situations. It is no surprise that one finds many in the upper reaches of the Saudi leadership, which sees trouble at almost any point of the compass.

To the north lies Iraq. Most Saudi oil can be found along the Persian Gulf coast, a short flight from Iraq's fighter bases. Its petroleum installations lie exposed on a seacoast, reachable by Iraqi armored forces in hours. Saudi leaders believe that Baghdad's armed forces would have moved into the Saudi oil fields after occupying Kuwait, had the US not intervened.

To the east and northeast, only about fifteen minutes' flying time from the Saudi oil fields, lies Iran, now buying a wide range of Russian and other Soviet-type equipment and clearly a major potential threat. If Iran succeeds in buying such equipment as the Tu-22M "Backfire" bomber and the Il-76 AWACS variant known as "Mainstay," it will be a significant threat. *[See "Backfire Goes to Market," February 1992, p. 42.]*

To the south lies Yemen. Riyadh keeps a wary eye on this desperately poor nation, which may have more people than its rich neighbor. Since the 1991 Persian Gulf War, when Yemen sided with Iraq, Saudi Arabia has expelled one million Yemeni guest workers. Yemen lost lands to Saudi Arabian conquest in 1934 and still regards these as "lost provinces."

To the northwest lies Israel, which Riyadh views as a major threat. The RSAF has never sought to engage Israel, for obvious reasons: The Israeli Air Force (IAF) is far superior in number, its pilots are well-trained and resourceful, and they have very short flight times to Saudi targets. The IAF has flown in Saudi airspace—for example, during IAF's 1981 raid on the Osirak nuclear plant near Baghdad and in frequent overflights of Tabuk AB in northwest Saudi Arabia.

This constellation of threats has dictated the contours of the Saudi air base structure. The biggest fighter facilities are located at Dhahran AB, from which the RSAF can confront Iraqi or Iranian incursions into its oil-producing areas. The RSAF has built a major facility, Khamis Mushayt AB, on the border with Yemen, and another at Taif, on the Red Sea coast. Saudi planners kept the fourth major base at Tabuk, opposite Israel.

In 1923, Great Britain provided some de Havilland DH-9 aircraft to

Saudi troops celebrate in Kuwait City at the end of the Persian Gulf War. The relatively weak Saudi ground forces are greatly strengthened by the RSAF, one of the best-trained and best-equipped air forces in the Middle East.

the forces of Abdel Aziz Ibn Saud, the eponymous founder and longtime leader of the modern Saudi state. The RSAF traces its birth from that event. From the 1950s onward, the force alternated acquisitions between US aircraft (B-26s, F-86s) and British (many, culminating with Lightnings and Strikemasters).

When the Saudis saw military coups in Yemen in 1962 and in Sudan and Libya in 1969, they tightened restrictions on the growth of their own military. In June 1969, several RSAF officers were arrested for plotting against the regime. The growth of the air force, however, was all but inevitable.

Two revolutions transformed the RSAF: the oil price revolution that began in 1973 and the Iranian Revolution of 1979. One provided the money for military modernization; the other threw a new light on the potential Iranian threat to Saudi internal security. The Iranian Revolution was followed by the Iran-Iraq War. By the mid-1980s, with Iranian forces threatening to break through the Iraqi lines, Iran began to look like an external threat.

Advent of the F-15s

In 1971, the RSAF purchased Northrop F-5A/Bs; it procured F-5E/Fs some years later. This was the beginning of the full modernization (and Americanization) of the Saudi fighter force. By the mid-1970s, recognizing Saudi Arabia's need for a more modern air defense fighter to replace its Lightnings, the US began to discuss the sale of F-15s. Agreement to sell these front-line fighters was announced by President Jimmy Carter in 1978. The United States delivered sixty F-15s over several years.

In 1980, the last full year of the Carter Administration, the US began a joint feasibility study on the modernization of the RSAF. The study produced strong recognition of the vulnerability of the Saudi oil fields and the need for enhanced air defense. That, in turn, led to the 1981 sale to the kingdom of five E-3A AWACS aircraft. Each of these sales engendered controversy, but each went through. Saudi Arabia's acquisition of the AWACS was a landmark for a Middle East client of the US.

Every proposed US arms sale to Saudi Arabia sparks debate about whether the sale could threaten Israel. Riyadh has been cooperative in restricting or limiting its arms deals so it would not appear threatening to Israel. The Saudis agreed, when first purchasing F-15s, that these would not be stationed at Tabuk. The Boeing E-3A Sentry AWACS aircraft in Saudi service contains software modified to prevent full coverage of Israeli airspace.

In 1985, RSAF expansion hit a reef in Congress. The Saudis requested conversion of existing F-15C/Ds to the Multistage Improvement Program level, acquisition of forty more fighters, and the purchase of missiles and other equipment. On Capitol Hill, concern ran high that delivery of these systems to Saudi Arabia could threaten the security of Israel. Despite the elimination of controversial subsystems, Congress balked, and the Reagan Administration withdrew the proposal.

In early 1986, the Saudis reminded the US that they were not entirely dependent on Washington. They ordered 132 aircraft from Great Britain in a deal code-named Al Yamamah. It included forty-eight Interdictor/Strike (IDS) Tornados, thirty-four F. Mk. 3

Saudi and US pilots are briefed for missions in Operation Desert Storm. The RSAF has had some training and assimilation problems, exacerbated by difficulties in combining US and British aircraft.

Air Defense Variant (ADV) Tornados, thirty Hawk trainers, thirty Pilatus PC-9 turboprop trainers, and munitions. The deal was estimated at more than £5 million, or some $10 billion at the 1986 exchange rate.

In July 1988, the Saudis signed Al Yamamah II, estimated to cost about $30 billion. This follow-up deal involved the sale of an additional forty-eight Tornados, sixty Hawks, helicopters, and mine hunters and the construction of two air bases.

If the two Al Yamamah projects are completed in full, the US will have lost perhaps $40 billion in sales—eagerly snapped up by Britain. Israeli Defense Minister Yitzhak Rabin (now Prime Minister) expressed his concern that, by opposing the F-15 upgrade in Congress, Israel might have encouraged the Saudis to become far more of a threat than had the sale gone through with restrictions.

There have been problems with the Al Yamamah deals. The Saudis were not happy with the Tornado ADV and converted later deliveries to the IDS, which provides the ground-attack capability they were denied in their F-15s. Arguments over the offsets, how much of the deal might be paid in oil, and other issues have delayed other aspects, and the Saudis have now reportedly dropped plans for one of the two British-built air bases. Riyadh recently announced it would move ahead with the purchase of forty-eight Tornados called for in Al Yamamah II.

In the mid-1980s, when the US was reluctant to sell Saudi Arabia F-15s, the Saudis went to Great Britain. The RSAF now includes Tornados (like these, in desert colors) for strike and ground attack, F-15 variants, old F-5s, and Hawk and Pilatus trainers.

A Mixed Bag of Aircraft

The Al Yamamah sales have created a mixed bag of aircraft. The RSAF has three squadrons of F-15s, one each at Dhahran, Taif, and Khamis Mushayt. Old F-5s remain at Tabuk in the northwest, the only peacetime defense against Israeli intrusions. The Tornados provide the strike and ground-attack capability. The Saudis are even said to have sought to convert some of the Tornado ADVs to the ground-attack mission.

Iraq's invasion of Kuwait led Washington to approve an emergency provision of an additional twenty-four F-15s as part of the Desert Shield buildup. These are, apparently, not forming a fourth squadron but are being dispersed among the three existing F-15 squadrons.

In the aftermath of the Gulf War, the Saudis decided to try the Americans again and requested F-15s with a ground-attack capability. President Bush, in the 1992 election campaign, announced the sale of seventy-two aircraft. Plans called for delivering twenty-four air defense and forty-eight attack variants of the F-15, all of which are designated F-15XP ("export").

These aircraft will include a number of limitations not found on the F-15E. The type of weaponry and the weapons delivery systems and the targeting, navigation, and other systems will reportedly be altered. The electronic warfare, Identification, Friend or Foe, and other systems will be tailored to prevent effective use against US-manufactured aircraft, such as those flown by Israel. Some skeptics suggest that these reconfigured F-15XP fighters will not serve original Saudi purposes. The sale will total about $5 billion.

It may seem odd to Westerners who think of Saudi Arabia as having endless wealth, but it has faced budget problems in recent years. It has run deficits and imposed some budget cuts following enormous spending on infrastructure in the 1970s and 1980s. These expenditures took a desert kingdom into the era of modern computers and shopping malls as well as of AWACS and F-15s. The buying sprees are over, and the Saudis are bargaining hard in the arms marketplace these days. They seem to have decided that the additional forty-eight Tornado IDSs in Al Yamamah II and the seventy-two F-15XPs are essential.

A major question is the issue of replacing the F-5s. Saudi Arabia has no light multirole fighter. The Saudis have been discussing possible purchases of the US F-16, though the F/A-18 also has been mentioned.

The RSAF is going to remain a major air force. Its developed, modern, hardened air bases in the Gulf region—at Hafir al-Batn, Dhahran, Riyadh, and Kharj, plus possibly some that have not been publicly identified—will remain major prepositioning centers for any future surge of Western airpower into the Persian Gulf region like that of Desert Shield.

The RSAF is likely to remain an elite service. The Saudi Ambassador to Washington, Prince Bandar Bin Sultan, is a former F-15 pilot and RSAF officer. He is also the son of Prince Sultan, the Minister of Defense and Aviation, and a full brother of King Fahd. Prince Bandar is a key figure in arms procurement decisions in his own right. That fact alone guarantees that the RSAF will continue to be heard in high places. ■

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A congressionally mandated study asks if the Air Force can put its bombers and quick-response fighters into active-reserve team units.

Rising Ratios in the Force Mix

By John T. Correll, Editor in Chief

COULD most of the Air Force's bombers and quick-response fighters be put into "associate" wings and operated by a combination of active-duty and Reserve crews? A new Total Force study, done by the RAND Corp. for the Defense Department at the behest of Congress, says the possibility ought to be explored. The report also identifies potential realignments in the other services, but none so revolutionary as this one.

The Air Guard and Reserve have heavy tasking already as fighter reinforcements, for airlift, and in numerous other combat and support missions. The suggestion in the study goes beyond that. It would put all USAF bombers except sixteen B-2s into active-reserve team units, with Reservists manning half the cockpits. It makes fighter associate units—with Reservists flying twenty-five percent of the aircraft—the first forces to deploy from the United States to crises abroad. Follow-on reinforcements would consist entirely of Guard and Reserve units.

This bomber-fighter option, one of several devised by RAND, set heads to shaking as it circulated through the Pentagon in December. The Air Force employs its Guard and Reserve components more effectively than the other services do, but it sees a limit to how much combat capability can be transferred away from active-duty forces.

The Air Force's existing drawdown plan is to take nearly all of the losses from the active component, holding Guard and Reserve strength approximately level. By 1997, the active-duty aircraft fleet will diminish by almost thirty percent. The reduction is primarily in fighters. The Air Guard and Reserve are to keep about the same number of aircraft as before.

Overall, USAF projects a reserve component of 31.7 percent when the restructuring is complete, but Air Guard and Reserve representation is strongest in flying units. The Air Force will have forty-three percent of its deployable fighter and interdiction strength in the reserve components by 1997. Consequently, the prospect of a considerably higher ANG and Reserve ratio in the combat force is startling.

The Total Force mix is expected to be a big issue this session of Congress. Last year, Congress endorsed deeper cuts in the active-duty forces, but insisted that the services (principally the Army) keep 76,000 more Guardsmen and Reservists than they wanted. Two years ago, Congress accused the Pentagon of tampering with the findings of a Total Force study and directed that another report be done by independent analysts. The job went to RAND, a California-based think tank with ties to the Air Force, but several other federal contract research centers helped. Notably, the portions of the study dealing with the sea services were done by the Center for Naval Analyses in Alexandria, Va.

The benchmark used for comparison in the RAND report is the "Base Force" projected by the defense lineup for 1997. The study also drew on "Option C," an alternative to the Base Force developed by Defense Secretary Les Aspin when he was chairman of the House Armed Services Committee. The Base Force plan cuts total military strength by 800,000, with the deepest reductions in the Army and the Air Force. Overall, thirty-six percent of the armed forces would be in the Guard and Reserve. Option C takes total strength down by another 233,000 and raises the reserve component to thirty-nine percent. Most of the RAND alternatives fall somewhere between the Base Force and Option C.

Four Options for Air Force Aircraft and Personnel

	Base Force			Option C			Force X			Force Y		
	ACT	ASC	RES	ACT	ASC	RES	ACT	ASC	RES	ACT	ASC	RES
Power Projection												
Fighter wings	15	—	11	10	—	8	12+	—	8	7+	6	9
Bombers	217	—	—	133	—	33	167	—	—	16	151	—
Mobility/Lift												
Strategic lift	—	236	103	—	173	180	—	236	103	—	236	103
Tankers	245	57	262	191	57	204	218	57	235	—	275	235
Tactical lift	154	—	296	100	—	300	137	—	263	137	—	263
C³I												
Strategic	13	—	—	13	—	—	13	—	—	13	—	—
Air-to-air	30	—	—	30	—	—	30	—	—	30	—	—
Air-to-ground	35	—	—	35	—	—	35	—	—	35	—	—
Forward air control	60	—	30	60	—	30	24	—	24	24	—	24
Personnel												
(in thousands)	430.3	—	200.0	364.0	—	193.0	389.6	—	177.5	380.7	—	197.6
Percentage of Force												
	68.3	—	31.7	65.4	—	34.6	68.7	—	31.1	65.8	—	34.1

ACT = Active-duty ASC = Active/Reserve Associate RES = Reserve Components (Air Guard and Reserve)

The Base Force is the configuration projected for 1995 by the National Defense Strategy of 1990. Option C is an alternative proposed by Defense Secretary Les Aspin when he was chairman of the House Armed Services Committee. Forces X and Y are alternatives developed by RAND Corp. Option C and Forces X and Y are imputed to cost ten percent less than the Base Force.

Alternatives X and Y

RAND identifies two possible configurations—Alternative X and Alternative Y—that preserve some of the Air Force structure that would otherwise be lost with Mr. Aspin's Option C. Under Alternative Y, the price for keeping that force structure is a transfer of missions to the reserve component.

The bomber-fighter associate wing idea was inspired by the Air Force's success with Reserve Associate units in the airlift and tanker missions. At present, AFRES has the equivalent of twenty-one squadrons in associate status. There are no associate units in ANG. An associate unit has its own command structure but flies aircraft owned by the parent active-duty organization. Associate aircrews and ground crews augment the active unit in both peacetime and wartime operations.

In the associate airlift and tanker operations, the ratio of active-duty crews to Reservists is fifty-fifty. RAND suggests a similar fifty percent mix for associate bomber units but holds the Reserve share of associate fighter units to twenty-five percent. This option gives the Air Force two fighter wings fewer than the Base Force—but four more than Option C. This would make an enormous difference in how the Air Force responds to international crisis.

In the Base Force projection, the active-duty component provides all of the units stationed abroad and the entire "crisis response force," those fighter and bomber units expected to be on the scene in a hurry. "Early reinforcement" fighter forces are all from the Guard and Reserve.

Alternative Y cuts the forward presence to 4.9 active fighter wings. The crisis response force is mixed. Part of it comes from active-duty squadrons specialized for interdiction, close air support, and suppression of enemy air defenses. The greater portion, though, is from the active-reserve associate combinations. Early reinforcement forces consist entirely of Guard and Reserve units. Associate airlift and tanker units would deploy as part of the crisis response force.

Alternative X cuts force structure deeper, leaving six fighter wings fewer than the Base Force, but the configuration follows traditional lines. It keeps all of the bombers in the active component and employs only active-duty fighters for crisis response. Early reinforcement units, mostly multirole fighters, would be from Guard and Reserve units. None of the alternatives—C, X, or Y—provides a capability equal to the Base Force. Each is imputed to cost ten percent less.

Decisive Force

RAND concluded that the US military presence abroad must be maintained by active-duty forces. Assigning such duty to rotational Guard and Reserve units would not make much difference in cost. Furthermore, to replace a single active-duty unit stationed overseas, it would be necessary, on average, to shift around troops from twenty-six reserve units.

"Discussions with senior Air National Guard and Air Force Reserve officers suggest that they could maintain a *small* forward presence if they were free to rotate aircrews frequently, as often as weekly, and could maintain a very sizable rotation base made up of volunteers from a large number of CONUS [Continental United States]-based units," the report says.

The armed forces are structured primarily to deal with major regional contingencies. When crisis occurs, the strategy is to react by stages. An *ini-*

The Difference in Crisis

	Forward Presence	Crisis Response	Early Reinforcement
Base Force			
Active-duty fighter wings	7	9	—
Guard-Reserve fighter wings	—	—	12
Bombers (active force)	—	200	—
Option C			
Active-duty fighter wings	4	7.6	—
Guard-Reserve fighter wings	—	—	9
Bombers (active-duty)	—	136	—
Bombers (Reserve)	—	—	33
Alternative Y			
Active-duty fighter wings	4.9	3.2	—
Associate force fighter wings	—	6	—
Guard-Reserve fighter wings	—	—	9.5
Bombers (associate forces)	—	167	—

tial response force deploys immediately. It can fight if need be, but its real job is to halt the aggressor's offensive and stabilize the situation until *decisive force* can arrive.

At the beginning of Operation Desert Shield, for example, the initial response force was the 1st Tactical Fighter Wing from Langley AFB, Va., along with tankers and transports. More fighter and attack squadrons and paratroopers from Fort Bragg, N. C., were close on their heels. These units blocked a surge southward by the Iraqi army and provided a thin defense of the border between Iraq and Saudi Arabia. That model—an extended delay of hostilities while the decisive force employed in Operation Desert Storm built up—led the RAND analysts to an assumption they soon found reason to change.

"Our initial hypothesis was that once stability was established, it would not be a serious problem to wait for the arrival of reserve forces, even if those forces took additional time to be trained to a high level of combat proficiency," the report says. Without exception, the military leaders RAND interviewed said this premise was wrong and that it was "absolutely unacceptable to delay the delivery of the decisive force."

Coalition forces in the Persian Gulf War faced an incompetent military dictator who frittered away his best tactical choices. It might not happen that way in the next crisis. "The greater the time needed to close the decisive force, the greater the chance that reserve combat units can participate in the decisive phase of the campaign," the RAND report says. "However, the greater the time needed to close the decisive force, the more friendly casualties may be suffered in the interval, the more difficult it may be to dislodge the enemy, and the more time he has to change the conditions of the battlefield in his favor—perhaps by using unconventional weapons."

The question, then, is what caliber of forces could deploy to the scene of a crisis and how rapidly they could get there in condition to fight.

A Divergence in Readiness

It is almost universally recognized that the Air Guard and the Air Force Reserve are more effective, by a wide margin, than their counterparts in the other services. In the Gulf War, RAND notes, all of the activated reserve flying units mobilized in twenty-four hours or less and were prepared to deploy—or did deploy—in less than seventy-two hours.

The report cites three reasons why this was possible. Air Reserve Components are held to the same readiness standards as active-duty units. The Air Force provides them the funds, equipment, and full-time personnel to conduct proper training. The vast majority—about seventy percent—of personnel in the Air Reserve Components have prior military experience in the active-duty force.

The reserve components of the other services are not of the same caliber. When the defense drawdown began, the Army already had half of its strength in the National Guard and the Army Reserve. Some of these units performed with distinction in the Gulf War, but others were in poor shape when they reported for duty. In some reserve combat brigades, half of the leaders had not completed the training required for their positions. Some were still gaining new knowledge in exercises intended to polish their skills.

RAND assigns an estimate of 128 days for the training time needed after mobilization by an Army combat unit at the brigade level but says that estimate may be optimistic. The larger the unit, the more time required. "The Army Chief of Staff suggested that it takes four times longer to make a reserve division ready than a reserve brigade, even though the brigade is the unit immediately subordinate to the division," RAND reported.

The analysts looked at numerous force mix options for the Army. They rejected some of them because they did not deploy fully trained combat power in the required time and others because they "reduced the size of the reserves to a level judged to be politically unacceptable."

The only alternative that saves much money (about ten percent) eliminates two active-duty divisions—leaving the Army with ten in the active component and six in the reserves. It would make the company or the battalion the standard round-out unit instead of the brigade. The reserve component of the total Army would be 57.2 percent rather than the 51.1 percent forecast by the Base Force.

The Sea Services Steam On

The sections of the report dealing with the Navy and the Marine Corps were prepared by the Center for Naval Analyses. They do not show the degree of hard-nosed scrutiny the Air Force and the Army got from RAND, and the alternatives are considerably gentler.

This is not to say that the sea services will survive the defense drawdown intact. The dream of a 600-ship Navy is long gone. The Base Force projects a total of 450 ships, and Option C reduces it to 340. When the drawdown began, the Navy had fifteen deployable aircraft carriers. The Base Force reduces that to twelve; Option C would cut it to eleven. In the Base Force, the Navy has fourteen air wings, two of them in the Reserve. Option C eliminates one of the active air wings.

The Navy is not big on Total Force policy. It has no National Guard component, and in 1991, Naval Reserve personnel accounted for only 20.8 percent of total strength. A goodly share of the Base Force adjustment was made in the Reserve, so the Navy actually projects a drop to nineteen percent for its reserve component by 1997.

The main new option posed by the Center for Naval Analyses is called the "Reserve Combat Alternative." It specifies eleven deployable carriers, but it transfers fifty surface combatants and forty submarines—which Option C would eliminate—to the Naval Reserve Fleet "rather than decommissioning and disposing of them." This does not give the Naval Reserve a new mission. The Center says that, after considering whether the Reserve might actually operate the submarines, it "excluded this option." The Reserve Combat Alternative drops the reserve component of the total Navy to 17.8 percent.

The Marine Corps section of the report takes a hard line, declaring that "the Marine Corps is a force in readiness, not a force in Reserve." In fact, five of the ten alternatives examined by the Center for Naval Analyses would make the Marine Corps larger than projected by the Base Force.

The report says that force structures in the leaner alternatives "cannot respond to any contingency on time." The minimum configuration to get the job done, it says, is three Marine Expeditionary Forces, 2.5 of them in the active-duty component. That option would set total Marine strength at 196,000 and cost $500 million more than the Base Force. The reserve component would be 11.7 percent.

Personnel and Politics

As the RAND report explains, several indirect considerations affect the sizing of the total force. One of these is the personnel base. All of the reserve components recruit substantial portions of their strength from veterans leaving active-duty service.

As the active components diminish in size, the pool of potential recruits drops. The report says the reserves will eventually have problems finding enough prior-service people and that "the larger the proportion of reserve forces in a force structure, the greater the recruitment shortfall for prior-service personnel will be."

RAND says only the Air Reserve Components could maintain their current levels of prior-service personnel, and even they would have to recruit nearly all of the veterans leaving active duty who were willing to join the reserves.

The active-duty veterans are important not only to sustain the reserve force levels but also because of the training and experience they possess. One reason cited regularly for the excellence of Air Reserve Components is the high percentage of former active-duty troops.

Another factor is politics. Secretary of Defense Dick Cheney complained constantly about the refusal of members of Congress to allow him to cut Guard or Reserve units in their districts.

Politics can also affect assumptions about the purpose of the Total Force policy. Almost everyone agrees on two objectives. The total force structure should meet the requirements of national defense strategy and do so as economically as possible.

Some service associations and members of Congress contend that there is a third objective. As RAND summarizes it, they believe the armed forces "should be structured to make active and reserve units so interdependent that a president could not send military forces to combat without activating the reserves."

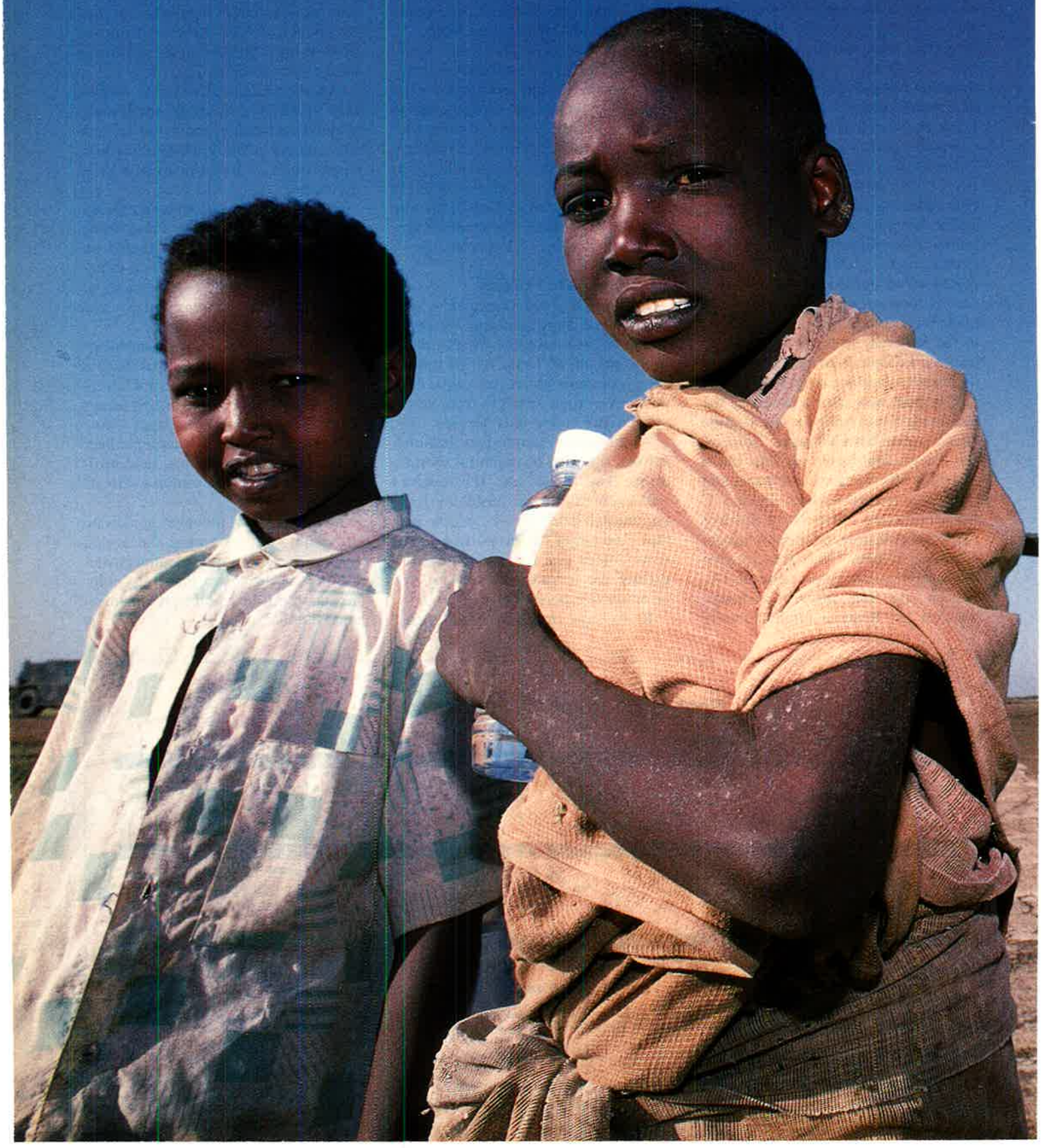
Official policy, however, makes no provision for structuring the armed forces as a check on presidential power. On that basis, RAND made its judgments on military and cost considerations alone. ■

Post-Mobilization Training Required

	Air Force	Army	Navy	Marine Corps
Air Units				
Air combat	14–21 days	—	60 days	30 days
Airlift and tanker	≤ 3 days	—	—	—
Nonflying	≤ 7 days	—	—	—
Ground Units				
Company	—	60 days	—	30 days
Battalion	—	70–90 days	—	60–70 days
Brigade/regiment	—	128 days	—	90–120 days
Naval Units				
Ships	—	—	2–5 months	—
Combat Service Support	—	**15–35 days**	**7 days**	**30 days**

While Air Reserve Components are ready to go in days—sometimes in hours—after mobilization, the case is different in the other services. RAND Corp. says it may be optimistic to expect that Army roundout brigades can train up to full readiness within 128 days of mobilization.

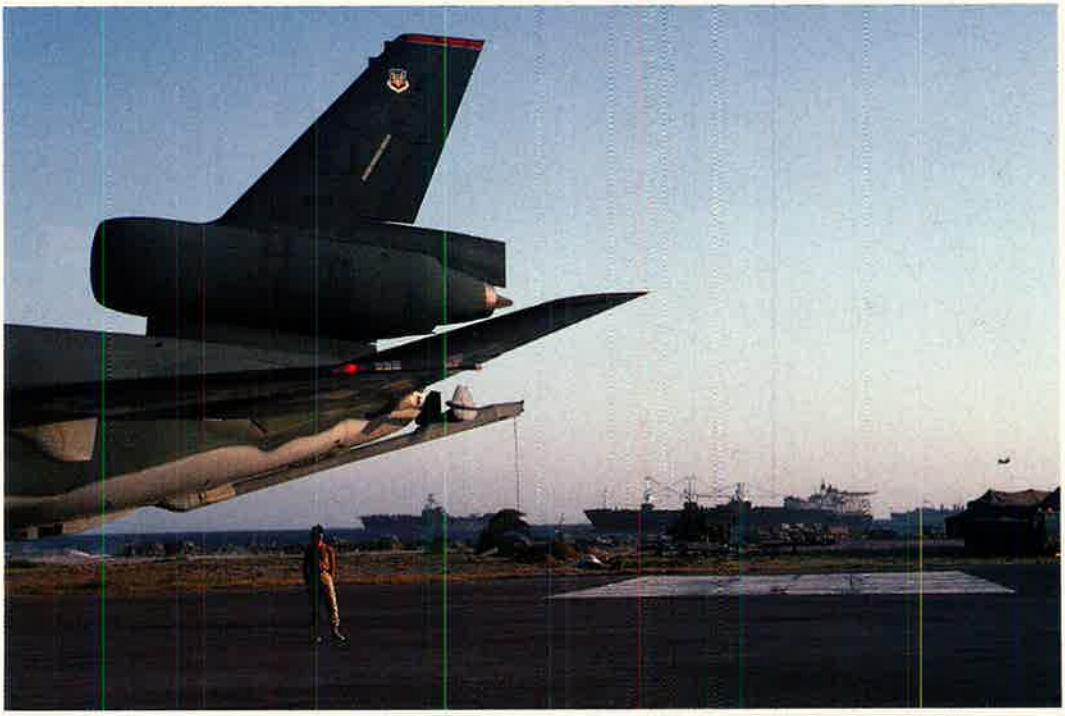
The Horn of Africa is the site of Air Mobility Command's latest humanitarian effort.



Mission to Somalia

Photographs by Ross Harrison Koty

Though there is a large international airport in Mogadishu, Somalia, conditions are considerably more austere at the airstrip of the inland city of Baidoa (preceding pages). The C-130 depicted is from the 463d Airlift Wing, Dyess AFB, Tex. KC-10 crews, such as the one at right, face flights of up to eleven hours on their way to Somalia. The Air Force has a tradition of performing humanitarian missions, dating back to the Berlin Airlift of 1948–49.



The KC-10's primary mission is aerial refueling, but its capacious fuselage (right) can also haul more than 169,000 pounds of cargo. The KC-10 above belongs to the 4th Wing, Seymour Johnson AFB, N. C., and the one at right is from the 79th Air Refueling Squadron, AFRES, March AFB, Calif., illustrating the Total Force nature of Operation Restore Hope.

Dusty, windswept Somalia can be inhospitable even in the best of times (parts of the country average less than four inches of rain per year). An influx of more than one million refugees from Ethiopia and a vicious, multisided civil war precipitated the current crisis, necessitating a fast-paced relief effort to prevent further starvation. The arrival of supplies in-country is only the beginning. The larger planes must be unloaded (left, an airman supervises a KC-10's unloading), and the C-130s must be loaded to take the food where it is needed most (below).

Photos © Ross Harrison Koty

These three airmen at work in their makeshift laundry are part of the 1,000-strong Air Force contingent (not including transient aircrews) in Somalia. Even in winter, temperatures can soar above 100° Fahrenheit, causing hardships for both men and aircraft. The Air Force air traffic controllers, security police, fire fighters, and other personnel must bring with them virtually everything they need for the deployment.

Sgt. Jerry Pritt, a C-130 loadmaster from the 772d Airlift Squadron, Dyess AFB, keeps an eye out for snipers on the ground at Baidoa. Too small for C-141s and C-5s, the airstrip there can only accommodate C-130s. The venerable Hercules aircraft fly supplies from staging areas in Mombasa, Kenya, and Mogadishu to the interior, where starvation had been rampant before Operation Restore Hope began.

The plight of Somalia's children is perhaps the most heart-wrenching aspect of the crisis. Torn by civil war since 1978, the desperately poor country was plunged into chaos after the 1991 ouster of strongman Muhammad Siad Barre, who had ruled since 1970. After a series of UN resolutions, USAF C-5Bs, KC-10s, KC-135s, and C-141s, along with Marines and Army soldiers, came to the rescue to provide food and some measure of order.

The US Marine Corps has provided the bulk of the US ground presence in Somalia, which peaked at more than 24,000 troops. Air Mobility Command airlifts thousands of tons of the supplies necessary for the operation, aided by such aircraft as this Marine Corps KC-130. Fast sealift brings in thousands more on special roll-on/ roll-off cargo ships.

Photos © Ross Harrison Koty

Above, a C-5 from the 60th Airlift Wing, Travis AFB, Calif., unloads at Mogadishu. By the end of January, AMC airlifters had flown more than 800 missions to Somalia, just part of its increasing load of humanitarian operations that may be the wave of the future for USAF's Global Reach command.

The Air Logistics Centers compete with industry for customers and business.

Warner Robins, Inc.

By Peter Grier

LAST YEAR, the C-141 Production Division at Warner Robins Air Logistics Center (ALC) in Georgia faced a problem far tougher than overhauling an airframe. It had to learn how to behave like a competitive business.

As part of a big push to save money and tighten management at the Air Force's massive maintenance depots, USAF decided in late 1991 to put a major C-141 repair project up for bid on the open market. The job, replacement of center wing boxes for 113 of the Lockheed-built StarLifters, represented four years of work and millions in revenue. To win it, Warner Robins would have to battle private contractors made eager for new business by the reduced defense budget.

Production Division officials tightened their cost estimates, eliminating generous fudge factors they could no longer afford. They developed an efficient repair process that included floating de-mated wings on cushions of air. Last December 17, they won the wing box project with a bid of $62 million—more than fifty percent lower than the next most competitive offer.

"Why was my bid so much lower? Because I'm so much better," jests Col. Charles Jernigan, C-141 Production Division chief.

The opening of more contracts to competitive bidding is just one of the major challenges facing Air Logistics Centers, the government-owned and less well-known "other side" of the US defense industrial base. Like its fellow ALCs, Warner Robins has to deal with both the intense maintenance requirements of aging airframes, such as the C-141 and the F-15, and an explosion in software reprogramming and other high-technology work. There are environmental messes that need to be cleaned up. The switch to operating under the aegis of the new Air Force Materiel Command still takes some getting used to.

If one theme runs through all these changes, it is the need to make sure ALCs are competitive in today's tougher budget environment. The five major USAF depots, taken as a whole, represent one of the largest industrial concentrations in the United States. From now on, that is how they will have to view themselves.

Keeping the basic military mission in mind, "we have to be able to step out of our blue suits . . . and step into business suits," says Maj. Gen. Wil-

liam P. Hallin, the commander of Warner Robins ALC. "We basically want to become our customer's supplier of choice."

"Avionics, Inc."

The word "customer" is often heard during a tour of Warner Robins. Also in the air are many other corporate terms such as "product lines" and "quality assurance." The depot's avionics division styles itself "Avionics, Inc.," and its officials say they consciously model themselves after Wal-Mart, the vast chain of low-price, high-volume retail superstores.

If the chain of Air Force ALCs is big enough to be an American corporate giant, then each center represents a major company division. With about 4,000 military personnel and another 14,000 civilian workers, Warner Robins is one of Georgia's largest employers. USAF officials figure that, when the values of salaries, contracts, retired pay, school impact funds, and other miscellaneous items are combined, the ALC pumps more than $2 billion a year into the state's economy.

All Air Force aircraft eventually return to a depot for major repair or overhaul, and Warner Robins manages some of the largest fleets in the service inventory. It is responsible for the upkeep of F-15s, C-130s, C-141s, and all Air Force special operations aircraft, among others. It repairs USAF's air-to-air missiles, all service avionics, and Air Force electronic warfare equipment.

At any one time, some three dozen F-15s are being worked on at Warner Robins, along with thirty C-141s and from twelve to fifteen C-130s. Given the number of C-130s in the Air Force inventory, one might think their numbers at the depot would be higher, but Ogden ALC at Hill AFB, Utah, can also handle C-130 depot maintenance, as can a number of private contractors around the world.

Warner Robins officials administer all parts the Air Force buys for each of its assigned planes. They also plan and carry out the programmed depot maintenance (PDM) cycle. With the F-15, for example, PDM is a 120-day process during which the airplane is stripped of wings and engines and checked with a keen eye. Some F-15 models go through both PDM and a Multistage Improvement Program, which involves installation of new avionics and wiring. "We're at the point where we almost remanufacture aircraft," says General Hallin.

Back in the mid-1980s, Warner Robins was organized along traditional functional lines. The base's flow chart had big boxes labeled "Contracting," "Material Management," "Maintenance," and so on.

In 1990, leaders of the now-defunct Air Force Logistics Command (AFLC) decided the big departments needed to be broken up and reorganized so the depots could focus on their product lines. Now the flow chart has smaller boxes for a stand-alone F-15 directorate, an avionics directorate, and so on.

With the combination of AFLC and Air Force Systems Command, also now disestablished, came a further refinement in depot organization: Integrated Weapon System Management. Under IWSM, each weapon will have a single manager, cradle to grave. Depending on how far along the weapon is in its life cycle, its director will be located at either a product center or a logistics installation.

A Single Face

The new system is intended to eliminate that old, awkward split in responsibility between a weapon's

development manager and its support chief. The buzzword now is "single face to the user," meaning that a combat commander with a problem will not have to call two different headquarters and get two different stories about the status of his software upgrade.

The F-15 fighter was one of the twenty-one weapon systems picked to prototype IWSM in mid-1991. Because the aircraft is middle-aged, its manager works from Warner Robins. "It was an easy call," notes Brig. Gen. James S. Childress, the F-15 system program director.

The IWSM concept is more than a shuffle of boxes on paper, says General Childress. He now has authority over engineers and other F-15 development staffers who work at Wright-Patterson AFB, Ohio. The F-15 has thirteen separate microprocessors, and under the old system it was hard to orchestrate software improvements for all of them. Now a coordinated eighteen-month software change cycle is in place.

Other Warner Robins systems, notably the C-130 and various special operations aircraft, are starting down the IWSM path. Among the lessons General Childress can pass along to new IWSM chiefs: Make sure all your employees can understand each other. Ex-AFSC and ex-AFLC people would often use different terms to describe the same thing.

Another lesson is to break your work up into projects and assign them to Integrated Product Teams. The independent action that can be undertaken by such teams is the only way to deal with the geographical split in an IWSM empire. "The geographic separation was a big concern, and still is," says General Childress.

Overall, the health of the F-15 force is good, according to the system director. The aircraft in all its variants has always been maintenance-intensive, and that is not likely to change even after such modifications as the coming upgrade to the earlier model APG-63 radar. Programmed depot maintenance brings F-15s in every six years for a structural overhaul.

The next big management change affecting the F-15 is the move to cut out the intermediate stage and go to what the Air Force calls "two-level maintenance." The F-15 is scheduled to head in that direction in 1994, and when it does, the depots will be undertaking some new repair tasks. "You may have to evaluate the mix of spare parts you have," says General Childress—perhaps leading to an increase in purchases of line replaceable units.

Flown Hard

The state of the C-141 force is a different story. The venerable StarLifter has been flown hard during recent decades and has undergone a series of major upgrades, from addition of refueling capability to an increase in its allowable flying lifetime *[see "Washington Watch," February 1993 issue, p. 13]*. Warner Robins officials say it is their biggest current airframe-repair challenge.

Taken together, the five major USAF depots represent one of the largest industrial concentrations in the United States.

Increased flying time caused by the surge in humanitarian relief around the world has not helped matters. In aid of Operation Restore Hope in Somalia, Warner Robins workers accelerated repair of the forty-five spare parts on the C-141 critical list, which includes such items as flapjack screws and various instruments.

"It's kind of a challenge keeping ahead of an aircraft originally intended to fly 30,000 hours when it has been extended to 45,000," said Colonel Jernigan.

Take windshield posts. The constant cycle of pressurization and release is now causing cracks around many C-141 cockpit windows. The window frames are complex structures, having more than 150 parts. A quick repair of a cracked part works for a short while, but eventually it shifts the stress around the frame and more extensive work is required. Pacer Post windshield frame repair is therefore a major C-141 maintenance program. Kits are planned for 165 aircraft, with replacement operations under way at Warner Robins and at operating bases, where field teams carry out the installation.

The most serious C-141 maintenance task, however, is fixing fatigue cracks in the wings. This complicated operation requires wing removal and replacement of the center wing box—the distinctive "shoulders" of the C-141 that carries wing strain across the top of the fuselage. When the wings have around 10,000 hours of flying time, repairing them takes just under half as long as a complete C-141 PDM overhaul.

Unlike fighters, cargo aircraft are not designed with easy wing removal in mind. Moving the massive wings once they are cut loose is a big job. Warner Robins has solved the problem by placing air bladders on elevators next to the plane. Inflation of the bladders with 125 pounds of pressure per square inch floats the wings onto and off of transport trailers.

Some defense contractors use this technique, but Warner Robins officials believe they are the only government installation that has adopted it. Once a wing is on its cushion of air, "you could start it moving with a finger," says Colonel Jernigan. "However, you couldn't stop it."

Precise Tolerance

Placement of the new wing box in the fuselage requires precise measurements. It must be placed within three one-thousandths of an inch of the old box's position—"a phenomenally tight tolerance," notes Wayne Davidson of the C-141 group.

It was not a foregone conclusion that this work would be done at Warner Robins. Last year, the C-141 wing box replacement became part of a larger USAF initiative: the push for more competition among the depots.

This push stems from the 1989 Defense Management Review (DMR). In general, DMR initiatives direct that ALCs be used at near 100 percent capacity. Any work load greater than a core needed to maintain ALC infrastructure should be open for competition to other services and to the commercial sector.

Air Force leadership is counting on depot competition to account for a hefty chunk of the $24 billion that DMR changes are supposed to save by 1997. The Air Force is moving carefully into this new, more open

environment: The first five work packages went up for grabs in 1991.

Two of these went to ALCs, including repair of ARC-186 UHF radios that was won by Warner Robins. The process of bidding for this work concentrated the minds of ALC avionics officials. By scrubbing expense estimates hard, they reduced the cost to taxpayers of ARC-186 depot maintenance by twenty-five percent.

Of course, ALCs have never done everything in-house. General Hallin estimates that forty percent of Warner Robins work is already contracted out.

The idea is not eventually to throw all of the other sixty percent open for bids, but to look throughout product lines for representative jobs that might benefit from competition. The process of fighting for work is supposed to show depot managers how they can keep costs down in other areas. Warner Robins avionics officials say that the experience of winning the ARC-186 bidding has emboldened them to ask all their product managers for a seven percent across-the-board cost reduction this year.

Core operations that will be retained under any circumstances include such basic tasks as C-130 propeller overhaul. "One thing we still have to define is how far we can go in competing our organic work load," says General Hallin.

A Big Win

Retaining the C-141 wing box after it was put up for bid was a big win last year for Warner Robins. Private bidders were not overjoyed at the result. They still do not quite trust the idea of the government selling services to itself. Warner Robins officials are quick to admit they have a big cost advantage over corporations: They do not have to figure a profit in their bids.

The attempt to infuse a more businesslike spirit into the depots goes beyond the few projects that have so far been exposed to direct competition. The leaders of Avionics, Inc., not only pay homage to the business acumen of Wal-Mart but also see Hewlett Packard and Motorola as role models. With more than 500 different systems to manage, as well as 58,000 spare parts, Warner Robins avionics is the size of a company division. The total value of its active inventory is about $2.5 billion. "Sales," in terms of repairs provided to operational customers, are about $1 billion annually.

It thus takes about 2.5 years to turn over the avionics inventory once. By private-sector standards, that is not very good. Wal-Mart turns its entire inventory some seventeen times a year. "We would like to get our rate to one inventory turn a year," says George Falldine, avionics deputy director.

To improve the inventory turnover, managers must know exactly what they have, where it is, and where it is going. That means an improvement in data systems. The Air Force has made some good starts in this regard, but it is not satisfied yet.

Studying private firms has taught avionics officers about "the dangers of sub-optimization." The focus has to be on the customer.

"Wal-Mart knows far more about its business on a daily basis than we do on a quarterly basis," says Col. John Stone, avionics director.

Studying private firms has also taught avionics officials about what they term "the dangers of suboptimization." If you are an executive of Wal-Mart, this means something specific: If you wait until you have a full truck before you ship goods from distribution centers to stores, then you have waited too long. Stores invariably need things faster than that.

An avionics analogy might be repair scheduling. It is most efficient to fix particular systems in large batches, but while the depot waits for the numbers of a type of radio, say, to accumulate, there are a lot of repair technicians out in the field, tapping their feet. The focus has to be on the customer.

Take the case of the F-15 horizontal situation indicator. This was number one on the F-15 critical part list before the Persian Gulf War. It was so unreliable that Warner Robins was carrying out 1,600 repair jobs on horizontal situation indicators each year, and there are only 900 of them in the Air Force inventory.

That kind of repair rate could make depot officials look good—after all, it was steady work that could be done efficiently—but the customer was unhappy, to say the least. An avionics action team tore the indicator apart. The team members discovered a design flaw causing tiny solder cracks. Fixing the defect has caused the repair rate to plummet.

New systems will place further demands on Warner Robins managers. Among them will be the E-8 Joint Surveillance and Target Attack Radar System aircraft, whose operational base will be Warner Robins, in part because the extensive Joint STARS electronics will be repaired there. The Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system is also now being shipped to Warner Robins for depot maintenance in a new computer-integrated repair facility that looks far sleeker than old avionics plants.

Automated carts lurch about the LANTIRN depot, guided by a faint track on the floor while they automatically deliver parts to the appropriate repair station. Technicians facing a new problem, or in need of a refresher course, can call up video clips of experts doing a similar job on their computer screens. Eventually, computer-integrated repair sites will be able to read the flight history of a certain black box—where it was and what the airplane was doing when a glitch or break occurred. By comparing these data with an accumulated library of similar information for related systems, technicians might be able to predict when failures will happen.

"We hope to be able to preemptively repair electronics—as we do now with airframes," says Sherman R. Stephens, an avionics production division acquisition specialist. ■

Peter Grier is the Washington, D. C., defense correspondent for the Christian Science Monitor *and a regular contributor to* Air Force *Magazine. His most recent article, "The Name on the Fuselage," appeared in the February 1993 issue.*

There are dangerous new elements in the confrontation between India and Pakistan.

Nuclear Standoff on the Subcontinent

By Richard Mackenzie

IN THE Indian town of Ayodhya late last year, tens of thousands of Hindu fanatics suddenly went berserk, tearing apart an ancient Islamic mosque and rampaging through the streets. The principal Muslim offense, said the Hindus, was building the mosque on the legendary birth site of Rama, a major Hindu deity.

The Indian outburst reverberated throughout south Asia. In Islamic Pakistan and Afghanistan, angry Muslims knocked down or torched Hindu temples. Then came an aftershock in India, where clashes between Hindus and Muslims claimed 1,000 lives. New Delhi imposed martial law in the state of Uttar Pradesh.

South Asia held its breath. The region was so thoroughly awash in political and military gasoline that it was natural to wonder if the Ayodhya affair would prove to be the long-awaited match. Everyone knew that any provocation could cause India and Pakistan to lunge at each other's throats in what would have been their fourth major war since 1947. The danger passed, but it has not gone away for good.

The situation in late 1992 and early 1993 had several dangerous new elements. The last time the countries clashed, in 1971, neither had crossed the nuclear threshold. By 1992, both had done so.

In 1974, India exploded what it termed a "peaceful nuclear device," which is no different from a nuclear weapon. Pakistan had not matched that event but had quietly acquired a nuclear capability. Military analysts deemed both India and Pakistan to be nuclear-equipped powers.

This was far from a military secret. Washington officials publicly acknowledged that the nuclear weapons club had two south Asian members. In open testimony last year, CIA Director Robert Gates told Congress that, "for safety reasons," neither country had built a stockpile of nuclear bombs but that each had everything needed to assemble several usable weapons on "very short notice."

The Changing Calculus

The end of the cold war also changed the security calculus in south Asia. Tensions between India and Pakistan had been manageable in cold war days, when Pakistan was Washington's client and India paid attention to Soviet wishes. The potential for eruption of a fight to the finish in south Asia

Encouraged by Hindu extremists, a mob of thousands stormed and destroyed a 400-year-old mosque in Ayodhya. The mosque had allegedly been built on the site of the birthplace of the Hindu god Rama, and its destruction triggered days of sectarian rioting.

Photo © Sunil Malhotra / Reuters / Beltmann

interested neither Washington nor Moscow, and both used political and diplomatic leverage to keep the two enemies in check. With the breakup of the two rigid blocs, the old influence waned greatly.

Finally, the situation was aggravated by the decade-long reinvigoration of militant Islam, a revival that has introduced into the region a new Islamic political assertiveness. Muslims began to point with pride to the establishment of Islamic governments in Iran and Pakistan, the victory of anti-Soviet Muslim guerrillas in Afghanistan, and the emergence of independent, mostly Muslim nations in what once had been Soviet central Asia.

Many of the disorders in south Asia can be traced to India's internal troubles, which greatly affect New Delhi's relations with neighboring countries, especially Pakistan and, to a lesser degree, China. The polyglot nation of almost 900 million includes ninety million Muslims. There are strong nationalist, breakaway movements in almost every section of the country. Indian politicians are concerned that internal fissures could widen dramatically, perhaps even leading to India's disintegration into substates.

At the time of partition, India was created as a predominantly Hindu country. Pakistan was designated the Muslim nation. Not all Muslims moved to Pakistan. Huge clashes erupted. The seething confrontation between Hindu and Muslim helped produce and continues to inflame the strategic issue that lies at the heart of the India-Pakistan conflict, the territorial dispute in Kashmir. This mountainous region at the northern tip of the border between the two countries was once an idyllic tourist haven where houseboats plied gorgeous Dal Lake. The lake is now polluted, and no traveler in his right mind would regard war-torn Kashmir as a vacation spot.

Shortly after partition, the UN gave Kashmir the right to decide whether to join India, join Pakistan, or set up an independent country. The process has produced a situation in which half of Kashmir is a semiautonomous part of Pakistan and the other half is under the firm grip of India.

Neither side will relinquish its interest in territory controlled by the other. India cannot let "its" Kashmir get the independence it wants because that could encourage demands on the part of many other independence groups. "You could see the whole place unravel," said one veteran south Asia observer.

Pakistan has assigned its fearsome military intelligence service, the directorate of Inter-Services Intelligence (ISI), to the Kashmir issue. Indian government officials claim that the ISI is financing and fomenting armed uprisings and terrorism in India's Kashmir. ISI activities have become so brazen that the Bush Administration made preliminary moves to place Pakistan on the State Department's list of states that sponsor terrorism.

Back to the Hard Line

As recently as 1990, India attempted to ease the strain, but Pakistani involvement in Kashmiri terrorism forced India into a harder line. "Given the complications of Kashmir and their own internal problems in other places, the new Indian leaders had to change their stance," said Rutgers University Professor Maya Chadda. "They became very tough. It was a bad situation, to which Pakistan reacted."

The ease with which the two Asian nations slide toward confrontation is a long-standing phenomenon. One example came during the 1987 edi-

Photo © Maraj / Reuters / Bettmann

Kashmir has been a bone of contention between India and Pakistan since the two won independence from Britain. This family of militants in Sringar displays some of the weapons that have kept this region a hot spot for decades.

tion of India's annual military maneuvers, which that year were code-named Operation Brass Tacks. Pakistani military leaders convinced themselves that the exercise presented the danger of a military attack. Within days, 340,000 troops from both sides faced off against each other in Punjab, another region split by the India-Pakistan border.

An Indian cabinet member drew attention to Pakistani divisions in place in "battle formations." Indian military leaders were instructed to take "corresponding moves." For days, Pakistani and Indian politicians hurled words at each other while their armies got ready to hurl ammunition. Pakistan's late President Zia ul-Haq defused the situation by visiting New Delhi, ostensibly to attend a cricket match but clearly to head off war.

Three years later came another emergency. The presence of nuclear weapons measurably increased regional tensions, which ran high even in normal times. It got so bad in 1990 that officials of the United States and the Soviet Union feared that India and Pakistan were about to start slugging it out, possibly with nuclear arms. The Indian and Pakistani armies were placed on full combat alert. Mobilizations got under way on both sides of the border. Only a strong joint effort by the US and the Soviet Union kept the situation from spiraling into war.

Those who watched the crisis close up were shaken by the experience. One American intelligence officer remarked recently that "few situations since the Cuban missile crisis [have] led to two countries with nuclear weapons being so ready and so close to using them." Professor Chadda said, "What happened in 1990 was really touch and go."

By all accounts, Mr. Gates played a key role in halting the slide toward war. He visited the region to put pressure on Pakistan to stop backing Kashmiri militants and interfering in India's internal affairs, and he bluntly warned military and political figures on both sides that the US would not stand by and let a nuclear war occur.

Since that time, however, the cold war structure has evaporated, leaving behind a host of problems that will make such disputes more frequent and perhaps harder to resolve.

Softening Borders

The cold war forced most countries to assume that boundaries were set in concrete because any resort to war over boundaries could have dragged in the Americans and the Soviets, which no one wanted. "Since the end of the cold war, those hardened boundaries have become soft," said Professor Chadda, "and that worsens the threat. The danger of war is greater, and it will be internal situations rather than external situations that will be likely to push them."

India lost the Kremlin as the supplier of its military hardware. Throughout the Afghan war, Pakistan served as a conduit for US weapons intended to arm Afghan resistance to the Soviet invasion. Pakistan was considered Washington's staunchest ally between the Suez Canal and Thailand. It was, in cold war terms, a front-line state. Pakistan was at one time third only to Israel and Egypt in terms of the aid, both humanitarian and military, that it received from the US. With the end of the cold war and because of skulduggery in the ISI's relations with the Afghan resistance, Washington's ties to Islamabad swiftly deteriorated.

Photo © Don Sharpe / Black Star

When this photo of Indian troops was taken in 1971, India was fighting to secure the independence of Bangladesh, which, as East Pakistan, had just fought a civil war in which one million died and ten million fled to India.

The greatest worry, however, has been Islamabad's pursuit of nuclear weapons. As evidence of Pakistan's nuclear program continued to emerge, President Bush could no longer plausibly claim that Pakistan was still a nonnuclear nation, a precondition for continuing the arms and aid relationship. All US aid to Pakistan stopped in 1991. Relations between Washington and Islamabad disintegrated.

Now, said Mr. Gates in his testimony, both India and Pakistan have several nuclear bombs at the ready, though probably in an unassembled form. On February 6, 1992, Pakistan's Foreign Secretary officially broke the secrecy of his country's nuclear program, albeit in a low-key way. He acknowledged that Pakistan had the parts and the know-how to put together one nuclear bomb. British intelligence, meanwhile, estimates that Pakistan has fifteen or so nuclear weapons and that India has enough plutonium and other ingredients for up to 200 nuclear bombs.

Both also appear to have solved the problem of delivering the weapons. India could carry them on jets. In 1989, India successfully test-fired its Agni missile, which is said to be capable of carrying a substantial nuclear warhead. The Agni has a range of up to 2,500 kilometers (about 1,500 miles). Pakistan would rely on tactical aircraft.

If India has nuclear bombs in the basement ready to be assembled, having them racked and ready could not be far away, despite a lack of recent testing. "Knowing the mindset, there is a very strong lobby in India that wants India to go fully nuclear and have delivery systems and so forth," said Professor Chadda.

No Weaklings

Pakistan and India are both scrambling to maintain supplies of spare parts for their conventional military equipment, but their armed forces are not weak. Pakistan's arsenal is based on US-made planes, particularly forty front-line F-16 fighters. India's forces rely mostly on Soviet technology, though India has diversified its sources of supply in recent years.

"Both countries have made substantial investment in their own indigenous production capabilities," says David Isby, a Washington, D. C., consultant on national security and foreign policy affairs. "While both India and Pakistan have been hurt by the end of spares and technology from their former superpower supporters, they are in much better shape than they would have been ten years ago because of what they have done for themselves."

Photo © P. Steinemann

Tensions remain high, exacerbated by the presence of high-technology weapons on both sides. Pakistan can counter these Indian MiG-29s with F-16s, and the world no longer doubts the nuclear capability of the two nations.

India's 1,265,000-member active military vastly outnumbers Pakistan's 565,000-strong fighting force, and India has won every war the two have fought. In 1948 and 1965, they fought over the independence of Kashmir. In 1971, India devastated Pakistan and lopped off its eastern territory, which became Bangladesh.

There is little doubt that India would win in any new war, but Pakistan could inflict terrible damage on its rival, even if it chose not to unsheathe the nuclear sword. "Pakistan could bomb all the northern Indian cities, and it could be terrible," said a US intelligence official. "Pakistan could cripple India's logistics," Professor Chadda said.

Each country has had problems to face on other borders. India views relations with China as a major factor in its security situation. Troubles on the India-China border flared into hot wars in 1959 and 1962, and there is continuous tension. Divisions are lined up on both sides of that border.

Debate about the proper disposition of Indian forces on the subcontinent is strong within the Indian defense establishment. Indian politicians have kept the diplomatic doors with China wide open, so no unexpected situation between the two should arise. However, Pakistan enjoys excellent diplomatic relations with China.

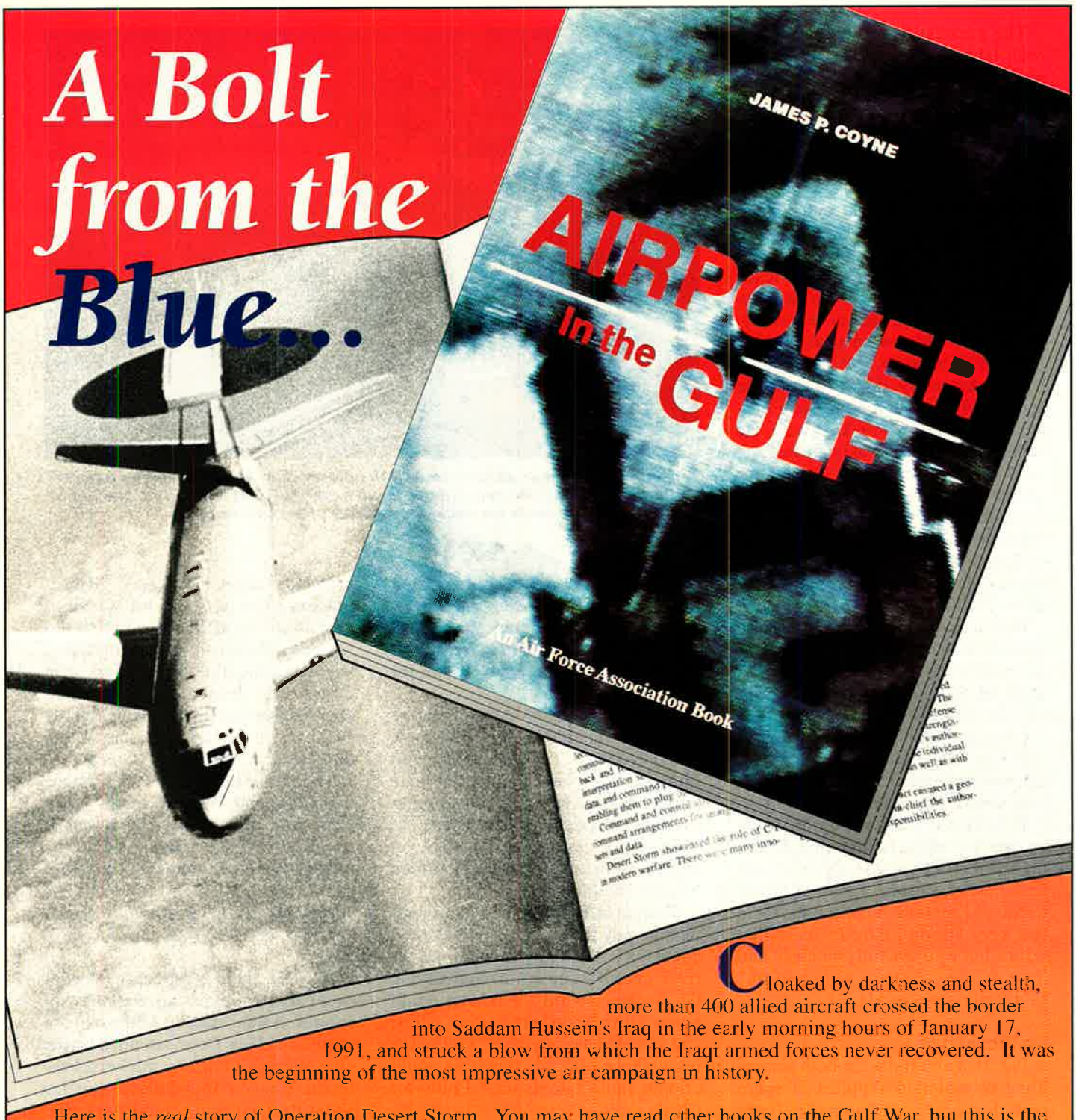
Today, one searches in vain for signs that India and Pakistan might move back from the brink. The Kashmir situation remains unresolved. India refuses to contemplate Pakistan's demands that it adhere to the 1948 UN agreement. Hatred continues to smolder over the Ayodhya mosque incident.

In India, there is immense concern over Pakistan's evolving relations with central Asian states. Addressing a seminar in New Delhi attended by the elite of India's military thinkers, Professor Chadda found deep worries about Pakistan and central Asia. She said they feel that the emergence of Islamic republics across the vast swath of Asia could give the Kashmir issue what they call "a new ideological and strategic depth."

That development would make the situation on the subcontinent more dangerous than ever. ■

Richard Mackenzie, editor in chief of Global News Service, was a war correspondent in Afghanistan in 1987–92 and in the 1991 Persian Gulf War. His most recent article for Air Force *Magazine was "India at the Crossroads" in the November 1992 issue.*

A Bolt from the Blue...



Cloaked by darkness and stealth, more than 400 allied aircraft crossed the border into Saddam Hussein's Iraq in the early morning hours of January 17, 1991, and struck a blow from which the Iraqi armed forces never recovered. It was the beginning of the most impressive air campaign in history.

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The Defense Conversion Commission says it's important to help workers and communities but that a defense industrial base is important too.

A Few Swords Along With the Plowshares

By Bruce Auster

AT FIRST, the defense conversion movement had a definite ideological slant. With the cold war over, proponents argued, defense industries should simply "convert" to civilian work as rapidly as possible. That, along with redistribution of funds once spent on defense, would promote the building of roads, schools, and the like. It is in such investments—rather than in an obsolete defense industrial base—that the nation's security lies, said the ideologues.

That is *not* the view of conversion held by David Berteau. He was chairman of President Bush's Defense Conversion Commission, chartered to study how to ease the pain of defense cutbacks for workers, communities, and companies. Following the release of the panel's eighty-six-page report in January, he became the chief advocate for a very new type of conversion.

Mr. Berteau's type of conversion is not a grandiose vision—"beating swords into plowshares" and so on—but a practical plan for achieving national goals. Conversion, new-style, is not an end in itself but a process. Moreover, the old-style conversion ignored the industrial needs of defense. New-style conversion considers the preservation of a healthy defense production base to be a critical—perhaps *the* critical—goal. In the commission's view, "Special attention must be paid to ensuring sufficient industrial capability for national security."

Mr. Berteau said that one of his top missions was to discover ways to help defense-oriented companies expand "outward" into commercial markets precisely so they can stay in business and retain the skills, plant, and technologies vital to producing high-quality military systems.

The plan is to help companies apply defense technologies and resources broadly to produce commercial products. That way, Mr. Berteau said, they might survive without having to abandon a business base on which the Pentagon has long depended.

The commission recommended "dramatic and immediate actions" to promote integration of military and commercial technologies, products, and processes. Among these would be removal of barriers to integration and specific steps to enhance a company's ability to develop and market commercially attractive products.

In addition, the commissioners suggested actions to strengthen develop-

The Big Difference in Drawdowns

Military Outlays in Billions of 1993 Dollars

Period	Peak		Valley		Difference		Average Annual Drop
	Year	Amount	Year	Amount	Years	Amount	
World War II	1945	885.7	1948	80.4	3	805.3	268.4
Korea	1953	390.7	1956	284.5	3	106.2	35.4
Vietnam	1968	371.2	1977	219.1	9	152.1	16.9
Current	1989	353.6	1997	256.9	8	96.7	12.1

Military Outlays as a Percent of Gross Domestic Product

Period	Peak		Valley		Difference		Average Annual Drop
	Year	Percent	Year	Percent	Years	Percent	
World War II	1944	39.3	1948	3.7	4	35.6	8.90
Korea	1953	14.5	1956	10.2	3	4.3	1.43
Vietnam	1968	9.6	1978	4.8	10	4.8	0.48
Current	1986	6.5	1997	3.6	11	2.9	0.26

ment and application of technologies that meet defense needs and to accelerate their commercial use. This, said the report, would allow the Pentagon to satisfy defense needs at lower cost and from a larger, integrated national industrial base and would ensure that US industry meets world standards.

Finally, the panel members recommended greater government support for the integration of military and commercial products and for increasing the Pentagon's reliance on this integrated private sector for defense and civilian goods.

Three Improvements

During the commission's deliberations, some questioned whether federal encouragement of defense companies to strike out into the commercial market and federal aid to help defense employees find new jobs in the commercial sector would help or hinder efforts to sustain the defense industrial base.

Mr. Berteau has no doubt that such measures will help. He cited three reasons for reaching this conclusion.

First, he maintained, keeping a company in business with commercial orders is more efficient than sustaining it with nonessential defense orders. "The degree to which you expand the business base," said Mr. Berteau, "is the degree to which you keep capability, without having to spend defense dollars solely for the purpose of preserving capability." The implication is that those funds can be spent more productively elsewhere.

Second, said Mr. Berteau, expanding the commercial component of a firm's business operation spreads overhead costs more widely and reduces the share that must be covered by increasingly scarce defense dollars.

Third, the defense side of an industrial concern could profit from infusions of advanced commercial technologies, said the commission chairman. In information systems, communications, electronics, and other areas, he noted, commercial technology is more advanced than available defense technology. "You create at least the potential for defense to benefit from the technological advancements that are going to occur naturally in the commercial world," he said.

All are controversial propositions. Moreover, there is near-universal agreement that conversion efforts will provide, at best, only part of the solution to the current problems.

The commission report emphasized that a growing economy is the best cure for what is ailing defense companies trying to make a transition to commercial markets: "With sufficient growth, the transition will be easier. Without it, the process will be much more difficult and adjustments more traumatic."

Experts agree that no amount of conversion can provide the production capacity for major weapon systems such as fighters, warships, helicopters, and tanks. In such cases, said the commission report, the Pentagon will have to take "special actions" to preserve the industrial facilities needed to produce replacement weapons.

The Submarine Problem

Some industries are in special jeopardy. Firms involved in the production of nuclear-powered submarines provide the most compelling example. Submarine work is expected to fall off to virtually nothing. A House Armed Services Committee panel reported that reconstitution of a submarine facility after it ceases to operate could take as long as ten years.

The Pentagon's decision to upgrade the M1 tank has given the armor industry a reprieve, particularly for workers and firms with the special skills and materials required for armor production. The Bush Administration's decision to export F-15 and F-16 fighters to Saudi Arabia and Taiwan will keep production lines open in Saint Louis and Fort Worth.

Commission members noted that the fate of many companies hinges on the future size of two investment accounts—procurement and research and development. They took heart from current plans that call for spending $50 billion to $60 billion a year to procure weapons and $30 billion a year to finance research.

"That is a substantial investment in terms of peacetime demand for defense goods and services," said Mr. Berteau. "So that alone is going to sustain a fairly big chunk of the industrial base."

For six months, the commissioners traveled across the country, visiting areas where defense is a substantial

part of the economy. They heard from chief executive officers of major defense contractors and from CEOs of small companies, some of which were successfully developing commercial markets, many of which were not. The commission held public hearings and met with government officials, academics, and community leaders.

Deep concerns were apparent everywhere about the effect of the cuts already taken and about the planned size of cuts yet to come. The commissioners based their report on the proposition that actual Pentagon cash outlays will decline from $340 billion in 1989 to $237 billion in 1997 (both figures expressed in 1993 dollars). No one is wholly confident the cuts will not be deeper.

The federal Office of Technology Assessment (OTA) and Bureau of Labor Statistics reports that, in 1985–89, more than 9.2 million Americans throughout the economy lost jobs as a result of plant closings or other types of economic dislocation. By comparison, the commission predicts losses of about one million defense jobs in 1991–97.

Concentrated Pain

In this defense build-down, however, much of the pain is local and at times severe.

The commission reports that half of all defense-related jobs and a large number of layoffs are concentrated in just eight states: California, New York, Texas, Virginia, Massachusetts, Pennsylvania, Ohio, and Florida.

Where The Defense Budget Gets Hit

Outlay Reductions 1988–97

Budget Category	Dollar Drop	Percent Drop
Military procurement	$46 billion	46.0
Military personnel	25 billion	28.4
Operations and maintenance	19 billion	19.8
Research and development	10 billion	23.8
Military construction	1 billion	9.1
Total	**$101 billion**	

In 1997, defense spending will be $101 billion lower than it was a decade earlier, as measured in constant 1993 dollars. The weapons procurement account will take the biggest hit, losing about half its 1988 value.

In one sense, the current drawdown is relatively gentle. "The present defense reduction is the mildest and most gradual of the past half-century," the commission said in its final report. This means that the drop in defense spending will be smaller, in percentage terms, and spread over more years, than the reductions that occurred in the wake of World War II, the Korean War, and the Vietnam War *[see box, p. 64]*.

Planners expect defense outlays to decline annually by an average of $12 billion in 1989–97, meaning that roughly three percent of Gross Domestic Product will shift from defense business to the commercial world. After World War II, the shift affected more than one-third of the national economy. From 1944 through 1948, the commission reported, defense spending fell from 39.3 percent to 3.7 percent of GDP.

Concentrations of jobs are apparent even within certain states. In the Norwich–New London area of Connecticut, where the submarine-building and engine-building industries are in deep trouble, one in five workers is employed in defense work. California has lost 60,000 aerospace and defense jobs since 1986, causing the loss of another 90,000 subcontractor jobs.

OTA estimates that 160 of the nation's 3,137 counties are defense-dependent. Some localities are affected most by base closings, others by contract cancellations. The pain caused by defense budget cuts can be great even in states that do not rank high in defense dependence. In Maine, just 2.2 percent of jobs are defense-related. Bath Iron Works, however, is Maine's biggest employer, with 11,700 workers, and is acutely vulnerable to crippling shipbuilding cuts.

In trying to cope with the problem, the government faces two challenges: preserving the most essential elements of defense industry and assisting the more than one million defense workers whose jobs are in jeopardy or have vanished.

The role that federal conversion assistance funding might play is still being worked out. The commission concluded that some federal conversion assistance programs can help companies, workers, and communities. The final report explicitly acknowledged the high potential value of job training, research subsidies, marketing advice, and small business assistance.

However, the commissioners sharply criticized a plan put forth by Congress to provide such assistance. The plan, contained in the Fiscal 1993 defense legislation, calls for spending $1.8 billion of DoD money on economic assistance programs. The final commission report blasted the legislation, claiming it "did not provide an integrated approach to [the defense industry's] transition problems."

The commissioners' report argued that elements of the legislation duplicated many existing federal efforts. One example was Congress's creation of a $100 million Defense Manufacturing Extension Program, which the panel charged was doing essentially the same work of several other extension centers.

In any event, concluded the report, the Defense Department should not take the lead in carrying out economic adjustment programs.

Where Money Should Go

Of the nearly $1.8 billion appropriated by Congress for economic adjustment, about $575 million goes to assist defense firms.

The commission approvingly cited business development programs that assist small businesses or that encourage companies to "spin off" new products or processes for commercial markets. For instance, despite its criticism of the Defense Manufacturing Extension Program, the presidential commission said that such entities, if run by other agencies, can do some good and "help improve productivity by encouraging companies to adopt current, and hence more productive, capital equipment and production processes."

New York has one of the most successful programs. Its leaders found that

Where Conversion Money Goes

1993 Federal Appropriations

Federal Program Category	Appropriations
Personnel assistance programs	$686,210,000
Community assistance programs	200,000,000
Defense industry/technology base programs	575,000,000
Additional technology programs	305,800,000
Total	**$1,767,010,000**

most of the state's defense firms, because they have sold only to the Pentagon, needed assistance with such basic business techniques as technology application, strategic planning, management development, and marketing.

ARO Corp. of Buffalo worked with the state in 1990 to find new markets. New York's Industrial Effectiveness Program (IEP) provided marketing assistance and helped ARO design new products. The plan was funded with $60,300 from IEP and another $235,000 from ARO. ARO was able to adapt military tactical aircraft oxygen supply equipment to commercial aviation and develop a product for medical use.

Active economic assistance is at best only part of the solution. Mr. Berteau's commission looked at what the government could *stop* doing in order to help companies make the transition to commercial business.

The commission concluded that the government should stop doing quite a bit in the area of acquisition.

Jacques Gansler, director of the Analytic Science Corp., has argued that commercial-military integration must be expanded if the defense industrial base is to be protected. At present, Mr. Gansler said, the Pentagon's buying practices make that impossible. The "barriers to integration" include onerous Pentagon accounting standards, auditing practices, and military specifications. The commission recommended that the Pentagon use commercial specifications in procurement.

Mr. Berteau singled out for criticism the government's overhead accounting practices, which he said discourage businesses from exploiting commercial markets because those who do so suffer reductions in the amount of overhead they can allocate to a defense contract.

The commission endorsed government efforts to help dislocated workers but said that most of the existing programs have not worked. Services came too late and reached too few to be of much value. Many of the workers had already dispersed or had become disillusioned with the job hunt.

The Conversion Commission called for a host of reforms to strengthen worker assistance programs. The possibilities include providing services before workers are laid off and better design of retraining programs.

The Ten Most Vulnerable States

Estimated Private Sector Defense Job Losses, 1991–97

State	Job Losses	Percent Nationwide	Cumulative Percent of Total
California	178,000	19	19
New York	62,000	6	25
Texas	56,000	6	31
Virginia	47,000	5	36
Massachusetts	46,000	5	41
Pennsylvania	38,000	4	45
Ohio	38,000	4	49
Florida	38,000	4	53
Connecticut	37,000	4	57
New Jersey	30,000	3	60
Totals	**570,000**	**60**	**60**

Just One in Three

OTA found that, at best, only one in every three displaced workers will seek retraining. Most cannot afford to change careers and instead seek the earliest reentry into the job market. This does not mean that training should be ignored. "A displaced-worker program that neglects training in the interests of getting the clients back to work quickly and cheaply is depriving many people of their best chance for a job with a future," concluded the OTA report.

Retraining must be tailored to specific needs of workers. For example, United Nuclear Corp., which made nuclear engines for submarines, began laying off 1,100 workers in 1990. The company, along with a local technical college, created a one-year associate degree program in environmental cleanup for the workers. The training qualified the workers for jobs as cleanup technicians at Department of Energy facilities.

Some will not have much trouble making the transition to civilian work. This is especially true of engineers. According to one federal report, sixty percent of engineers forced to leave jobs at Lockheed-Burbank have found jobs with nondefense firms. Texas Instruments' Dallas plants placed eighty-two percent of their exiting engineers in the commercial sector. The figure for McDonnell Douglas engineers was eighty-three percent.

The commissioners believed that, as it pares the defense budget, the United States will have an opportunity to strengthen its economy by shifting the resources to other areas. "The national challenge," the commission's report said, "is to seize this opportunity and accomplish the reallocation . . . while still preserving the appropriate defense industrial base." ■

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Gallery of Russian Aerospace Weapons

By John W. R. Taylor

Bombers and Maritime

Antonov An-72P (NATO "Coaler")

First seen in 1992 and not yet allocated a NATO reporting suffix, the An-72P is a maritime patrol aircraft based on the standard airframe of the An-72 STOL transport. It is intended for armed surveillance of coastal areas, within 230 miles of shore, in all-weather day/night conditions, carrying a navigator and radio operator in addition to the normal three-man crew. On-board avionics permit automated navigation at all stages of flight and precise fixing of the coordinates, speed, and heading of surface ships. Fixed cameras for photographing targets are supplemented by a TV scanning system, with flares for night use. The TV equipment is carried in the port main landing gear fairing. A 23-mm gun pod can be mounted forward of the starboard fairing, with a UB-32M rocket pack under each wing. The day/night cameras are carried in the fuselage aft of the rear loading hatch; four 220-lb bombs can be carried in the roof of the hold, above the hatch, with the loading ramp slid forward under the cabin to make their release practicable. *(Data generally as for An-72.)*

Weights: mission load 1,433 lb, gross 70,545 lb.

Performance: patrol speed at 1,640–3,280 ft 186–217 mph, ceiling 33,135 ft, field requirement 4,600 ft, max endurance 5 hr 18 min.

Accommodation: on secondary missions can carry and airdrop 22 fully equipped paratroops, or transport 16 litter patients and attendant, or up to 11,020 lb of ammunition, supplies, and equipment.

Antonov An-72P ("Coaler") (Richard Malachowski)

Beriev A-40 Albatross ("Mermaid") (Martin Fricke)

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

This elegant amphibian was designed to replace the Il-38 May and M-12 Mail, though not on a one-for-one basis. In its basic **A-40** form, it is equipped for ASW/surveillance/minelaying duties, carrying weapons and other stores in a 21 ft 4 in bay in the bottom of the hull aft of the step.

The prototype was first observed by a US reconnaissance satellite passing over the Beriev OKB facilities at Taganrog, in the northeast corner of the Sea of Azov, in the spring of 1988. It made a first public appearance in the Aviation Day flyby at Tushino Airport, Moscow, on August 20, 1989, and was exhibited subsequently at the 1991 Paris Air Show. The largest amphibian yet built, the A-40 has flush intakes at the front of the underwing pods to provide cooling air for the extensive avionics required for its military missions. Other features include booster turbojets in pods with eyelid nozzles mounted 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. Traditional cockpit instrumentation on the early aircraft will be replaced by color CRTs on production A-40s.

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

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

Power Plant: two Perm/Soloviev D-30KPV turbofans, each 26,455 lb thrust, on pylons above rear of hull (33,070 lb thrust engines to be fitted later). Two RKBM RD-60K booster turbojets, each 5,510 lb thrust.

Dimensions: span 136 ft 6½ in, length 143 ft 10 in, height 36 ft 3¾ in.

Weights: max payload 14,330 lb, gross 189,595 lb.

Performance: max speed at 19,700 ft 472 mph, max cruising speed 447 mph, ceiling 31,825 ft, T-O run 3,280 ft, landing run 2,955 ft, range with max payload 2,547 miles, with max fuel 3,417 miles.

Accommodation: crew of eight.

Armament: not yet specified.

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

About 75 of an estimated 100 **M-12** twin-turboprop amphibians, built from 1964, are in service. Built for overwater surveillance and antisubmarine duties within a 230-mile radius of Naval Aviation shore bases, some have been converted into **Be-12PS** search-and-rescue amphibians. *(Data for M-12.)*

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

Dimensions: span 97 ft 5¾ in, length 99 ft 0 in, height 22 ft 11½ in.

Weight: gross 68,345 lb.

Performance: max speed 378 mph, service ceiling 37,000 ft, max range 4,660 miles.

Accommodation: crew of five.

Armament and Operational Equipment: torpedoes, depth charges, mines, and other stores for maritime search and attack carried in internal bay aft of step in bottom of hull and on four pylons under outer wings. Radar in nose "thimble"; MAD (magnetic anomaly detection) tailsting.

Ilyushin Il-38 (NATO "May")

Derived from the Il-18 airliner, this intermediate-range, shore-based, antisubmarine/maritime patrol aircraft serves with Naval Aviation units at coastal bases and on detachments overseas. Standard equipment includes 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 Ivchenko AI-20M turboprops; each 4,250 ehp.

Dimensions: span 122 ft 9¼ in, length 129 ft 10 in, height 33 ft 4 in.

Weights: empty 79,367 lb, gross 140,000 lb.

Performance: max speed at 21,000 ft 448 mph, patrol speed at 2,000 ft 248 mph, T-O run 4,265 ft, landing run 2,790 ft, max range 4,473 miles, patrol endurance 12 hr.

Accommodation: crew of nine.

Armament and Operational Equipment: variety of attack weapons and sonobuoys in weapons bays.

Tupolev Tu-16 (NATO "Badger")

Now in its 41st year, the Tu-16 has been largely retired from its attack roles. The Air Armies may retain many of the 20 Tu-16N tankers and 105 reconnaissance/ECM Tu-16s that support their attack units, there being no variant of the Tu-22M configured for such tasks. Similarly, Naval Aviation bases may require for some time their few remaining attack models (mostly Badger-G) and a proportion of the 150 tankers, reconnaissance, and ECM Tu-16s that they had in the 1980s. Versions listed below are, therefore, of varying significance:

Tu-16A (Badger-A). Original strategic bomber version. Glazed nose with small undernose radome. Armed with seven 23-mm guns. Some equipped as in-flight refueling tankers (**Tu-16N**) using a unique wingtip-to-wingtip transfer technique to refuel other Tu-16s or a probe-and-drogue system to refuel Tu-22s.

Tu-16K-10 (Badger-C). Antishipping version, originally with obsolete K-10 (AS-2 Kipper) winged missile in recess under fuselage (Badger-C Mod carries AS-6 Kingfish missiles under wings). Wide nose radome in place of glazing and nose gun of Tu-16A. No provision for free-fall bombs.

Tu-16R (Badger-D). Maritime/electronic reconnaissance version. Nose like Tu-16K-10. Larger undernose radome. Three elint radomes in tandem under weapons bay, which contains cameras.

Tu-16 (Badger-E). Photographic and electronic reconnaissance version. Similar to Tu-16A, but with cameras in weapons bay and two additional radomes under fuselage, larger one aft.

Tu-16R (Badger-F). Basically as Badger-E, but with elint pod on pylon under each wing. Late versions have small radomes under center-fuselage.

Tu-16 (Badger-G). Converted from Badger-B. Generally as Tu-16A, but with underwing pylons for two obsolescent AS-5 (Kelt) rocket-powered ASMs that can be carried to a range greater than 2,000 miles. Free-fall bombing capability retained. Serves with antishipping squadrons of the Naval Air Force.

Tu-16K (Badger-G modified). Equipped to carry AS-6 (Kingfish) ASM under each wing. Large radome, presumably associated with missile operation, under center-fuselage, replacing chin radome. Device mounted externally on glazed nose might help to ensure correct attitude of Tu-16 during missile launch.

Tu-16PP (Badger-H). Standoff or escort ECM aircraft to protect missile-carrying strike force, with primary function of chaff dispensing. Two teardrop radomes, fore and aft of weapons bay, house passive receivers to identify enemy radar signals and establish length of chaff strips to be dispensed. The dispensers (max capacity 20,000 lb) are in the weapons bay, with three chutes in doors. Hatch aft of weapons bay. Two blade antennas aft of weapons bay. Glazed nose and chin radome.

Tu-16PP (Badger-J). ECM jamming aircraft to protect strike force, with some equipment in a canoe-shaped radome protruding from the weapons bay and surrounded by heat exchangers and exhaust ports. Antiradar noise jammers operate in A to I bands inclusive. Glazed nose as Tu-16A. Some aircraft have large flat-plate antennas at wingtips.

Tu-16R (Badger-K). Electronic reconnaissance variant with nose like Tu-16A. Two teardrop radomes, inside and forward of weapons bay (closer together than on Badger-H); four small pods on centerline in front of rear radome. Chaff dispenser aft of weapons bay.

Tu-16 (Badger-L). Naval electronic warfare variant. Like Badger-G, but with equipment of the kind fitted to the Tu-95 Bear-G, including an ECM nose thimble, pods on center-fuselage forward of engine ducts, and "solid" extended tailcone housing special equipment instead of tailgun position. Sometimes has a pylon-mounted pod under each wing. *(Data for Badger-G.)*

Power Plant: two Mikulin RD-3M-500 turbojets; each 20,920 lb thrust.
Dimensions: span 108 ft 3 in, length 114 ft 2 in, height 34 ft 0 in.
Weights: empty 82,000 lb, normal gross 165,350 lb.
Performance: max speed at 19,700 ft 652 mph, ceiling 49,200 ft, range with 6,600-lb bomb load 4,475 miles.
Accommodation: crew of six (eight to ten in Tu-16Rs).
Armament: seven 23-mm AM-23 guns; in twin-gun turrets above front fuselage, under rear fuselage, and in tail, with single gun on starboard side of nose. Two Kingfish missiles; or up to 19,800 lb of bombs in internal weapons bay.

Tupolev Tu-22 (NATO "Blinder")

Naval Aviation has about 30 Tu-22 bombers and 20 maritime reconnaissance/ECM Blinders. Most of those in the Air Armies (about 75 total) have been reassigned progressively to such support roles as ECM jamming and reconnaissance. The following versions have been identified:

Blinder-A. Original reconnaissance bomber version, first seen in 1961, with fuselage weapons bay for free-fall nuclear or conventional bombs. Limited production only.

Blinder-B. Similar to Blinder-A but equipped to carry an AS-4 Kitchen ASM recessed in weapons bay. Larger radar and partially retractable flight refueling probe on nose.

Blinder-C. Maritime reconnaissance version, with six camera windows in weapons bay doors. Flight refueling probe like Blinder-B.

Blinder-D (Tu-22U). Training version. Cockpit for instructor in raised position aft of standard flight deck, with stepped-up canopy.

Blinder-E. Electronic warfare/reconnaissance conversion. Modified nosecone, additional dielectric panels, etc.

Power Plant: two Koliesov VD-7M turbojets in pods above rear fuselage, on each side of tailfin; each 35,275 lb thrust with afterburning.
Dimensions: span 78 ft 0 in, length 132 ft 11½ in, height 35 ft 0 in.
Weight: gross 185,000 lb.
Performance: max speed at 40,000 ft Mach 1.4, ceiling 60,000 ft, max unrefueled combat radius 1,490 miles.
Accommodation: crew of three, in tandem.
Armament: single 23-mm NR-23 gun in radar-directed tail mounting. Other weapons as described for individual versions.

Tupolev Tu-22M (NATO "Backfire")

The Tu-22M was displayed in public for the first time in the West at the 1992 Farnborough Air Show, confirming its availability for export. Production has averaged 30 a year since the late 1970s. Well over 200 have been delivered to the strategic Air Armies, to attack deep theater targets; Naval Aviation units have more than 160. A high proportion of these forces are equipped with the latest Tu-22M-3 version, including the majority of Smolensk units and regiments of the Irkutsk Air Army that were upgraded with equipment relocated from the ATTU (Atlantic-to-the-Urals) region prior to signature of the CFE Treaty. The two versions in service:

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

Tupolev Tu-142 Mod 3 ("Bear-F") (Linda Jackson)

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

Tu-22M-2 (Backfire-B). Initial series production version. Three-position wingsweep (20°, 30°, 65°). Slightly inclined lateral engine air intakes, with large splitter plates. Two GSh-23 twin-barrel 23-mm guns, with barrels side by side horizontally, in radar-directed tail mounting. Above-nose fairing now replaces formerly observed in-flight refueling probe.

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

Backfire is capable of performing nuclear strike, conventional attack, and antiship missions, its low-level penetration features making it more survivable than earlier Tupolev bombers. Deployment of SRAMs with Backfire-C has improved deliverable warhead potential and increased flexibility for air force strategists.

Power Plant: two KKBM/Kuznetsov NK-25 turbofans; each 55,115 lb thrust with afterburning.
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.
Performance: max speed at high altitude Mach 1.88, at low altitude Mach 0.9, 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 hi-lo-hi 1,365 miles, at height 2,485 miles.
Accommodation: crew of four, in pairs.
Armament: max offensive weapon load comprises three Kh-22 (AS-4 Kitchen) ASMs, with one semi-recessed under the center-fuselage and one under the fixed center-section panel of each wing; or 52,910 lb of conventional bombs or mines, half of them carried internally and half on external racks under the wings and engine air intake trunks. Internal bombs can be replaced by a rotary launcher for six Kh-15P (AS-16 Kickback) SRAMs, with four more underwing as alternative to Kh-22s. Normal weapon load is quoted as a single Kh-22 or 26,455 lb of bombs. Typical bomb loads are two FAB-3000, eight FAB-1500, 42 FAB-500, or 69 FAB-250 or -100 bombs (figures indicate weight in kg). Single GSh-23 twin-barrel 23-mm gun in radar-directed tail mounting.

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

After 38 years of continuous production, ending in 1992, these remarkable propeller-driven aircraft remain a formidable spearhead of Russian strategic nuclear attack and maritime airpower. The Air Armies have about 159, mostly Tu-95K22 and Tu-95MS missile carriers; Naval Aviation has a total of about 80 maritime reconnaissance/ASW/"TACAMO equivalent" versions. Major current versions:

Tu-95RT (Bear-D). Identified in 1967, this maritime reconnaissance aircraft is equipped with I-band surface search radar in a large blister fairing under the center-fuselage. Glazed nose with undernose radome and superimposed refueling probe. Elint blister fairing on each side of its rear fuselage. Added fairing at each tailplane tip. I-band tail-warning radar in large fairing at base of rudder. Defensive armament of six 23-mm NR-23 guns in pairs in remotely controlled rear dorsal and ventral turrets and manned tail turret. Carries no offensive weapons, but tasks include pinpointing of maritime targets for missile launch crews on board ships and aircraft that are themselves too distant to ensure precise missile aiming and guidance. About 15 operational.

A Bear-D was the first version seen, in 1978, with a faired tailcone housing special equipment in place of the normal tail turret and associated radome.

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

Tu-142 (Bear-F). Antisubmarine aircraft. First of the Tu-142 series of extensively redesigned Bears, with more highly cambered wings and longer fuselage forward of the wings. Deployed initially by Naval Aviation in 1970. Reentered production in the mid-1980s. Originally, Bear-F had enlarged and lengthened fairings for 12-wheel main landing gear bogies aft of its inboard engine nacelles, and undernose radar. The main underfuselage J-band radar housing is considerably further forward than on Bear-D and smaller in size. There are no large blister fairings under and on the sides of the rear fuselage, and the nosewheel doors bulge prominently, suggesting the use of larger or low-pressure tires. Bear-F has two stores bays for sonobuoys, torpedoes, and nuclear or conventional depth charges in its rear fuselage, one of them replacing the usual rear ventral gun turret and leaving the tail turret as the sole defensive gun position. Later variants of Bear-F are identified as follows:

Mod 1: As original Bear-F, but reverted to standard-size nacelles and four-wheel main landing gear bogies. Chin-mounted J-band radar deleted. Fewer protrusions.

Mod 2 (Tu-142M): Fuselage nose lengthened by 9 in and roof of flight deck raised. Angle of refueling probe lowered by 4°.

Mod 3: MAD boom added to fintip. Fairings at tips of tailplane deleted. Rear stores bay lengthened and narrowed.

Mod 4: Chin radar reinstated. ECM thimble radome on nose, plus other fairings. Observation blister each side of rear fuselage deleted.

Most of approximately 60 Bear-Fs in service are now to Mod 3 or Mod 4 standard.

Tu-95K22 (Bear-G). Bomber and elint conversion of early Bear-B/C bombers, able to carry two Kh-22 (AS-4 Kitchen) ASMs, on a large pylon under each wingroot. Other features include a new undernose radar, an ECM thimble under the in-flight refueling probe, a streamlined ECM pod on each side at the bottom of both the center and rear fuselage, and a "solid" tailcone, containing special equipment, similar in shape to that on some Bear-Ds. Defensive armament of two 23-mm guns, in ventral turret. More than 45 operational with the Irkutsk Air Army.

Tu-95MS (Bear-H). New-production bomber based on Tu-142 airframe, but fuselage shortened to length of Tu-95. Initial **Tu-95MS6** version carries six RKV-500 (AS-15 Kent) long-range cruise missiles on an internal rotary launcher. The **Tu-95MS16** carries two more under each wingroot and a cluster of three between each pair of engines, for a total of 16. Bear-H attained initial operational capability in 1984, and more than 80 are now deployed, some in the Far East. Features include a larger and deeper radome built into the nose and a small fintip fairing. There are no elint blister fairings on the sides of the rear fuselage, and the ventral gun turret is deleted. Some aircraft have a

single twin-barrel 23-mm gun, instead of the usual pair, in the tail turret.

Tu-142 (Bear-J). Identified in 1986, this is the Soviet equivalent of the US Navy's E-6A and EC-130Q TACAMO aircraft, equipped with VLF communications avionics to maintain an on-station/all-ocean link between national command authorities and nuclear missile armed submarines under most operating conditions. Large ventral pod for VLF trailing-wire antenna, several kilometers long, under center-fuselage in weapons bay area. Undernose fairing as on Bear-F Mod 4. Fintip pod with trailing-edge as on some Bear-Hs. Satcom dome aft of flight deck canopy. Operational in comparatively small numbers with the Northern and Pacific Fleets, it appears to use a modified Tu-142 Bear-F airframe. *(Data for Tu-95MS.)*

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

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

Weights: empty 264,550 lb, gross 414,470 lb.

Performance: max speed at 25,000 ft 506 mph, ceiling 39,370 ft, combat radius with 25,000-lb payload 3,975 miles.

Armament: as described for individual versions.

Tupolev Tu-160 (NATO "Blackjack")

Following a US lead, Tu-160 and Tu-95 long-range bombers have been taken off alert status and a start made on placing their nuclear weapons in storage at their bases. It was expected that at least 100 Tu-160s would be built in a complex added to the huge Kazan airframe plant. Instead, only some 20 are in operational service—the same total as USAF's planned B-2 force. In most respects, the two types of strategic bomber could hardly be more dissimilar. The subsonic, flying-wing, two-crew B-2 represents the epitome of stealth technology, to ensure optimum possibility of penetrating densely structured defenses against air attack. The supersonic, four-crew Tu-160 is configured like the B-1B, its scant attention to low-observables reflecting the depletion of US air defenses. It was believed initially to be intended as a high-altitude standoff cruise missile launcher. However, the rotary launcher inside each of its two weapons bays can carry short-range attack missiles similar to USAF's SRAMs, as an alternative or in addition to ALCMs, for defense suppression during low-altitude penetration missions at transonic speed.

Blackjack is about 20 percent longer than the B-1B, with greater unrefueled combat radius and maximum level speed comparable with that of the original B-1 prototypes. It is in no way a simple scale-up of Tupolev's earlier Tu-22M. Common features include low-mounted variable-geometry (20° to 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. The very long and sharply swept fixed root panel of each wing, and the engine installation, resemble those of the long-retired Tu-144 supersonic transport rather than the Tu-22M.

Power Plant: four Samara/Trud NK-321 turbofans; each 55,115 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.

Weight: gross 606,260 lb.

Performance: max speed at high altitude Mach 1.88, ceiling 60,000 ft, max unrefueled range 8,700 miles.

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

Armament: no guns; internal stowage for up to 36,000 lb of free-fall bombs, short-range attack missiles, or ALCMs. Each rotary launcher carries 12 Kh-15P (AS-16 Kickback) SRAMs or six ALCMs, currently RKV-500s (AS-15 Kents).

Fighters

MiG-23 (NATO "Flogger")

Production of the MiG-23 ended in the mid-1980s, and all versions are expected to be withdrawn from first-line Russian service by the mid-1990s. Current variants as follows:

MiG-23M (Flogger-B). Single-seat air combat fighter with 27,540 lb thrust Soyuz/Khachaturov R-29-300 turbojet. Wingsweep variable manually in flight or on the ground at 16°, 45°, or 72°. Equipment includes Sapfir-23D-Sh J-band radar (NATO High Lark; search range 53 miles, tracking range 34 miles) in nose, Sirena-3 radar warning system, TP-23 infrared search/track pod beneath cockpit, and Doppler. The first Soviet aircraft with a demonstrated ability to track and engage targets flying below its altitude. Standard version from about 1975.

MiG-23UB (Flogger-C). Tandem two-seater for operational training and combat use, with 22,045 lb thrust Tumansky R-27F2M-300 turbojet. Slightly raised second cockpit to rear, with retractable periscopic sight for occupant, and modified fairing aft of canopy.

MiG-23ML (Flogger-G). Basically similar to MiG-23M, but with R-35 engine, rear fuselage fuel tank deleted, much smaller dorsal fin, Sapfir-23ML lighter-weight radar, and TP-23M IRST.

MiG-23P (Flogger-G). Modified MiG-23ML. Digital navigation computer guides aircraft under automatic ground control and informs pilot when to engage afterburner and to fire missiles and gun.

MiG-23MLD (Flogger-K). Midlife update of MiG-23ML, identified by dogtooth notch at junction of wing glove leading-edge and intake trunk on each side. Leading-edge flaps extended and retracted automatically when wingsweep passes 33°. RWR and chaff/flare dispensers added. New IFF antenna forward of windshield. R-73A (AA-11 Archer) close-range AAMs on fuselage pylons. Pivoting weapon pylons under outer wings. *(Data for MiG-23ML.)*

Power Plant: one Soyuz/Khachaturov R-35-300 turbojet, rated at 28,660 lb thrust with max afterburning. Variable-geometry air intakes and variable nozzle. Attachment for assisted takeoff rocket each side of rear fuselage.

Dimensions: span 45 ft 10 in spread, 25 ft 6¼ in swept, length incl probe 54 ft 10 in, height 15 ft 9¾ in.

Weights: empty 22,485 lb, max external weapons 6,615 lb, gross 32,405–39,250 lb.

Performance: max speed at height Mach 2.35, at S/L Mach 1.1, ceiling 60,700 ft, combat radius with six AAMs 715 miles, with 4,410 lb of bombs 435 miles.

Accommodation: pilot only.

Armament: one twin-barrel 23-mm GSh-23L gun in belly pack, with 200 rds. Two pylons in tandem under center-fuselage, one under each engine air intake duct, and one under each fixed inboard wing panel, for AAMs, bombs, rocket packs, or other stores. Use of twin launchers under air intake ducts permits carriage of four R-60T (AA-8 Aphid) missiles, in addition to two R-23R or R-23T (AA-7 Apex) on underwing pylons.

Tupolev Tu-160 ("Blackjack")
(Paul Duffy)

MiG-23MLD ("Flogger-K")
(Piotr Butowski)

MiG-29S ("Fulcrum-C")
(Neville M. Beckett)

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

No other combat aircraft in first-line service has exceeded the Mach 2.83 limit speed of the MiG-25 interceptor and its reconnaissance counterpart, the MiG-25R. More than 300 of the interceptors are in service 30 years after the design was finalized and are expected to equip the home defense forces through the end of this century. Their airframes are manufactured of 80 percent tempered and welded steel, with eight percent titanium in areas subject to extreme heat, such as the wing and tail unit leading-edges, and 11 percent D19 heat-resistant aluminum alloy. Versions are:

MiG-25P (Foxbat-A). Basic single-seat interceptor, first flown as Ye-155P-I prototype on September 9, 1964. Two R-15B-300 turbojets, each rated at 22,500 lb thrust with afterburning, and with 150-hr service life. Smertch-A look-down/shoot-down radar with search range of 62 miles and tracking range of 31 miles. Sirena-3 RWR in wingtip antiflutter bodies and starboard fintip, and SRO-2M IFF. Armed with one R-40T infrared and one R-40R radar homing AAM (AA-6 Acrid) under each wing. All converted to MiG-25PDS.

MiG-25R series (Foxbat-B/D). Reconnaissance/bomber versions. Described in Reconnaissance, ECM, and Early Warning Aircraft section.

MiG-25PU and RU (Foxbat-C). Training versions of MiG-25P and R, respectively. Redesigned nose section, containing separate cockpit for instructor, with individual canopy, forward of standard cockpit and at lower level. No radar or reconnaissance sensors in nose and no combat capability. Limited to Mach 2.65.

MiG-25PD (Foxbat-E). Development of MiG-25P, produced 1978–82. Uprated R-15BD-300 engines, with life of 1,000 hr. Sapfir-25 radar and IRST, giving look-down/shoot-down capability comparable with MiG-23M. Basic armament of two R-40R/T and four R-60 (AA-8 Aphid) AAMs. Provision for 1,400-gallon underbelly fuel tank.

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

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

Power Plant: two Tumansky R-15BD-300 turbojets, each 24,700 lb thrust with afterburning.

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

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

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

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

MiG-29 (NATO "Fulcrum")

Operational since early 1985, the MiG-29 is a twin-engine combat aircraft comparable in size to the US Navy's F/A-18 Hornet. Its N019 Sapfir-29 coherent pulse-Doppler look-down/shoot-down radar (search range 62 miles) is supplemented by a laser rangefinder and infrared search/track sensor forward of the windscreen. Both systems operate in conjunction with the pilot's helmet-mounted target designator. Primary operational role is as a single-seat counterair fighter, but the MiG-29 has dual-role air combat/attack capability. More than 600 are in service with CIS air and naval forces, for which production of the basic versions has ended. Versions identified to date:

MiG-29 (Fulcrum-A). Landbased single-seater. During takeoff and landing, hinged doors shield the engine air intakes against foreign object ingestion; engine air is then taken in through louvers in the upper surface of the wingroot extensions. Flying controls are actuated hydraulically. IRCM flare dispensers in "fences" forward of dorsal tailfins. Airbrakes above and below rear fuselage. Max gross weight 40,785 lb.

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

MiG-29S (Fulcrum-C). As Fulcrum-A, but with more deeply curved top to fuselage aft of cockpit, containing equipment. This may have been transferred from inside fuselage to make room for extra fuel. Able to carry new R-77 AMRAAM-class AAMs, or up to 8,820 lb of bombs.

MiG-29K (Fulcrum-D). Maritime version, used in late 1989 for ski-jump takeoff trials on carrier *Admiral Kuznetsov*. Two demonstrators converted from Fulcrum-As. Two 19,400 lb thrust RD-33K turbofans. Upward-folding outer wing panels, with bulged tips, probably for ESM, and with two additional underwing hardpoints (eight total). Strengthened landing gear, with arrester hook. No intake FOD doors required for carrier operation; replaced by lighter, retractable grids, permitting deletion of overwing louvers and internal ducting in center-section, which now provides much-increased fuel tankage (674 gallons in center-section). Flight refueling capability. No APU airscoop on rear fuselage. Single large airbrake above rear fuselage. New radar and different IRST. Typical underwing armament four Kh-31P (AS-17 Krypton) ASMs and four R-73A (AA-11 Archer) AAMs. Expected to form close-range air defense/attack force on *Admiral Kuznetsov*.

MiG-29M. Greatly redesigned, with quadruplex fly-by-wire controls and a "glass" cockpit with CRTs. First of six prototypes flown in late 1989. New Zhuk radar in nose of more tapered profile, and new IRST. Nose lengthened by approx 7½ inches. Longer canopy. Wider and longer dorsal spine, terminating in a spade-like structure that extends beyond the jet nozzles. Larger tailplane with dogtooth leading-edge. More rounded wingtip trailing-edge. Center-section without engine air louvers, eight underwing hardpoints, single airbrake, and RD-33K engines, like MiG-29K. Larger, sharp-edged and repositioned wingroot leading-edge extensions, vortex generators on wing leading-edges, 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. Armament options include Kh-31P and Kh-29T (AS-14 Kedge) ASMs and up to eight R-77 AAMs.

A MiG-29 with fiber optics has been flight tested, and a "fifth-generation" version with multiaxis thrust-vectoring engine nozzles has been flown at the Zhukovsky flight research center. *(Data for MiG-29S.)*

Power Plant: two Klimov/Sarkisov RD-33 turbofans; each 18,300 lb thrust with afterburning.
Dimensions: span 37 ft 3¼ in, length 56 ft 10 in, height 15 ft 6¼ in.
Weights: normal T-O weight 33,730 lb, gross 43,430 lb.
Performance: max speed at height Mach 2.3, at S/L Mach 1.06, ceiling 59,055 ft, T-O run 820 ft, landing run 1,970 ft, range on internal fuel 932 miles, with external tanks 1,800 miles.
Accommodation: pilot only.
Armament: six close-range R-60T (AA-8 Aphid) AAMs, or four R-60T and two medium-range R-27R (AA-10A Alamo-A), on three pylons under each wing. Alternative AAMs include R-73A (AA-11 Archer). Able to carry bombs, submunitions dispensers, 80-mm, 130-mm, and 240-mm rockets, and other stores (including nuclear weapons) in attack role. One 30-mm GSh-301 gun in port wingroot leading-edge extension, with 150 rds.

MiG-31 (NATO "Foxhound")

Despite having a configuration similar to that of the MiG-25, Foxhound is a very different aircraft. The requirement was for an all-altitude, all-weather interceptor, embodying advanced digital avionics and carrying two crew. There was no call for higher speed than that of the MiG-25, but a longer range was specified. Mikoyan decided to reduce the airframe's steel content to 50 percent, with 16 percent titanium, 33 percent aluminum alloy, and negligible composites except for the radome. A prototype known as the Ye-155MP (originally MiG-25MP) flew on September 16, 1975. Four years later, production of the fully developed **MiG-31** began at the Gorky works. Its Zaslon radar was the first electronically scanned phased-array type to enter service, enabling Foxhound to track ten targets and engage four simultaneously. Other equipment includes a retractable infrared search/track sensor, radar warning receivers, and active infrared and electronic countermeasures. Offset tandem twin-wheel main landing gear units facilitate operation from unprepared ground and gravel. Retractable flight refueling probe on port side of front fuselage. More than 160 in service, with production continuing.

The basic MiG-31 (Foxhound-A) can be guided automatically, and engage targets, under ground control. Under development is the improved **MiG-31M** (Foxhound-B), identified by small side windows for the rear cockpit, a wider dorsal spine, more rounded wingtips (except when carrying ECM jammer pods), larger curved fin root extensions, modified and extended wingroot leading-edge extensions, and four new-type underwing pylons for R-77 active radar-guided AAMs. Flight refueling probe transferred to starboard side. *(Data for MiG-31 Foxhound-A.)*

Power Plant: two Perm/Soloviev 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.

MiG-29K ("Fulcrum-D") (Piotr Butowski)

Sukhoi Su-30 ("Flanker") (Piotr Butowski)

Sukhoi Su-35 (Neville M. Beckett)

Weights: empty 48,115 lb, gross 90,390–101,850 lb.
Performance: max speed at height Mach 2.83, at S/L Mach 1.23, ceiling 67,600 ft, T-O run 3,940 ft, landing run 2,625 ft, combat radius at Mach 2.35 450 miles, at Mach 0.85 with external tanks 870 miles.
Accommodation: crew of two, in tandem.
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-33

MiG-33 is the reported designation of the fully developed MiG-29M configuration for the Russian Air Forces, claimed to offer fivefold increase in air-to-air performance compared with basic Fulcrum-A. More powerful engines, possibly designated RD-37.

Sukhoi Su-27 and Su-30 (NATO "Flanker")

This formidable fighter was developed to replace Su-15, Tu-28/128, and Yak-28P interceptors in home defense forces, and as a long-range escort fighter, with attack capability. More than 200 Su-27s now equip air defense units in states of the CIS; others form primary equipment of fighter units intended to escort Su-24s of the Air Armies on deep penetration missions. Fine-grille hinged screens in the engine air intake ducts of these versions guard against FOD during takeoff and landing. A range of more than 2,500 miles on internal fuel removed the need for external tanks. Variants are as follows:

Su-27 (Flanker-A). Prototypes, the first of which flew on May 20, 1977. Curved wingtips, rearward retracting nosewheel, and tailfins mounted centrally above the engine housings.

Su-27 (Flanker-B). Single-seat production version, first flown April 20, 1981. Square wingtips carrying launchers for AAMs in basic interceptor role, tailfins relocated outboard of engine housings, extended tailcone, forward retracting nosewheel, and other changes. 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. No composites, but a considerable quantity of titanium in the airframe. Integrated fire-control system enables the track-while-scan coherent pulse-Doppler radar, IRST, and laser rangefinder to be slaved to the pilot's helmet-mounted target designator and displayed on the wide-angle HUD. Radar has search range of 150 miles and tracking range of 115 miles. In ground-attack configuration, carries cylindrical ECM jammer pod instead of AAM on each wingtip. Provision for reconnaissance pack on centerline pylon. Three banks of chaff/flare dispensers in bottom of tailcone.

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

Su-27K (Flanker-D). Version for ramp-assisted operation from naval carriers, first seen on the *Admiral Kuznetsov* in 1989. Basically as Flanker-B, but with movable foreplanes. Folding outer wings and tailplane, strengthened landing gear with twin-wheel nose unit, and added arrester hook. Long tailcone of landbased version deleted to prevent tailscrapes during takeoff and landing. Able to refuel in flight and to carry centerline auxiliary fuel tank or buddy refueling pack. In production with uprated AL-31F engines giving 12–15 percent greater thrust. Can carry large antiship ASM, known as Mosquito, under fuselage.

Also seen conducting trials with the *Admiral Kuznetsov* was a side-by-side two-seat version of the Su-27 with foreplanes and twin nosewheels but without folding wings or deck hook. This aircraft has a wider nose, a deep fairing behind the canopy, and wing extensions carried forward as chines to the tip of the nose. The nosewheel leg has been moved forward and retracts rearward. The example seen had no ventral fins, radar, IRST, or underwing pylons, but the gun was retained.

This or a similar aircraft was exhibited in modified form at an airfield near Minsk in February 1992, with attack weapons, under the reported designation **Su-27IB.** It was shown with Kh-31 (AS-17 Krypton) ASMs under the engine ducts, R-73A (AA-11 Archer) AAMs at the wingtips, and underwing armament of two laser-guided bombs, two TV/laser-guided Kh-29 (AS-14 Kedge) ASMs and two R-77 AAMs. A flight refueling probe was fitted. It was described as a prototype, not intended for production in that form.

Su-30. Two-seat airborne command post and fully combat-capable two-seat fighter based on Su-27UB. In production at Irkutsk for Russian Air Forces. Designed to operate with four standard Su-27s. Only the Su-30 would have its radar switched on, so that it could assign targets to the other aircraft by radio data link. Flight refueling probe standard. *(Data for Flanker-B.)*
Power Plant: two Saturn/Lyulka AL-31F turbofans; each 27,557 lb thrust with afterburning.
Dimensions: span 48 ft 2¾ in, length excl noseprobe 71 ft 11½ in, height 19 ft 5½ in.
Weight: gross 48,500–66,135 lb.
Performance: max speed at height Mach 2.35, at S/L Mach 1.1, ceiling 59,055 ft, combat radius 930 miles.
Accommodation: pilot only.
Armament: one 30-mm GSh-301 gun, with 149 rds, in starboard wingroot extension. Up to ten AAMs, including pairs of R-27 (AA-10 Alamo-A/B/C/D), or R-33 (AA-9 Amos), and four R-73A (AA-11 Archer) or R-60 (AA-8 Aphid). Able to carry a wide range of air-to-surface weapons, including five-round packs of 130-mm rockets.

Sukhoi Su-35

This advanced single-seat development of the Su-27, with digital fly-by-wire controls, was exhibited for the first time at the 1992 Farnborough Air Show. The airframe resembles that of the Su-27K, with foreplanes, but without specifically shipboard features such as folding wings and an arrester hook. It is in the final stages of flight testing and is scheduled to enter Russian Air Force service in two to three years. The engines are AL-35F turbofans, uprated by comparison with the AL-31F. Thrust vectoring nozzles (±15°) are to be offered for later use.

The Su-35's radar is of an improved look-down/shoot-down type, with the ability to acquire airborne targets at ranges up to 250 miles and ground targets up to 125 miles. Fifteen targets can be tracked, and six engaged, simultaneously. An IRST is standard, and the aircraft was shown at Farnborough carrying a GEC Ferranti TIALD (thermal imaging airborne laser designator) night/adverse visibility pod, as used with considerable success by RAF Tornados during the Persian Gulf War. Also fitted were wingtip ECM jammer pods and underwing Kh-31 (AS-17 Krypton) antiradiation ASMs. Max weapon load is 17,635 lb.
Performance: max speed at height Mach 2.35, at S/L Mach 1.15, ceiling 59,055 ft, runway required 3,940 ft, max range on internal fuel more than 2,485 miles, with flight refueling more than 4,040 miles.

Yakovlev Yak-38 (NATO "Forger")

Since 1976, the Yak-38 has been the standard fixed-wing aircraft in *Kiev*-class carriers. It remains the only operational jet combat aircraft that shares the Harrier's V/STOL capability, but it requires three engines, rather than one, to make this possible. Payload/range performance is limited, and it appears to be in the process of retirement from service, with no successor in production.

The Yak-38's normal STOL takeoff technique employs an automatic control system by which the lift engines are brought into use, and the thrust-vectoring rear nozzles rotated, at the optimum point in the takeoff run. Puffer-jets at the wingtips and tail help to give the aircraft commendable stability during takeoff and landing. An electronic system ejects the pilot automatically if aircraft height and descent rate are sensed to indicate an emergency. There are two versions:

Yak-38 (Forger-A). Basic single-seat combat aircraft. Ranging radar in nose. Prototype was completed in 1971, and production began in 1975. Twelve were deployed on each of the four carrier/cruisers, in addition to Yak-38Us and about 19 Kamov Ka-25 or Ka-27 helicopters. Forger-A has also been operated from the carrier *Admiral Kuznetsov*. Primary roles are reconnaissance, strikes against small ships, and fleet defense against shadowing maritime reconnaissance aircraft. Production totaled about 75 by late 1986, with limited subsequent manufacture.

Yak-38U (Forger-B). Two-seat trainer, of which two are deployed on each carrier/cruiser. Second cockpit forward of normal cockpit, with its ejection seat at lower level, under a continuous canopy. Rear fuselage lengthened to compensate for longer nose. No ranging radar or weapon pylons. Overall length about 58 ft 0 in. *(Data for Forger-A.)*

Power Plant: one Soyuz/Tumansky R-27V-300 turbojet, without afterburner, exhausting through two vectored-thrust nozzles that can turn up to 10° forward of vertical for VTOL; 15,300 lb thrust. Two Rybinsk RD-36-35FVR liftjets in tandem aft of cockpit, inclined forward at 13° from vertical; each 6,725 lb thrust.

Dimensions: span 24 ft 0 in, width with wings folded 16 ft 0 in, length 50 ft 10¼ in, height 14 ft 4 in.

Weights: basic operating (including pilot) 16,500 lb, gross 25,795 lb.

Performance: max speed at height Mach 0.95, at S/L Mach 0.8, ceiling 39,375 ft, combat radius 115–230 miles.

Accommodation: pilot only.

Armament: four pylons under inner wings for 4,410 lb of stores, including Kh-23 (AS-7 Kerry) short-range ASMs, armor-piercing antiship missiles, R-60 (AA-8 Aphid) AAMs, pods each containing a 23-mm twin-barrel GSh-23 gun, rocket packs, bombs of up to 1,100 lb, and auxiliary fuel tanks.

Yakovlev Yak-141 (NATO "Freestyle")

The Yak-141 was projected in 1975 as a longer-range supersonic successor to the Yak-38. The first of two prototypes flew in March 1989; one was lost in a landing accident on the *Kiev*-class *Admiral Gorshkov* in October 1991. Official funding for the program was withdrawn, but the Yakovlev OKB is continuing development, primarily in the form of a refined landbased or naval combat aircraft. The multiengine lift/thrust configuration of the Yak-38 is retained, but thrust vectoring is by a single large nozzle between flat-sided tailbooms carrying the widely separated vertical and horizontal tail surfaces. Wedge-type engine air intakes are located on each side of the fuselage, beneath the hinged intake cover over the liftjets. The structure is advanced, with extensive use of aluminum/lithium, and 26 percent by weight composites. Control is digital fly-by-wire, and the Yak-141's agility is claimed to be comparable with that of the MiG-29. Manual or automatic flight control is said to be practicable from takeoff to touchdown, day and night, in all weather. The multimode fire-control radar is similar to that of the MiG-29, with a slightly smaller antenna.

Power Plant: one Soyuz/Kobchenko RD-79V-300 turbofan; 34,170 lb thrust with afterburning. Vectoring nozzle turns 65° downward for short takeoff, 95° downward and forward for vertical landing. R-79 lift thrust is approx 80 percent of cruise rating. Two Rybinsk RRD-41 liftjets; each 9,040 lb thrust, able to vector rearward to 24° from vertical for STOL, and 2° forward for braking. Puffer-jet stability controls at wingtips and nose (at tail of first prototype only).

Dimensions: span 33 ft 1¾ in (19 ft 4¼ in folded), length 60 ft 0 in, height 16 ft 5 in.

Weight: gross 42,990 lb.

Performance: max speed at height Mach 1.7, at S/L Mach 1.02, ceiling 49,200 ft, range on internal fuel VTOL 870 miles, with external tanks STOL 1,305 miles.

Accommodation: pilot only (tandem two-seat trainer at mockup stage).

Armament: one 30-mm gun, with 120 rds; four underwing hardpoints for two R-27 (AA-10 Alamo) and two R-73 (AA-11 Archer) AAMs, or four R-77 AAMs, antiship missiles, Kh-31 (AS-17 Krypton) or Kh-25 (AS-12 Kegler) ASMs, 1,100-lb bombs, rockets, or 23-mm gun pods.

Attack Aircraft

MiG-27 (NATO "Flogger-D and J")

This single-seat, variable-geometry, ground-attack aircraft has many airframe features in common with the MiG-23. It has the same basic power plant as the MiG-23M, but with a two-position (on/off) afterburner nozzle and fixed engine air intakes, consistent with the primary requirement of transonic speed at low altitude. MiG-27s constitute the air spearhead of Russian ground-attack air forces; others are in service with Naval Aviation units landbased within the ATTU zone. There are two main variants:

MiG-27K (Flogger-D). Forward portion of fuselage completely redesigned by comparison with MiG-23 interceptors. Instead of having an ogival radome, the MiG-27K's nose is sharply tapered in side elevation, with a small sloping window at the front, covering a laser rangefinder and marked target tracker. PrNK-23K nav/attack system provides automatic flight control, gun firing, and weapons release. Seat and canopy raised to improve view from cockpit. External armor plate on flat sides of cockpit of early aircraft only. Wider, low-pressure, mainwheel tires. Six-barrel 30-mm GSh-6-30 underbelly gun, with 260 rds, replaces GSh-23 of interceptor. Bomb/JATO rack under each side of rear fuselage, in addition to five pylons for 8,820 lb of external stores, including tactical nuclear bombs, two SPPU-22 pods each containing a twin-barrel 23-mm gun that can be depressed to fire downward (with 260 rds), R-3S (AA-2 Atoll) and R-13M AAMs, Kh-23 (AS-7 Kerry) and Kh-29 (AS-14 Kedge) ASMs, 240-mm rockets, UB-32A or UB-16 pods of 57-mm rockets, twenty-two 110/220-lb bombs, nine 550-lb or eight 1,100-lb bombs, or napalm containers.

Yakovlev Yak-141 ("Freestyle") (Piotr Butowski)

Sukhoi Su-17M-4 ("Fitter-K") (Austin J. Brown)

Sukhoi Su-24M ("Fencer") (Richard Malachowski)

Bullet-shaped antenna above each glove pylon, associated with missile guidance. Blister fairing under nose of later aircraft, with windows, providing rearward designation capability for laser weapon delivery. RWR fairing each side of front fuselage, ahead of nosewheel bay. Other equipment includes SUV fire-control system and an active ECM jammer.

MiG-27D (Flogger-J). Identified in 1981 and delivered subsequently in successively upgraded variants. Improved PrNK-23M nav/attack system. Final model has wider and deeper nose, with lip at top over much larger and less sloping window for the more advanced Klen laser rangefinder. Bullet-shaped antennas above wingroot glove pylons deleted. Wingroot leading-edge extensions on some aircraft. As well as SPPU-22 pods, this version can carry a photoreconnaissance pod containing three cameras. *(Data for MiG-27K.)*

Power Plant: one Soyuz/Khachaturov R-29B-300 turbojet; 25,335 lb thrust with afterburning.

Dimensions: as for MiG-23M, except length 56 ft 0¼ in.

Weights: gross from unprepared runway 39,920 lb, gross with eight 1,100-lb bombs 45,570 lb.

Performance: max speed at height Mach 1.7, at S/L Mach 1.1, ceiling 45,900 ft, T-O run 3,120 ft, landing run with brake-chute 2,950 ft, combat radius (lo-lo-lo) with two Kh-29 missiles 140 miles, with two Kh-29s and three external tanks 335 miles.

Armament: described above.

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

Production of the swingwing Fitter has ended, and many of those that served with Frontal Aviation ground-attack forces in the late 1980s have been retired, passed to training schools, and reassigned to Naval Aviation units in the ATTU zone. Others have replaced older Fitters deployed at land bases of the Baltic Fleet and in the Pacific for antishipping strikes and amphibious support roles. Variants are as follows:

Su-17M (Fitter-C). Basic single-seat attack aircraft with AL-21F-3 turbojet. Manual wingsweep control, to 30°, 45°, and 63°. Curved dorsal fin. Gun in each wingroot. Equipment includes SRD-5M I-band centerbody ranging radar, ASP-5ND fire-control system, Sirena-3 omnidirectional radar warning system, and SRO-2M IFF. Operational since 1971 in small numbers.

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

Su-17UM-2D (Fitter-E). Tandem two-seat trainer version of Su-17M-2, but without Doppler pod. Deepened dorsal spine fairing for additional fuel tankage. Port wingroot gun deleted.

Su-17UM-3 (Fitter-G). Two-seat trainer variant of Su-17M-3, with combat capability. Deepened dorsal spine fairing and drooped front fuselage like Su-17UM-2D. Taller vertical tail surfaces. Shallow ventral fin (removable). Starboard gun only. Laser rangefinder standard.

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

Su-17M-4 (Fitter-K). Single-seat version identified in 1984. Dorsal fin embodies small cooling air intake at front. Chaff/flare and decoy dispensers standard. Weapons include four S-25 tube-launched rockets with 325-mm head. When four SPPU-22 gun pods are fitted, with downward attack capability, the two underfuselage pods can be arranged to fire rearward. *(Data for Su-17M-4.)*

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

Dimensions: span 45 ft 3 in spread, 32 ft 10 in swept, length 61 ft 6¼ in, height 16 ft 5 in.

Weight: gross 42,990 lb.

Performance: max speed at height Mach 2.09, at S/L Mach 1.14, ceiling 49,865 ft, max range at height 1,430 miles, at S/L 870 miles.

Accommodation: pilot only.

Armament: two 30-mm NR-30 guns, each with 80 rds, in wingroots; nine pylons under fuselage and wings for up to 9,370 lb of nuclear weapons, bombs, rocket pods, air-to-surface rockets, 23-mm SPPU-22 gun pods, two R-3 (AA-2 Atoll), R-60 (AA-8 Aphid), or R-73A (AA-11 Archer) AAMs, Kh-23 (AS-7 Kerry) or Kh-25ML (AS-10 Karen) ASMs, or a reconnaissance pod.

Sukhoi Su-24 (NATO "Fencer")

About one-quarter of the estimated 900 Su-24s delivered from the Komsomolsk factory continue to

form primary deep strike components of the Russian Air Armies. Reassignment of other former Air Army Fencers has increased the capability of MD/GOF and Naval Aviation forces, often replacing Su-17s and deployed for operation in company with MiG-25BMs carrying antiradiation missiles.

Smaller and lighter than USAF's F-111, with three-position (16°, 45°, 69°) variable-geometry wings, the Su-24 entered first-line service in December 1974 as a replacement for the Yak-28 (Brewer). The much-reduced max speed quoted this year reflects the use of fixed engine air intakes, a feature overlooked by many Western observers. The Su-24's ability to deliver a wide range of ASMs provides defense suppression and some hard-target kill potential, with the emphasis for many years on low-level attack. Its already impressive combat radius was increased in the 1980s by the addition of an in-flight refueling probe and provision for carrying buddy refueling equipment. Current operational versions:

Su-24 (Fencer-C). Entered service in 1981, with important equipment changes. Multiple fitting on nose instead of former simple probe. Triangular fairing for RWR forward of each wingroot on side of air intake and on each side of fin near tip. Chord of lower part of tailfin extended, giving kinked leading-edge.

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

Su-24MR (Fencer-E). Reconnaissance variant of Su-24M used by tactical and Naval air forces. Internal equipment includes Shtik side-looking airborne multimission radar in nose, Zima IR reconnaissance system, Aist-M TV reconnaissance system, and panoramic and oblique cameras in ventral fairing. A Shpil-2M laser pod can be carried on the centerline, with a Tangazh elint pod or Efir-1M radiation detector pod on the starboard underwing swiveling pylon, and two R-60 AAMs under the port wing. Data can be transmitted to the ground by data link. Flight refueling and ASM capabilities are retained.

Su-24MP (Fencer-F). Electronic warfare/jamming/sigint version to replace Brewer-E model of Yak-28. Added small fairing under nose. *(Data for Su-24M.)*

Power Plant: two Saturn/Lyulka AL-21F-3A afterburning turbojets; each 24,800 lb thrust.

Dimensions: span 57 ft 10 in spread, 34 ft 0 in swept, length 80 ft 5¾ in, height 20 ft 3¾ in.

Weights: empty, equipped 41,885 lb, gross 87,520 lb.

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

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

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

Sukhoi Su-25 (NATO "Frogfoot")

The prototype Su-25 flew for the first time on February 22, 1975. It was conceived as a modern counterpart of the World War II Ilyushin Il-2 Shturmovik close-support aircraft, survivable enough 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. 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 containers above the engine nacelles and tailcone for use during eight attack runs. These and other survivability features account for 7.5 percent of the aircraft's normal takeoff weight. The big wings support ten pylons for a wide range of ordnance, including self-protection AAMs. The engines will run on any fuel likely to be found in a combat area, including MT gasoline and diesel oil. The Su-25 can ferry into a forward operating area, on its underwing pylons, a four-pod servicing kit adequate to keep it operating independently of ground equipment for 12 days.

Production of the basic version for the Russian Air Forces has ended, and some Su-25s delivered earlier from the Tbilisi airframe plant to Frontal Aviation units have been passed to Naval Aviation. The remainder make up more than one-third of the fighter-bomber force. Versions identified to date:

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

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

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

Su-25UTG (G for *gak*, "hook") (Frogfoot-B). As Su-25UT, with arrester hook added under tail for deck landing training on dummy flight deck marked out on runway at Saki Naval Airfield, and for trials on carrier *Admiral Kuznetsov*. At least ten being built.

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

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

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

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

Weights: empty 20,950 lb, gross 32,187–38,800 lb.

Performance: max level speed at S/L Mach 0.8, max attack speed, airbrakes open, 428 mph, ceiling 22,965 ft, T-O run 3,935 ft, landing run 1,312–1,970 ft, range with combat load at S/L 466 miles, at height 776 miles.

Accommodation: pilot only.

Armament: one twin-barrel 30-mm gun in port side of nose, with 250 rds. Eight underwing pylons for 9,700 lb of air-to-surface weapons, including SPPU-22 pods for 23-mm guns with twin barrels that pivot downward, 57-mm to 370-mm rockets, laser-guided rocket-boosted bombs, and 1,100-lb incendiary, anti-personnel, and other cluster bombs. Two small outboard pylons for R-3S (AA-2D Atoll) or R-60 (AA-8 Aphid) AAMs.

Su-25T

The Su-25T is a considerably upgraded Frogfoot derivative with improved navigation and attack systems, and new missiles. The first development aircraft flew in August 1984. Embodying lessons learned during action in Afghanistan, it utilized a converted Su-25UB airframe, with the humped rear cockpit faired over and the internal space used to house new avionics and an extra metric ton of fuel. The navigation system, with two digital computers and an inertial platform, makes possible flights to and from combat areas under largely automatic control. The widened nose houses a TV system, laser rangefinder, and target designator of improved capability. The TV can be activated some six miles from the target, after which target tracking, weapon selection, and release are automatic.

Chaff/flare dispensers are installed in the top of the fuselage tailcone and in a large cylindrical housing at the base of the rudder. This housing also contains an infrared jammer, optimized against Stinger and Redeye frequencies. A radar warning/emitter location system is standard. The Voskhod nav/attack system and Schkval electro-optical system are intended to ensure precision attacks on enemy armor (the T in the aircraft's designation indicates antitank). A podded low-light-level night navigation system, or a FLIR system known as Mercuri, enables a main battle tank to be identified at night over a distance of nearly two miles. The gun is transferred to an underbelly position on the starboard side of a farther-offset nosewheel.

Weight: gross 42,990 lb.

Performance: max speed 590 mph, ceiling 32,800 ft, T-O and landing run on unpaved runway 2,300 ft, combat radius with 4,410 lb of weapons at S/L 248 miles, at height 435 miles.

Armament: as Su-25, plus two eight-round underwing clusters of Vikhr tube-launched ASMs able to penetrate 900 mm of reactive armor, KAB-500 laser-guided bombs, and Kh-25ML (AS-10 Karen), Kh-58 (AS-11 Kilter), Kh-29L (AS-14 Kedge), and Kh-31 (AS-17 Krypton) ASMs.

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

Antonov An-26 ("Curl-B") (Piotr Butowski)

Reconnaissance, ECM, and Early Warning Aircraft

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

The large hold of this four-turboprop transport can accommodate a wide variety of equipment for special duties. Variants are:

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

Cub-B. Conversion of Cub transport for elint missions. Two additional radomes under the forward- and center-fuselage, plus other antennas. About 10 produced for Naval Aviation.

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 electronic equipment, is fitted in place of the usual gun position.

Cub-D. Further ECM variant for active countermeasures, with pods on each side of front fuselage and tailfin. Naval Aviation has about 20 Cub-Cs and Ds.

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

This signals intelligence version of the An-26 transport can be identified by many short blade antennas above and below the fuselage.

Beriev A-50 (NATO "Mainstay")

Development by the Beriev OKB of this AEW&C version of the Il-76 transport continues, to enhance its capabilities. About 25 currently operate with MiG-29, MiG-31, and Su-27 counterair fighters of the Home Defense Force and tactical air forces, mainly in the northwestern TVD centered on the Kola Peninsula. Mainstay's configuration is conventional, with a pylon-mounted rotating "saucer" radome, lengthened fuselage forward of the wings, a new IFF system, comprehensive ECM, and flight refueling probe. The Il-76's nose glazing around the navigator's station is replaced by nontransparent fairings, and there is no rear gun turret. Color CRT flight deck displays are now standard. Wingtip ECM pods have been fitted to the development aircraft.

The A-50 can detect and track aircraft and cruise missiles flying at high or low altitude over land and water, and it could be used to help direct fighter operations over battlefields as well as to enhance air surveillance and defense. Production has averaged two to five A-50s a year.

Ilyushin Il-20 (NATO "Coot-A")

The Il-20 elint/reconnaissance aircraft is a conversion of the Il-18 four-turboprop transport. An underfuselage container, about 33 ft 7½ in long and 3 ft 9 in deep, is assumed to house side-looking radar. Smaller containers on each side of the forward fuselage each contain a door over a camera or other sensor. About eight antennas and blisters can be counted on the undersurface of the center- and rear-fuselage, plus two large plates projecting above the forward-fuselage.

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

The first examples of this airborne command post conversion of the Il-18 airframe illustrated in the West had 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 considerably from one aircraft to another. One possible Il-22 or test-bed conversion has been seen with a cylindrical nose radome, undernose radar similar to that of the Il-38, a long square-section container above the center-fuselage, and other additions.

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

The Ye-155R-1 prototype of this single-seat, high-altitude, reconnaissance aircraft flew on March 6, 1964, before its Ye-155P-1 interceptor counterpart. Production of the basic MiG-25R began at the Gorky works in 1969, but in the following year it was decided to add a bombing capability, and a modified version, the MiG-25RB, became standard. From the start, no gun or AAMs for self-defense were considered necessary, because of the aircraft's high speed and ceiling, maneuverability, and ECM. An automatic bombing system was developed that made possible all-weather, day and night precision attacks at supersonic speed and from heights above 65,600 ft, against targets whose geographic coordinates were known. The aircraft's navigation system was an inertial type, updated by Doppler, for the first time in the Soviet Union. Eventually, the following variants were produced:

MiG-25RB series (Foxbat-B). Able to carry any one of three different reconnaissance/elint packs in its nose, offering various combinations of cameras and side-looking airborne radar (SLAR). Later subtypes were the **MiG-25RBV** and **MiG-25RBT,** with different SLAR or navigation equipment. 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-25RBK series (Foxbat-D). Produced simultaneously with RB series in 1971–82. Modules contain different elint systems and no cameras, requiring no camera windows. **MiG-25RBS** followed the RBK into production, with different sensors, and all RBSs were upgraded to **MiG-25RBSh** standard, with more sophisticated equipment, from 1981. Further changes were embodied in the **MiG-25RBF.**

More than 50 MiG-25R reconnaissance/bombers remain in service. All have a generally similar specification, two R-15BD-300 engines as fitted to MiG-25 interceptors, 4,885 gallons of internal fuel, and provision for the same 1,400-gallon underbelly tank.

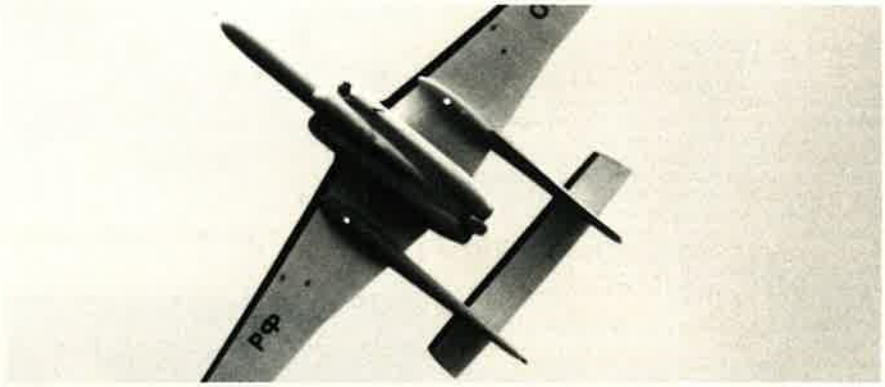
Dimensions: as MiG-25P, except span 44 ft 0¼ in.
Weights: gross 81,570–90,830 lb.
Performance: max speed at height Mach 2.83, at S/L Mach 0.98, ceiling 68,900 ft, range at supersonic speed on internal fuel 1,015 miles, subsonic with underbelly tank 1,490 miles.
Armament: provision for four 1,100-lb bombs under wings and two under fuselage.

MiG-25R ("Foxbat-B") (Bob Archer)

slovak Air Force service, at the Dobrany-Line air base, near Plzen, in 1991. Each of the two examples seen had a tandem pair of very large cylindrical containers mounted on each side of the cabin. It is assumed that the containers are made of dielectric material and contain receivers able to locate and analyze hostile electronic emissions. Each of two operator's stations in the main cabin has large screens, computer-type keyboards, and an oscilloscope. Several blade antennas project from the tailboom.

Mil Mi-24 (NATO "Hind-G1 and G2")

See main Mi-24 entry for details of these special-duty versions of the helicopter known to NATO as Hind.



Myasishchev M-17MR ("Mystic-B") (Piotr Butowski)

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

In addition to the standard Mi-6 heavy transport helicopter, there are two special-duty versions:

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

These helicopters are expected to be replaced by specially equipped versions of the Mi-26.

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

Versions of this medium-size helicopter adapted for various electronic duties have been allocated the following NATO reporting names:

Hip-D. For airborne communications role. Generally similar to Hip-C transport, but with canisters of rectangular section on outer stores racks and added antennas above forward part of tailboom.

Hip-J. Additional small boxes on sides of fuselage, fore and aft of main landing gear legs, identify this ECM version.

Hip-K (Mi-8PPA). Communications-jamming ECM version with a rectangular container and array of six cruciform dipole antennas on each side of cabin. No Doppler radar box under tailboom. Some uprated to Mi-17 standard, with port-side tail rotor.

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

The designation Mi-9 applies to the airborne command post helicopter 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. Strakes on fuselage undersurface.

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

An ECM communications jamming helicopter, first seen in 1990 and designated Hip-K derivative by NATO, has an airframe and power plant of Mi-17 standard and a much-enhanced antenna array. 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. Six heat exchangers can be seen under the front fuselage.

A further military variant of the Mi-17, presumably with an electronic warfare role, was first seen in Czecho-

Mil Mi-26 (NATO "Halo")

The 1990 edition of DoD's *Soviet Military Power* stated: "New variants of 'Halo' are likely in the early 1990s to begin to replace 'Hooks' specialized for command support." No further information is available.

Myasishchev M-17 (NATO "Mystic")

The M-17 is a single-seat high-altitude reconnaissance and research aircraft similar in concept to USAF's U-2. The first of two **M-17** (Mystic-A) prototypes, each with a single 15,430 lb thrust Rybinsk RD-36-51V turbojet, was observed in 1982. The **M-55** (Mystic-B) twin-engine version has the military designation **M-17MR** and is assumed to represent the intended production aircraft, although the two preseries examples have been seen so far only in civil-registered research form. Cameras and other sensors are housed in a large compartment in the lower fuselage, with underbelly dome-shaped fairing. Performance includes an ability to loiter for 4 hr 12 min at 65,600 ft with 3,305 lb of sensors, or for 5 hr at 55,775 ft. *(Data for M-17MR.)*

Power Plant: two Perm/Soloviev PS-30-V12 turbojets; each 11,025 lb thrust.
Dimensions: span 123 ft 0½ in, length 78 ft 9 in, height 15 ft 9 in.
Performance: max speed at height 435–466 mph, ceiling 65,600 ft, max endurance 7 hr.
Accommodation: pilot only.
Armament: none.

Sukhoi Su-17 (NATO "Fitter-H and K")

Some Su-17 (Fitter-H/K) fighters serving with Air Force units are equipped for reconnaissance. See main entry for this aircraft in the Attack Aircraft section.

Sukhoi Su-24 (NATO "Fencer-E and F")

Reconnaissance and electronic warfare versions of the Su-24 are listed under the main entry for this aircraft in the Attack Aircraft section.

Tupolev Tu-16 (NATO "Badger-D, E, F, H, J, K, and L")

Details of these maritime, photographic, and electronic reconnaissance versions of the Tu-16, and ECM chaff-dispensing and jamming versions, can be found under the main Tu-16 entry in the Bombers and Maritime section.

Tupolev Tu-22 (NATO "Blinder")

See main Tu-22 entry in Bombers and Maritime section.

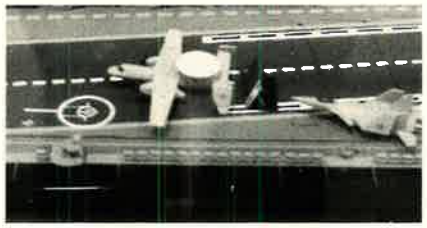
Tupolev Tu-95 (NATO "Bear")

See main Tu-95 entry in Bombers and Maritime section.

Yakovlev Yak-44

The Yakovlev OKB is developing this twin-turboprop AEW&C aircraft for operation from the carrier *Admiral Kuznetsov*. No details have been released, but photographs of a model show a configuration almost identical with that of the US Navy's E-2 Hawkeye, with an overfuselage rotodome.

Transports and Tankers



Yakovlev Yak-44

Antonov An-22 ("Cock")

Ilyushin Il-76MD ("Candid-B") (Piotr Butowski)

Antonov An-12BP (NATO "Cub")

Fewer than 100 of these veteran aircraft remain in service with the Military Transport Aviation force (VTA). Others still fly with the Air Armies and MD/GOF, but 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 airdropping of supplies and equipment. A full load of 60 paratroops can be dispatched via this exit in under one minute.

The Cub-A, B, C, and D elint and ECM versions are described separately on p. 72.

Power Plant: four Ivchenko AI-20K turboprops; each 3,945 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.

Antonov An-22 (NATO "Cock")

Until the An-124 became available, the An-22 was the only Soviet transport aircraft capable of lifting the Soviet Army's main battle tanks and theater missile systems. Production was terminated sooner than expected, in 1974, and only 45 An-22s are now available to VTA. Each has a max payload of 176,350 lb, loaded via a rear ramp.

Power Plant: four Kuznetsov NK-12MA turboprops; each 15,000 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")

The twin-turboprop An-26 freighter **(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, in the usual way, but can be slid forward under the rear of the cabin to facilitate direct loading to the floor of the hold, or when the cargo is to be airdropped. 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 Ivchenko AI-24VT turboprops; each 2,820 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 0¼ in, height 28 ft 8½ 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. Improved An-26B **(Curl-A)** version has roll-gangs and mechanical handling system, enabling two men to load and unload three 8 ft long standard freight pallets in 30 minutes.
Armament: none.

Antonov An-32 (NATO "Cline")

The basic airframe of this specialized "hot and high" short/medium-range transport is similar to that of the An-26, except for having triple-slotted trailing-edge flaps, automatic leading-edge slats, much-enlarged ventral fins, and a full-span slotted tailplane. It is able to operate from airfields 13,000 to 14,750 ft above sea level in an ambient temperature of ISA + 25°C. Production has been maintained at the rate of around 40 a year through the 1980s to the present time.

Power Plant: two Ivchenko AI-20D Series 5 turboprops; each 5,112 ehp.
Dimensions: span 95 ft 9½ in, length 78 ft 0¼ in, height 28 ft 8½ in.
Weights: empty, equipped 38,158 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 745 miles, with max fuel 1,565 miles.
Accommodation: crew of three or four; freight, or 42 paratroops and a jumpmaster, or 24 litter patients and up to three medical attendants.
Armament: none.

Antonov An-72 and An-74 (NATO "Coaler")

The basic An-72 was conceived as a STOL replacement for the An-26 that would be able to operate from unprepared airfields or from surfaces covered with ice or snow. The high location of the engines was adopted primarily 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. The first of two prototypes flew on December 22, 1977, and received the NATO reporting name Coaler-A. Features included a Doppler-based automatic navigation system and, on the second prototype, a "slide-forward" loading ramp of the kind fitted to the An-26. Production versions are being built at the rate of 20 aircraft a year, in the following forms:

An-72A (Coaler-C). Light STOL transport. Conventional landing gear, with twin-wheel nose unit and two wheels in tandem on each main unit.

An-72AT (Coaler-C). Cargo-carrying version of An-72A, equipped to accommodate international standard containers.

An-72S (Coaler-C). Executive transport version, with cabin divided by bulkheads into three separate compartments. Can be adapted to carry a light vehicle, freight, 38 passengers, or eight litters.

An-72P. See Bombers and Maritime section.

An-74 (Coaler-B). Specialized version for operation in the Arctic and Antarctic, with flight crew of five. Available in same forms as An-72. More advanced navigation aids include inertial navigation system; provision for wheel/ski landing gear, and greatly increased fuel. Airframe identical with that of An-72A, but with larger nose radome. *(Data for An-72A.)*

Power Plant: two Zaporozhye/Lotarev D-36 turbofans; each 14,330 lb thrust.
Dimensions: span 104 ft 7½ in, length 92 ft 1¼ in, height 28 ft 4½ in.
Weights: empty 42,000 lb, max payload 22,045 lb, gross 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 three or four; main cabin designed primarily for freight, but folding seats for 68 passengers or 57 paratroops along side walls and on removable central seats, and provision for 24 litter patients, 12 seated casualties, and attendant.
Armament: none.

Antonov An-124 (NATO "Condor")

The An-124 is Antonov's counterpart to USAF's C-5 Galaxy, with a slightly larger wingspan and higher gross weight. It has an upward-hinged, visor-type nose and rear fuselage ramp/door for simultaneous front and rear loading/unloading. Advanced features include a fly-by-wire control system, titanium floor throughout the main hold, and 12,125 lb of composites, making up 16,150 sq ft of its surface area. The 24-wheel landing gear enables the An-124 to operate from unprepared fields, hard-packed snow, and ice-covered swampland. The oleos can be deflated so that the aircraft "kneels" to facilitate front loading. Payloads range from the largest battle tanks to complete missile systems, Siberian oil well equipment, and earth movers.

The first of two prototypes flew on 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 around the northern periphery of the former Soviet Union. Deliveries to VTA to replace An-22s began in the same year.

Power Plant: four Zaporozhye/Lotarev D-18T turbofans; each 51,590 lb thrust.
Dimensions: span 240 ft 5¾ in, length 226 ft 8½ in, height 68 ft 2¼ 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 reserve 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 on aircraft seen to date.

Ilyushin Il-76 (NATO "Candid-B")

In the same class as USAF's C-141 StarLifters, more than 500 Il-76s are the workhorses of CIS air forces, with manufacture continuing. Deliveries of military **Il-76Ms** (Candid-B), with rear guns and small ECM fairings, has been ongoing since 1974. When operating into combat areas, they can be fitted with packs of 96 x 50-mm infrared countermeasures flares, in the landing gear fairings and/or on the sides of the rear fuselage.

Basic Il-76 design features include rear-loading ramp/doors, full-span leading-edge slats and triple-slotted flaps for good field performance, a navigator's station in the glazed nose, ground-mapping radar in a large undernose fairing, and a unique and complex 20-wheel landing gear. The entire accommodation is pressurized, making it possible to carry 140 troops or 125 paratroops as an alternative to freight. Advanced mechanical handling systems are fitted for containerized and other freight. Equipment for all-weather operation includes a computer for automatic flight control and automatic landing approach.

The following data refer to the basic military Il-76M. Also in service is an improved version, designated **Il-76MD,** with an increased gross weight of 418,875 lb, max payload of 110,230 lb, and additional fuel to extend max range by 745 miles.

Power Plant: four Perm/Soloviev D-30KP 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 88,185 lb, gross 374,785 lb.

Performance: cruising speed at 29,500–39,350 ft 466–497 mph, T-O run 2,790 ft, landing run 1,475 ft, nominal range with 88,185 lb payload 3,100 miles, max range 4,163 miles.
Accommodation: crew of seven, incl two freight handlers.
Armament: two 23-mm twin-barrel GSh-23L guns in tail turret.

Ilyushin Il-76 Command Post

Two examples of what appears to be an airborne command post version of the Il-76MD were seen at Zhukovsky flight test center in 1992. Each has a large canoe-shaped fairing above the fuselage forward of the wing, with smaller antennas, and air intake scoops, under the front fuselage, on the rear of the main landing gear fairings, and on short pylons under the outer wings. A large, downward-inclined, flat-plate antenna can be seen on the starboard (both?) side of the tailcone. The usual nose glazing around the navigator's compartment has been deleted.

Ilyushin Il-78 (NATO "Midas")

The first unit of Il-78 in-flight refueling tankers entered service during 1987; more than 12 are now operational, in support of both strategic and tactical aircraft. Each is able to refuel up to three aircraft simultaneously, using the probe-and-drogue technique. Two refueling pods are mounted conventionally under the outer wings. The third hose and drogue are streamed from a box-type pod on the port side of the rear fuselage. The rear turret is retained as a flight refueling observation station, without guns. *(Data generally as for Il-76.)*

Ilyushin Il-86 Command Post

Two Il-86 transports were seen at Zhukovsky flight test center in 1992 with modifications similar to those seen on the Il-76s described earlier as probable airborne command posts. Each had a large fairing above the front fuselage, as well as other antennas above and below the fuselage, and large pods under the wings inboard of the inner engines.
Power Plant: four KKBM Samara/Trud NK-86 turbofans; each 28,660 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.

Helicopters

Kamov Ka-25 (NATO "Hormone")

Of the 460 Ka-25s built between 1966 and 1975, about 100 remain in service with Naval Aviation, in three forms:

Ka-25BSh (Hormone-A). Basic ship-based ASW version, with typical Kamov contrarotating three-blade rotors. Operational equipment includes a flat-bottom housing for undernose search radar; racks for small stores, including sonobuoys, on the starboard side of the fuselage; and cylindrical canisters on each side of the lower fuselage for markers, smoke generators, or beacons. Some aircraft have an underfuselage weapon bay. Most have ESM equipment in the tailboom under a "flower pot" housing. Each of the four wheels of the landing gear can be enclosed in an inflatable pontoon. Dipping sonar is housed in a compartment at the rear of the cabin, but the Ka-25 is unable to operate with this at night or in adverse weather, through lack of automatic hover capability. Ka-25s have served on missile frigates, cruisers, the helicopter carriers *Moskva* and *Leningrad*, and carrier/cruisers of the *Kiev* class.

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

Ka-25PS (Hormone-C). Similar to Hormone-A but equipped to provide midcourse guidance for long-range, ship-launched, surface-to-surface missiles. Yagi aerial on nose associated with guidance system. With operational equipment removed, many are used on utility and search-and-rescue missions. *(Data for Hormone-A.)*
Power Plant: two Glushenkov GTD-3F turboshafts; each 900 shp (later aircraft have 990 shp GTD-3BMs).
Dimensions: rotor diameter (each) 51 ft 7¾ in, length of fuselage 32 ft 0 in, height 17 ft 7½ in.

Ilyushin Il-78 ("Midas") refueling two Su-30s and Su-27IB (Piotr Butowski)

Ilyushin Il-86 Command Post (Paul Duffy)

Kamov Ka-25BSh ("Hormone-A") (Linda Jackson)

Kamov Ka-50 Werewolf ("Hokum") (Piotr Butowski)

Weights: empty 10,505 lb, gross 16,535 lb.
Performance: max speed 130 mph, ceiling 11,000 ft, range 250–405 miles.
Accommodation: crew of two on flight deck; two or three systems operators in main cabin, which is large enough to contain 12 folding seats for passengers.
Armament: two 18-in ASW torpedoes, nuclear or conventional depth charges, and other stores in underfuselage weapons bay, when installed.

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

Design of the Ka-27 was started in 1969. A primary requirement was to overcome the inability of the Ka-25 to operate dipping sonar at night and in adverse weather. Retaining the proven contrarotating rotor configuration, Kamov's General Designer, Sergei Mikheyev, found that he could produce a helicopter to stow in much the same space as the Ka-25 with the rotors folded, despite its much greater power and capability. He specified extensive use of titanium and composite materials throughout the airframe, with special emphasis on resisting corrosion at sea. An ability to operate independently of ground support equipment also received priority.

The prototype Ka-27 flew for the first time in December 1974, and the basic ASW version was first observed on the stern platform of the guided missile destroyer *Udaloy* in 1981. DoD had already referred to what it called "Hormone variant" helicopters carried in telescoping hangars on *Sovremennyy*-class destroyers. In 1983, at least 16 Ka-27s were seen on board the *Kiev*-class carrier/cruiser *Novorossiysk,* since when the replacement of Ka-25s with Ka-27 variants has continued, in the following forms:

Ka-27PL (Helix-A). Basic ASW helicopter, with crew of three. Described as being effective against submarines cruising at up to 40 knots, at a depth of 1,640 ft, out to 124 miles from its base, by day and night. Equipment includes undernose 360° search radar, ventral weapons bay for torpedoes, depth charges, and other stores, internally stowed sonobuoys, IR jammer above engine bay fairing, chaff/flare dispensers, IFF, radar warning receivers on nose and above tailplane, ESM radomes above rear of power plant pylon fairing and at tailcone tip, flotation gear container on each side of fuselage, dipping sonar compartment in rear of fuselage, MAD, and Doppler box under tailboom. Normally operated in pairs; one aircraft tracks the hostile submarine, the other drops depth charges. More than 100 operational with Naval Aviation.

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

Ka-29TB (Helix-B). Combat transport version; entered service 1985. Heavy armor on wider flight deck and engine bay. Four-barrel Gatling-type 7.62-mm machine gun behind downward-articulated door on starboard side of nose. Four pylons on outriggers can carry four-round clusters of 9M114 (AT-6 Spiral) ASMs and 80-mm or 128-mm rocket pods. Undernose sensor pods for missile guidance and electro-optics. ESM "flower pot" above engine bay fairing, forward of IR jamming pod. Two-part upward/downward-opening cabin door for speedy exit of 16 assault troops in cabin.

Ka-29RLD. Early-warning version, first shown on carrier *Admiral Kuznetsov* in August 1990. Shallow pannier extends full length of underfuselage. Added large panniers on sides, fore and aft of main landing gear. APU repositioned above rear of power plant fairing, with air intake at front. No ESM or IR jamming pods above fairing. Longer conical tailcone. No stores pylons, gun door, or armor. *(Data for Ka-29TB.)*
Power Plant: two Klimov (Isotov) TV3-117V turboshafts; each 2,200 shp.
Dimensions: rotor diameter (each) 52 ft 2 in, length of fuselage 38 ft 0¾ in, height 17 ft 8½ in.
Weights: empty 12,170 lb, gross 27,775 lb
Performance: max speed at S/L 174 mph, ceiling 14,100 ft, range 285 miles.
Accommodation: flight crew of two, with seat for third person; up to 16 combat-ready troops as alternative to mission equipment.
Armament: see above.

Kamov Ka-50 Werewolf (NATO "Hokum")

Although the Ka-50 has been flying in prototype form since July 27, 1982, it was not displayed in public, on the ground, until a production example was sent to the 1992 Farnborough Air Show. Being the world's first

single-seat close-support helicopter, it was one of the stars of the show, not least because the UK Ministry of Defence is in the market for up to 130 attack helicopters to replace the Army Lynx. It is already in major production for the Russian Army, after winning competitive evaluation with the Mi-28.

Retention of Kamov's familiar coaxial rotor configuration ensures compact dimensions, with no tail rotor to cause problems during nap-of-the-earth operation. Composite materials constitute 35 percent by weight of the structure, including the three-blade rotors. The usual difficulties experienced by standoff attack helicopters as a result of poor battlefield visibility are intended to be avoided by attacking targets fast and low, with great agility, at close range. Rate of climb is adequate to pass over mountain slopes at high speed, with an impressive hover ceiling. Ka-50 avionics and missions require four computers to meet navigation, mission control, and display demands. Equipment in the nose includes a laser marked target seeker for its laser weapons, but the intention is to rely on another aircraft or ground personnel to locate and designate targets. Other equipment includes a FLIR pod, TV, and cockpit CRT, but the Ka-50 is not yet a day/night, all-weather, combat aircraft in the form shown at Farnborough. The pilot has a MiG-29 type helmet sight and HUD.

Some 770 lb of armor protect the pilot and critical airframe parts. All canopy and windscreen panels are of heavy bulletproof glass, and the double-wall steel armor surrounding the pilot will resist hits by 20-mm and 23-mm antiaircraft weapons over ranges as close as 330 ft. In an emergency, at any altitude, the rotor blades and cockpit roof are separated by explosive charges; the pilot is then extracted from the cockpit by a large rocket. Alternatively, he can jettison the cabin doors, and stores, before rolling out of the cockpit sideways. The Ka-50 is self-deployable over long distances and can be air-ferried, partially disassembled, in an Il-76 freighter. All systems are configured to permit combat flying from an advanced base for at least two weeks without need for ground maintenance equipment. A tandem two-seat training version is being developed.

Power Plant: two Klimov (Isotov) TV3-117VK turboshafts; each 2,200 shp.
Dimensions: rotor diameter (each) 47 ft 7 in, length (rotors turning) 52 ft 6 in, height 16 ft 2 in.
Weights: normal T-O weight 21,605 lb, max gross 23,810 lb.
Performance: max speed in shallow dive 217 mph, in level flight 193 mph, vertical rate of climb at 8,200 ft 1,970 ft/min, hover ceiling out of ground effect 13,125 ft, endurance 4 hr.
Accommodation: pilot only.
Armament: one flexibly-mounted 30-mm 2A42 gun, with 500 rds, on starboard side of fuselage; four wing pylons for two seven-round clusters of Vikhr (AT-9) laser-guided ASMs, plus two packs of 20 x 80-mm S-8 rockets, 23-mm gun pods, Kh-25MP (AS-12 Kegler) ASMs, AAMs, or dispenser weapons.

Mil (WSK-PZL Swidnik) Mi-2 (NATO "Hoplite")

Manufacture of this small helicopter was transferred to the WSK-PZL at Swidnik in Poland in 1964. More than 5,250 have been delivered for military and commercial service, of which well over 2,000 went to the former Soviet Union.

Power Plant: two Polish-built Isotov GTD-350 turboshafts, each 400 shp.
Dimensions: rotor diameter 47 ft 6¾ in, length of fuselage 37 ft 4¾ in, height 12 ft 3½ in.
Weights: basic operating 5,213 lb, gross 8,157 lb.
Performance: max speed at 1,640 ft 130 mph, ceiling 13,125 ft, range with max payload 105 miles, with max fuel 360 miles.
Accommodation: pilot and eight passengers, 1,543 lb of freight, or four litter patients and medical attendant.
Armament: provision for air-to-surface rocket pod, or two AT-3 Sagger missiles, on each side of cabin, and two 7.62-mm guns in cabin; alternatively, one 23-mm gun on port side, four 7.62-mm gun pods, and two 7.62-mm guns in cabin.

Mil Mi-6 (NATO "Hook")

When announced in the autumn of 1957, the Mi-6 was the world's largest helicopter. It was also the first production helicopter in the former USSR to be fitted with small fixed wings to offload the main rotor in cruising flight. These wings are normally removed when the aircraft operates in a flying crane role, carrying external freight. More than 860 production Mi-6s are believed to have been delivered for commercial and military service. The basic task of these helicopters in military use is to haul guns, armor, vehicles, supplies, freight, or troops in combat areas; but some are equipped for command support roles (see Reconnaissance, ECM, and Early Warning Aircraft section). Replacement with Mi-26 Halos has been under way for some years.

Power Plant: two Soloviev D-25V turboshafts; each 5,500 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 17,637 lb.
Armament: some aircraft have a 12.7-mm gun in the nose.

Mil Mi-8 (NATO "Hip")

Since 1961, more than 10,000 Mi-8s and uprated Mi-17s (described separately) have been delivered from plants in Kazan and Ulan Ude for military and civil use. About 2,400 of these were operated by former Soviet armies in the field and by the Air Forces. Their primary combat task is to put down assault troops, equipment, and supplies behind enemy lines, which their crews are trained to do within 15–20 minutes of a nuclear or conventional bombardment/strike. Versions as follows:

Hip-C. Standard equipment of army support forces, carrying 24 troops or freight, loaded via rear clamshell doors and ramp. Twin rack for stores on each side of cabin, able to carry 128 x 57-mm rockets in four packs, or other weapons. Some uprated to Mi-17 standard, as **Mi-8T** and **Mi-8TB.**

Hip-D. For airborne communications role; see p. 73.

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

Hip-G. See Mi-9 entry on p. 73.

Hip-H. See Mi-17 entry below.

Hip-J and **K.** ECM versions; see p. 73.

Power Plant: two Klimov (Isotov) TV2-117A turboshafts; each 1,700 shp.

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

Mil Mi-8T ("Hip-C") (Piotr Butowski)

Mil Mi-24VP ("Hind") (Piotr Butowski)

Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 59 ft 7¼ in, height 18 ft 6½ in.
Weights: empty 16,007 lb, gross 26,455 lb.
Performance: max speed at 3,280 ft 161 mph, ceiling 13,125 ft, range as personnel transport 311 miles.
Accommodation: crew of two or three; up to 32 passengers, but normal military configuration is 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")

The original prototype of this shore-based amphibious helicopter, designated V-14, first flew in September 1969, with an Mi-8 power plant. Overall dimensions, power plant, and dynamic components of the production versions are generally similar to those of the Mi-17, reflecting parallel development from the Mi-8. New features to suit the Mi-14 for its maritime roles include a boat hull of the kind used on the Sikorsky Sea King, a small float attached to the tailskid, and a sponson on each side at the rear, carrying an inflatable flotation bag. The landing gear is fully retractable.

Three versions of the Mi-14 are in service:

Mi-14PL (Haze-A). Basic ASW version, with crew of four. Antisubmarine equipment includes a large undernose radome, a retractable sonar unit housed in the starboard rear of the planing bottom forward of two sonobuoy or signal flare chutes, a towed magnetic anomaly detection (MAD) "bird" stowed against the rear of the fuselage pod, and a Doppler radar box under the tailboom. Weapons include torpedoes, bombs, and depth charges carried in a weapons bay in the bottom of the hull.

Mi-14BT (Haze-B). Mine countermeasures version, identified by long duct for hydraulic tubing, and air-conditioning pod, on starboard side of cabin. No MAD. Container for searchlight to observe MCM gear during deployment and retrieval under tailboom, forward of Doppler box.

Mi-14PS (Haze-C). Search-and-rescue version. Double-width sliding door at front of cabin on port side, with retractable rescue hoist able to lift up to three persons in basket. Searchlight on each side of nose and under tailboom. Fuselage duct and air-conditioning pod as Mi-14BT. Room for ten survivors in cabin; provision for towing many more in ten 20-place life rafts carried on board. Normal crew of three.

About half of the 230 Mi-14s built were delivered to Naval Aviation.

Power Plant: two Klimov (Isotov) TV3-117 turboshafts, each 1,950 shp.
Dimensions: rotor diameter 69 ft 10¼ in, length overall incl rotors 83 ft 0 in, height 22 ft 9 in.
Weights: empty 25,900 lb, gross 30,865 lb.
Performance: max speed 143 mph, ceiling 11,500 ft, max range 705 miles.
Accommodation and Armament: as described above.

Mil Mi-17 and Mi-171 (NATO "Hip-H")

The **Mi-17** has an airframe basically identical to that of the Mi-8, but with more powerful TV3 engines in shorter nacelles, with the intakes positioned above the midpoint of the sliding cabin door. The tail rotor is repositioned on the port side of the vertical stabilizer, and the engine air intakes are fitted with deflectors to prevent the ingestion of sand, dust, or foreign particles at unprepared landing sites. Military versions have the same armament options as the Mi-8, supplemented by 23-mm GSh-23 gun packs, and with external armor plate on the cockpit sides.

Details of two special-duty versions can be found in the Reconnaissance, ECM, and Early Warning Aircraft section. Mi-8s can be uprated to Mi-17 standard (see Mi-8 entry). Latest version of the Mi-17 is the **Mi-171** with 2,100 shp TV3-117VM engines. Weights and performance are generally unchanged, except for greatly improved rate of climb and ceiling. *(Data for basic Mi-17.)*

Power Plant: two Klimov (Isotov) TV3-117MT turboshafts; each 1,950 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 590 miles with auxiliary fuel.
Accommodation and Armament: as for Mi-8 Hip-E.

Mil Mi-24 (NATO "Hind")

Of more than 2,300 Mi-24s (and export Mi-25s and -35s) built in Arsenyev and Rostov, about half are at the disposal of the CIS military, in the following gunship and special-duty variants:

Mi-24D (Hind-D). First observed in 1977. Front fuselage completely redesigned by comparison with original Hind-A, B, and C armed assault transports. Transport capability retained and airframe heavily armored. Tandem stations for weapon operator (in nose)

and pilot have individual canopies, with rear seat raised to give pilot an unobstructed forward view. Air data sensor boom forward of top starboard corner of bulletproof windscreen at extreme nose. Under nose is a four-barrel Gatling-type 12.7-mm machine gun in a turret, slaved to adjacent electro-optical sight, and providing air-to-air as well as air-to-surface capability. Four hardpoints under stubwings for 32-round packs of 57-mm rockets, 20-round packs of 80-mm rockets, UPK-23 pods each containing a twin-barrel 23-mm gun, large pods each containing one four-barrel 12.7-mm gun and two four-barrel 7.62-mm guns or a 30-mm grenade launcher, up to 3,300 lb of bombs, mine dispensers, or other stores; four 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. Many small antennas and blisters, including IFF and RWR. IR jammer in "flower pot" container above forward end of tailboom; decoy flare dispenser initially under tailboom; later triple racks (total of 192 flares) on sides of center-fuselage. Engine exhaust suppressors now standard.

Mi-24V (Hind-E). As Mi-24D, but with modified wingtip launchers and four underwing pylons for up to twelve 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 photographed in 1992, with twin-barrel 23-mm GSh-23 gun in place of four-barrel 12.7-mm gun in nose.

Mi-24P (Hind-F). First shown in service in 1982 photographs. 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). First identified at Chernobyl, after the April 1986 accident at a nuclear power station, this version lacks the usual undernose electro-optical and RF guidance packs for antitank missiles. Instead of wingtip weapon attachments, it has "clutching hand" mechanisms, associated with NBC (nuclear, biological, and chemical) warfare, on lengthened pylons. Other features include a bubble window on the starboard side and a small rearward-firing marker flare pack on the tailskid. This version is deployed individually throughout ground forces, in small numbers.

Mi-24K (Hind-G2). As Mi-24R, but with a large camera in the cabin, with the lens on the starboard side. Missions believed to be reconnaissance and artillery spotting. *(Data for Mi-24P.)*

Power Plant: two Klimov (Isotov) TV3-117 turboshafts; each 2,225 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")

Except for the four-engine, twin-rotor Mi-12, which did not progress beyond prototype testing, the **Mi-26** is the heaviest helicopter yet flown anywhere in the world. Its rotor diameter is smaller than that of the Mi-6, but this is offset by the fact that the Mi-26 is the first helicopter to operate successfully with an eight-blade main rotor. Other features include a payload and cargo hold very 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 to permit landing on varying surfaces. The Mi-26 flew for the first time on December 14, 1977, began in-field testing and development in early 1983, and was fully operational by 1985. More than 70 have since been built for military and civil use by day and night, in all weather. Infrared jammers, exhaust heat suppressors, and decoy dispensers can be fitted to production aircraft. Under development is an uprated version with more powerful engines, all-composites rotor blades, and max payload of 48,500 lb. An **Mi-26TZ** tanker version is projected.

The 1990 edition of DoD's *Soviet Military Power* stated that "new variants of the 'Halo' are likely in the early 1990s to begin to replace 'Hooks' specialized for command support."

Power Plant: two ZMDB/Lotarev D-136 turboshafts; each 11,240 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 1,240 miles.
Accommodation: crew of five; about 40 tip-up seats along side walls of hold; seats can be installed for 80 combat-equipped troops, plus four more passengers in compartment aft of flight deck, or litters for 60 casualties plus three attendants. Other loads include two airborne infantry combat vehicles or a standard 44,100-lb ISO container.
Armament: none.

Mil Mi-28 (NATO "Havoc")

Although the Ka-50 has been selected for the Russian Army, after competitive evaluation with the Mi-28, production of this Mil attack helicopter is scheduled to begin in 1993. Its general configuration is similar to that of the slightly smaller US Army AH-64A Apache, and it has broadly similar applications. The original prototype, flown for the first time on November 10, 1982, had less developed sensors and a three-blade tail rotor. The switch to a Δ_3 (delta 3) tail rotor, comprising two independent two-blade rotors set as a narrow X on the same shaft, relieves loads in flight. The agility of the Mi-28 is further enhanced by doubling the hinge offset of the main rotor blades by comparison with the Mi-24.

The Mi-28's IFR instrumentation is conventional, with autostabilization, autohover, and hover/heading hold lock in the attack mode. Survivability has received particular attention. The fuel tanks are protected by a thick second skin of composites. All vital units and parts are redundant and widely separated. The cockpits have armored glass transparencies and are protected by titanium and composite armor. Energy-absorbing seats and landing gear are designed to protect the crew in a 40 ft/second vertical crash landing. Escape by parachute would be facilitated by a system that blasts away the doors and stubwings in an emergency, although there is no provision for main rotor separation. A door aft of the port stubwing 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 gun currently fitted is identical with 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 weapons. The pilot normally fires only unguided weapons but can also fire the gun if it is fixed. Operational equipment includes a swiveling undernose turret for a daylight optical sight and laser ranger-designator, with a housing on each side for low-light-level TV and FLIR night combat systems. It has been seen with a pod on each wingtip, housing chaff/flare dispensers and sensors, probably RWR. The Mil OKB has said that versions are under development for naval amphibious assault support, night attack, and air-to-air missions.

Power Plant: two Klimov (Isotov) TV3-117 turboshafts; each 2,200 shp.
Dimensions: rotor diameter 56 ft 5 in, length excl rotors 55 ft 3½ in, height overall 15 ft 9½ in.
Weights: empty 15,430 lb, gross 25,353 lb.
Performance: max speed 186 mph, ceiling 19,025 ft, max range 292 miles.
Accommodation: crew of two, in tandem.
Armament: one 30-mm 2A42 gun in undernose turret. Four underwing pylons for 4,230 lb of stores, typically two UB-20 pods of 20 57-mm or 80-mm rockets and total of 16 9M114 (AT-6 Spiral) antitank missiles. Missile guidance equipment in thimble radome on nose.

Intercontinental Ballistic Missiles

SS-11 (RS-10; NATO "Sego")

Although the Mod 3 version of this "light" ICBM was the first operational Soviet missile with multiple reentry vehicles (MRVs), Russian reports suggest that only single-warhead SS-11s are now deployed. There were 296 at six sites in Russia in 1991, directed at softer area targets in China, Europe, and the Middle East. Since 1973, the primary version has been known to NATO as the SS-11 Mod 2, carrying a single one-megaton reentry vehicle plus penetration aids. The Mod 3, with three 200-kiloton MRVs, was deployed from 1975 but may have been withdrawn subsequently. All SS-11s are expected to be deactivated by the mid-1990s.

Design Bureau: Chelomei OKB.
Launch Mode: silo based (not upgraded in hardness); hot launched.
Power Plant: two-stage storable liquid-propellant.
Guidance: inertial.
Warhead: single nuclear (Mod 2); three MRVs (Mod 3).
Dimensions: length 62 ft 4 in, body diameter 6 ft 6¾ in.
Launch Weight: 110,450 lb.
Performance: max range 8,075 miles (Mod 2), 6,585 miles (Mod 3). CEP 1.1 km (0.7 miles).

SS-13 (RS-12/SS-12; NATO "Savage")

When development of the SS-13 began in 1957, the choice of solid propulsion was unique among the larger Soviet missiles. Only 60 were deployed, in Mod 2 configuration from 1971. Of these, 40 remain in silos in Russia. Each is in approximately the same category as the US Minuteman.

Design Bureau: Nadiradze OKB.
Launch Mode: silo based; hot launched.
Power Plant: three-stage solid-propellant, each with four nozzles and separated by truss structures.
Guidance: inertial.
Warhead: single nuclear (750 kilotons).
Dimensions: length 71 ft 2½ in, body diameter 6 ft 0½ in (first stage base).
Launch Weight: 112,435 lb.
Performance: range 5,840 miles. CEP 1.8 km (1.1 miles).

SS-17 (RS-16; NATO "Spanker")

When the START I Treaty was signed in 1991, only 44 SS-17 "light" ICBMs remained operational, of 150 originally emplaced. In their time, they had introduced innovative features, as well as much-improved accuracy. They were loaded in modified SS-11 silos inside their transportation canister. A cold launch technique enabled them to be "popped" out of the launchers by a gas generator before the main booster motors were fired. As a result, the silos would not have been heavily damaged in operational use and could have been reloaded, although this would have been a slow process. The SS-17 Mod 1 had multiple independently targetable reentry vehicles, like the other fourth-generation Russian ICBMs, the SS-18 and SS-19. All three missile types were test-fired with a single reentry vehicle for a multimegaton warhead, in case it might be needed for use against future very hard targets; but all SS-17s were eventually upgraded to Mod 3 standard with four MIRVs, as described below. Many redundant silos have been adapted for SS-24 Mod 2 missiles.

Design Bureau: Yangel OKB.
Launch Mode: silo based; cold launched.
Power Plant: two-stage storable liquid-propellant.
Guidance: inertial.
Warhead: four MIRVs (each 200 kilotons).
Dimensions: length 78 ft 5 in, body diameter 7 ft 4½ in (first stage).
Launch Weight: 156,750 lb.
Performance: max range 6,200 miles. CEP 1,300 ft.

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 of 308 deployed in converted SS-9 silos has to be reduced to 154 by 1998. This is expected to be achieved by removing the 104 SS-18s that constitute Kazakhstan's entire ICBM force, at Derzhavinsk and Zhangiztobe, plus 50 of those based in Russian Siberia, between the Urals and the Enisey River. There are four basic versions, two with single warhead and two with MIRV payloads of 10 reentry vehicles each. DoD stated in 1991 that "silo conversion is under way to replace older variants of the SS-18 . . . with substantially more capable versions (the SS-18 Mod 5, equipped with 10 MIRVs, and the single-warhead Mod 6)." This development effort may have been delayed or canceled. In any case, all SS-18s will be eliminated under START II. Ninety of their silos will be retained for SS-25s.

Design Bureau: Yangel OKB.
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). CEP 820 ft.

SS-19 (RS-18; NATO "Stiletto")

Russia has 170 SS-19s, with the largest base at Tatishchevo. They were expected to be deactivated under START II, but 105 of the missiles may be kept if converted to single warheads.

The hot-launched SS-19 Mod 3, now deployed, is a light ICBM, comparable in size to USAF's Peacekeeper, with the flexibility to attack targets in Eurasia as well as

in the US. Although less accurate than the SS-18, it is reckoned to have significant capability against all but hardened silos.
Design Bureau: Chelomei OKB.
Launch Mode: silo based; hot launched.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: six MIRVs (each 500 kilotons).
Dimensions: length 88 ft 7 in, max diameter 8 ft 2½ in.
Launch Weight: 232,805 lb.
Performance: range 6,200 miles. CEP 985 ft.

SS-24 (RS-22; NATO "Scalpel")

Operational since 1987, the SS-24 is a Peacekeeper-sized, solid-propellant system, intended for use against soft or semihardened targets. The Mod 1 version, regarded in the US as the first Russian fifth-generation ICBM, reflects the 1970s emphasis on survivability through weapon system mobility. DoD's *Military Forces in Transition* reports, "Deployment of the rail-mobile SS-24 Mod 1 is complete. The [Russians] currently have three garrisons for this system that has the capability to roam over 145,000 km [90,100 miles] of track."

Only 33 SS-24 Mod 1s were operational by September 1991, and production has ended. The other 56 SS-24s deployed since 1989 are Mod 2s; only ten of these are in Russia, at Tatishchevo, the remainder in Ukraine, in converted SS-17 silos. Their accuracy is believed to be better than that of the SS-18 and SS-19.
Design Bureau: Nadiradze OKB.
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. CEP 660 ft.

SS-25 (RS-12M: NATO "Sickle")

A total of 288 road-mobile SS-25s were operational in the summer of 1991, with production continuing at the Votkinsk Machine Building factory, Udmurt, at the rate of 60 missiles a year. All but 54 were based in seven regions of Russia, each with 27 to 45 missiles, at Irkutsk, Kansk, Nizhniy Tagil, Novosibirsk, Teykovo, Yoshkar-Ola, and Yuryu. Ninety SS-18 silos are to be made available for nonmobile SS-25s under START II.

As the CIS designation RS-12M implies, Moscow regards this Minuteman-sized ICBM as a direct modernization of the SS-13 (RS-12). This enables it to conform with the 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. Advances claimed for the SS-25 include 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.
Design Bureau: Nadiradze OKB.
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. CEP 660 ft.

Submarine-Launched Ballistic Missiles

SS-N-6 (R-21; NATO "Serb")

The oldest class of Russian SSBN still operational is known to NATO as "Yankee I." Thirty-four were built in 1963–74, each with two rows of launchtubes in its hull for 16 SS-N-6 ballistic missiles. Twelve remain in service with the Pacific Fleet. The others have been replaced by "Typhoons" and "Deltas." The missiles are all of the type known to NATO as SS-N-6 Mod 2.
Design Bureau: Chelomei OKB.
Launch Mode: submarine-launched; intermediate range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: single RV (one megaton).
Dimensions: length 31 ft 8 in, body diameter 4 ft 11 in.
Launch Weight: 31,305 lb.
Performance: max range 1,865 miles. CEP 4,265 ft.

SS-N-8 (NATO "Sawfly")

Increased size and the addition of stellar sensing techniques to the guidance system gave this SLBM intercontinental range and greatly improved accuracy compared with the SS-N-6. It was deployed from 1971 on 18 (now 15) "Delta I" submarines, developed from the "Yankee," with a deeper housing for the longer SS-N-8s above the rear casing. To compensate for added top-weight, the number of missiles was restricted to 12. This was restored to 16 in the four Delta IIs, which have a lengthened hull at the expense of a small speed reduction to 24 knots. The total of 244 SS-N-8s still operational are all of Mod 1 type, as described.
Design Bureau: Makeyev OKB.
Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: one RV (one megaton).
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; NATO "Stingray")

This SLBM is similar in many respects to the SS-N-8 from the same OKB. A major advance was the first use of MIRVed warheads on a Russian submarine-launched ballistic missile. Increased length required an even higher housing above the ship's casing when the SS-N-18 was deployed on 14 "Delta III" SSBNs in 1976–82. Each ship carries 16 missiles, in two rows, making a total of 224 currently deployed with the Pacific Fleet. All now carry three MIRVs. It is expected that some will be replaced eventually with SS-N-23 Skiff SLBMs in a modernization program.
Design Bureau: Makeyev OKB.
Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: three MIRVs (each 100 or 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 (RSM-52; NATO "Sturgeon")

Largest and heaviest of Russian SLBMs, the SS-N-20 is carried by the formidable "Typhoon" SSBNs. The ships of this class are by far the biggest submarines ever put into service, with a length of 562 ft and displacement of 21,500 tons surfaced, 26,500 tons submerged. Six entered service in 1982–89; they are based in the Kola Peninsula and are intended to launch their missiles from protected waters near Russia to ensure survivability.

The SS-N-20 was the first Russian series-production, solid-propellant SLBM. It incurred repeated failures before two successful tests were reported in 1981. Twenty were eventually loaded in each Typhoon in a unique configuration with the launchtubes forward of the sail.
Design Bureau: Makeyev OKB.
Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage solid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: ten MIRVs (each 100 kilotons).
Dimensions: length 59 ft 0½ in, body diameter 7 ft 10½ in.
Launch Weight: 185,185 lb.
Performance: max range 5,150 miles. CEP 1,640 ft.

SS-N-23 (RSM-54; NATO "Skiff")

This latest known Russian SLBM, first tested in 1983, has liquid propulsion, suggesting that this is still preferred by that state's submariners. To carry the SS-N-23, seven new *Delphin*-class (NATO "Delta IV") submarines have been constructed at Severodvinsk, at the rate of about one a year, with another five planned. Each carries 16 SS-N-23s inside the conventional type of raised housing aft of the sail. They are based with the other newer ("Typhoon") class in the Kola Peninsula as part of the Northern Fleet.
Design Bureau: Makeyev OKB.
Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: four MIRVs (each 100 kilotons).
Dimensions: length 55 ft 1½ in, body diameter 6 ft 2¾ in.
Launch Weight: 88,845 lb.
Performance: max range 5,160 miles. CEP 1,640 ft.

Airborne Nuclear Attack and Cruise Missiles

AS-4 (Kh-22 Burya; NATO "Kitchen")

This large ASM was first observed on a Tu-22 (Blinder) bomber during an Aviation Day flyby over Moscow 32 years ago. It remains one of the most important weapons available to Russian air and naval air forces, and it is the primary armament of two of the three major types of current strategic bombers. The original version had inertial guidance and a 350-kiloton nuclear warhead, needing no terminal homing. When an alternative version, with a 2,200-lb high-explosive warhead for antishipping use, was developed in the early 1970s, active radar terminal homing was added. A defense-suppression version, with passive radar homing, has also been reported.
Type: short-range ASM.
Power Plant: liquid-propellant rocket.
Guidance: inertial, or inertial plus active radar homing, or inertial plus passive radar homing.
Warhead: alternative nuclear (350 kilotons) or high-explosive (2,200 lb).
Dimensions: span 9 ft 10 in, length 37 ft 1 in, body diameter 3 ft 3½ in.
Launch Weight: 13,000 lb.
Performance: max speed Mach 4.6, range 185 miles at low altitude, 285 miles at high altitude.
Carried by: Tu-22 Blinder-B (one), Tu-22M Backfire (up to three), Tu-95 Bear-G (two).

AS-6 (KSR-5; NATO "Kingfish")

The AS-6 Kingfish has an airplane configuration similar to that of the AS-4 Kitchen but is powered by a solid-propellant rocket motor. It was first seen under the port wing of a Tu-16K, replacing the bomber's underbelly 1961-vintage K-10 (AS-2 Kipper) antishipping missile. In first-line service, the Badger-C Mod version of the Tu-16K carried a Kingfish under each wing, as do Badger-G Mod conversions of the Tu-16KS-1 Badger-B.

The AS-6 began, like Kitchen, with a 350-kiloton nuclear warhead and inertial guidance, requiring no terminal homing. To optimize its accuracy in an antiship role, a second version was developed with an active radar terminal seeker and alternative nuclear or high-explosive warhead.

The third variant has a defense-suppression role, with a passive radar seeker that homes on ship- or landbased radars. Deployment is believed to have started in 1973, with about 300 missiles now operationally available.
Type: short-range ASM.
Power Plant: solid-propellant rocket.
Guidance: inertial, or inertial plus active radar homing, or inertial plus passive radar homing.
Warhead: alternative nuclear (350 kilotons) or high-explosive (2,200 lb).
Dimensions: span 8 ft 2½ in, length 36 ft 1 in, body diameter 2 ft 11½ in.
Launch Weight: 12,125 lb.
Performance: max speed Mach 3, range 250 miles.
Carried by: Tu-16K Badger-G Mod.

AS-15 (Kh-55; NATO "Kent")

When the START I Treaty becomes fully effective, some three-fourths of the CIS strategic bomber force will consist of Tu-95MS Bear-Hs and Tu-160 Blackjacks armed with AS-15 air-launched cruise missiles (ALCMs) unless stated intentions change. AS-15 appears to be similar in configuration and size to the US BGM-109 Tomahawk that was fired with considerable success from Navy ships during the 1991 Persian Gulf War. Both missiles are turbofan powered, and the AS-15 has a terrain-comparison/inertial guidance system like Tomahawk's Tercom.

Deployment on the Tu-95MS6 began in 1984, with six **AS-15As** on an internal rotary launcher in each aircraft. The Tu-95MS16 has, in addition, pylons for up to ten more in four underwing clusters. The Tu-160 has two rotary launchers for a total of 12 **AS-15Bs.** The two current versions differ in body diameter. *(Data for AS-15A.)*
Type: long-range ASM.
Power Plant: turbofan.
Guidance: inertial with terrain comparison.
Warhead: nuclear (200 kilotons).
Dimensions: span 10 ft 2 in, length 19 ft 8¼ in, body diameter 1 ft 8 in (AS-15B 2 ft 6¼ in).
Launch Weight: 3,307 lb.
Performance: speed subsonic, range 1,865 miles. CEP 500 ft.
Carried by: Tu-95MS Bear-H, Tu-160 Blackjack.

AS-16 (RKV-500B; NATO "Kickback")

In addition to two underwing AS-4 Kitchens, a Tu-22M-3 Backfire-C bomber exhibited at Machulische AB, near Minsk, in February 1992, had a rotary launcher carrying six AS-16 Kickbacks in its weapons bay. DoD believes that the Backfire-C can carry four more AS-16s underwing, instead of two AS-4s. Designated RKV-500B in Russia, the AS-16 is a short-range attack missile in the same class as USAF's AGM-69 SRAM. Development is assumed to have begun in the 1980s, with IOC in about 1988. Twelve can be carried as an alternative to six AS-15B ALCMs on each of the Tu-160 Blackjack's rotary launchers. The following data are estimated.

Type: short-range ASM.
Power Plant: solid-propellant.
Guidance: inertial.
Warhead: nuclear (350 kilotons), or 550-lb high-explosive.
Dimensions: span 2 ft 11½ in, length 16 ft 5 in, body diameter 1 ft 5¾ in.
Launch Weight: 2,650 lb.
Performance: max speed Mach 3, range 125 miles.
Carried by: Tu-22M-3 Backfire-C, Tu-160 Blackjack.

AS-X-19 (BL-10; NATO "Koala")

This supersonic ALCM, still in the research and development phase, is Russia's counterpart to USAF's AGM-129 ACM. A diagram in DoD's *Military Forces in Transition* suggests that it is a sweptwing/swept tail missile, with an overall length of about 40 ft. This would make it much too large to be carried on the standard Russian rotary launcher, implying an underwing mounting of the kind used for the AS-6 Kingfish or AS-4 Kitchen. The Tu-160 would be capable of carrying such a missile, but the AS-X-19 has been associated officially with only the Tu-95MS Bear-H, with two of the missiles loaded underwing on each aircraft. The Russians have stated that no production is planned.

Type: long-range ASM.
Power Plant: turbofan.
Warhead: nuclear or high-explosive.
Dimensions: span 20 ft, length 40 ft.
Performance: speed Mach 2.5 to 3 at 70,000 ft, range 1,865 miles.

Airborne Tactical Missiles

AS-7 (Kh-23 and Kh-66; NATO "Kerry")

In service since about 1965, this first-generation tactical ASM is said to have a single-stage 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 MiG-27, Su-17, Su-24, and Yak-38. The latest version is designated Kh-66.

Dimensions: span 2 ft 7¼ in, length 11 ft 7 in.
Weight: 633 lb.
Performance: max speed transonic, range 3 miles.

AS-9 (NATO "Kyle")

This liquid-propellant antiradiation missile has a configuration similar to that of the much larger Kh-22 (AS-4 Kitchen). In service for defense suppression since the early 1970s, it has a passive radar homing system and 330-lb warhead with which to attack landbased and shipborne radars. Launch aircraft are reported to be the MiG-25, MiG-27, Su-17, Su-24, Tu-16, and Tu-22M, but not all of these applications have been confirmed. Like the AS-4, it is said to cruise to the target at high altitude and to complete its terminal homing in a steep dive.

Dimensions: span 4 ft 7¼ in, length 19 ft 8¼ in, body diameter 1 ft 5 in.
Weight: 1,576 lb.
Performance: max speed supersonic, range 56 miles.

AS-10 (Kh-25ML/MR; NATO "Karen")

There are two basic operational versions of Karen, each with 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 very similar. The **Kh-25ML** is laser-guided, with target designation by the launch aircraft. These include the MiG-27, Su-17, Su-24, and Su-25. The Kh-25MP (AS-12 Kegler) is an antiradiation version of the same missile.

Dimensions: span 2 ft 7½ in, length 13 ft 3 in, body diameter 10⅞ in.
Weight: 660 lb.

AS-11 (Kh-58 "Kilter") (Nick Cook)

AS-17 (Kh-31P "Krypton") (Linda Jackson)

AS-? (Kh-35 "Harpoonski") (Linda Jackson)

AS-? Mosquito under Su-27K

Performance: launch height 330–33,000 ft, max speed Mach 2.35, range 1.25–12.5 miles.

AS-11 (Kh-58; NATO "Kilter")

The Kh-58 has been in service since about 1978. It is an antiradiation missile of conventional cruciform clipped-delta wing/tailfin configuration, with 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 330/440-lb blast fragmentation type. Intended primarily for antiship use, Kilter forms the primary armament of the MiG-25BM and is compatible with the MiG-27, Su-17, and Su-25.

Dimensions: span 3 ft 10 in, length 16 ft 4⅞ in, body diameter 1 ft 3 in.
Weight: 1,433 lb.
Performance: max speed Mach 4, range at low altitude 37–43 miles.

AS-12 (Kh-25MP; NATO "Kegler")

Kegler differs from the AS-10 Karen ASMs only in having a passive radar homing head. Much smaller and lighter than the AS-9, it can be carried by the MiG-27, Su-17, Su-24, Su-25, and Tu-22M. It has a 198-lb warhead.

Dimensions: as AS-10, except length 14 ft 3½ in.
Weight: 685 lb.
Performance: launch height 330–49,200 ft, max speed Mach 2.5, range 1.5–37 miles.

AS-13 (Kh-59; NATO "Kingbolt")

The AS-13 is a medium-range, TV-guided ASM, with two-stage solid-propellant power plant. Although it was first displayed in 1991, it was probably developed in the 1970s to supplement the short-range AS-10. It is thought to have a 330-lb warhead and is carried by the MiG-27, Su-17, Su-24, and Su-25.

Dimensions: span 4 ft 1¼ in, length 17 ft 8½ in, body diameter 1 ft 3 in.
Weight: approx 1,765 lb.
Performance: range 37 miles.

AS-14 (Kh-29; NATO "Kedge")

The two basic versions of the AS-14 are the TV-guided **Kh-29T** and the semiactive, laser-guided **Kh-29L**. Except for the interchangeable seeker heads, the two tactical ASMs are identical. In the class of the US Air Force's Maverick, they are carried on the extended wingroot glove pylons of the Su-24M and, probably, by the Su-25. The Kh-29L has been seen on a MiG-27, accompanied by an underfuselage laser designator pod. Each version has a 705-lb high-explosive warhead. A **Kh-29MP** version, with passive antiradiation seeker, has been reported on an Su-17. *(Data for Kh-29T.)*

Dimensions: span 3 ft 7¼ in, length 12 ft 8½ in, body diameter 1 ft 3¾ in.
Weight: 1,500 lb. (Kh-29L 1,455 lb.)
Performance: launch height 650–16,400 ft, range 1.85–18.5 miles.

AS-17 (Kh-31P; NATO "Krypton")

Seen for the first time at Dubai '91, this impressive medium-range antiradiation ASM 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. The warhead weight is 198 lb. An ASM version with active radar terminal guidance, for use against ship targets, has been reported. An AAM version is described separately. The Kh-31P has been seen mounted in inert form, or has been reported, on MiG-29K, Su-17, Su-24, Su-25T, Su-27IB, and Su-35 aircraft.

Dimensions: length 17 ft 2 in, body diameter 1 ft 2¼ in.
Weight: 1,323 lb.
Performance: launch height 165–49,200 ft, max speed Mach 3, range 3–43 miles.

AS-? (Kh-35)

First seen in 1992 and dubbed "Harpoonski" because of its similarity to the US AGM-84 Harpoon, this missile is intended as an antiship ASM to arm combat aircraft and helicopters, as surface-to-surface armament for ships and shore-based combat vehicles, and as a target vehicle for troops and antiaircraft defenses training to intercept hostile weapons of the Harpoon type. Delivery is scheduled to begin in 1994, with the Su-27K as a potential early carrier. Warhead weight is 320 lb.

Dimensions: length 12 ft 3½ in, body diameter 1 ft 4½ in.
Weight: 1,060 lb.
Performance: launch height 650–16,400 ft, max speed 670 mph, range 3–80 miles.

AS-? (Mosquito)

This large antiship missile was first displayed in inert form as underbelly armament of an Su-27K at Machulische Airfield, near Minsk, in February 1992. Few details could be discerned from photographs, except that it appeared to be air-breathing, with folding wings and fins. It is now known to be a rocket/ramjet missile, similar in configuration to the much smaller Kh-31P but with its wings located toward the front of the wraparound ramjet air intakes. It has a 705-lb high-explosive warhead and makes a sea-skimming approach to the target.

Dimensions: length 32 ft 0 in, body diameter 2 ft 6 in.
Weight: 9,920 lb.
Performance: max speed Mach 3, range 93–155 miles.

AT-2 (NATO "Swatter")

Designed originally for launch from land vehicles, this antitank weapon forms the missile armament of the Mi-24D helicopter gunship and is carried by the Hip-E version of the Mi-8. The solid-propellant **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 an increased range of 2.5 miles.

Dimensions: span 2 ft 2 in, length 3 ft 9¾ in, body diameter 5¼ in.
Weight: 65 lb.
Performance: cruising speed 335 mph, range 1.85 miles.

AT-6 (9M114 Skorpion; NATO "Spiral")

Spiral is a solid-propellant, tube-launched missile, with a radio command guidance system. The 22-lb high-explosive warhead fitted to the basic antitank version

can penetrate 11 inch armor plate at an angle of 60°. A variant with a fragmentation warhead for attacking other battlefield targets has been reported. The antitank version is standard armament on the Hind-E and F versions of the Mi-24, the Mi-28, and the Ka-29TB.
Dimensions: span 1 ft 0 in, length 6 ft 0 in, body diameter 5¼ in.
Weight: 77 lb.
Performance: cruising speed 895 mph, range 3 miles.

AT-9 (Vikhr)

This tube-launched, solid-propellant, antitank missile, known as Vikhr, was seen for the first time in the form of two eight-round clusters under the wings of the Su-25T attack aircraft. It appeared subsequently on the Ka-50 combat helicopter at the 1992 Farnborough Air Show. Guidance is by laser beam riding. The warhead weight is estimated at 6.6 lb.
Dimensions: length 3 ft 11¼ in, body diameter 5 in.
Weight: 37 lb.
Performance: range 2.5 miles.

AA-2 (R-3; NATO "Atoll")

Designated **R-3A** in Russia, the basic AA-2 was the Soviet counterpart to the US Sidewinder 1A (AIM-9B), to which it was almost identical in size, configuration, and infrared guidance. Other versions that followed included the AA-2D (**R-3S**), with improved seeker, and the radar homing AA-2C with a length of 11 ft 6 in and weight of 205 lb. All versions of Atoll have a solid-propellant rocket motor and 24-lb fragmentation warhead. Range of the AA-2C is five miles. Aircraft that carry Atoll include the MiG-23, MiG-27, and Su-17. *(Data for AA-2D.)*
Dimensions: length 9 ft 3½ in, body diameter 5 in, finspan 1 ft 8¾ in.
Weight: 165 lb.
Performance: cruising speed Mach 2.5, range 1.85 miles.

AA-6 (R-40; NATO "Acrid")

This AAM, with a 110-lb warhead, is one of the weapons carried by MiG-25 interceptors. The version with an infrared homing head (**R-40T**) is normally carried on each inboard underwing pylon, with a semiactive radar homing version (**R-40R**) on each outer pylon. Other aircraft reported to have been seen carrying the AA-6 include the MiG-31.
Dimensions: length 20 ft 4 in, body diameter 1 ft 2¼ in, wingspan 5 ft 11 in.
Weight: 1,015 lb.
Performance: cruising speed Mach 2.2, range 18.5 miles.

AA-7 (R-23; NATO "Apex")

This AAM is one of the two types carried as standard armament by interceptor versions of the MiG-23 and is reported to be an alternative weapon for the MiG-25 and MiG-29. Apex has a solid-propellant rocket motor and exists in infrared and semiactive radar homing versions (Soviet designations **R-23T** and **R-23R**, respectively). Warhead weight is 66 lb. *(Data for R-23R.)*
Dimensions: length 14 ft 11 in, body diameter 8 in, wingspan 3 ft 5 in.
Weight: 518 lb.
Performance: range 12.5 miles.

AA-8 (R-60; NATO "Aphid")

Successor to the AA-2 as standard close-range AAM of CIS air forces, Aphid is carried by MiG-23s, MiG-25s, MiG-29s, MiG-31s, Su-17s, Su-25s, Su-27s, and Yak-38s. It is intended for both interception and self-defense and has been reported in the latter role on Mi-24D/24V helicopters. It is a highly maneuverable, solid-propellant weapon with infrared homing guidance in its basic **R-60T** form. The **R-60R** semiactive radar version has not been seen in service and probably did not enter production. A 13.2-lb fragmentation warhead is fitted.
Dimensions: length 6 ft 10 in, body diameter 5⅛ in, wingspan 1 ft 5 in.
Weight: 143 lb.
Performance: range under 1,650 ft min, 3 miles max.

AA-9 (R-33; NATO "Amos")

This all-aspect, all-weather, radar homing, long-range AAM is reported to have achieved successes against simulated cruise missiles after look-down/shoot-down launch from a MiG-25. It is standard armament on the MiG-31 and is claimed to be capable of destroying targets flying at up to Mach 3.5 at all altitudes from 80 ft to 92,000 ft. The AA-9 has a solid-propellant motor and a 104-lb warhead and combines inertial midcourse guidance with semiactive radar terminal homing. It is an alternative weapon for the Su-27.
Dimensions: length 13 ft 7½ in, body diameter 1 ft 3 in, finspan 3 ft 10½ in.
Weight: 1,080 lb.
Performance: max launching range 75 miles.

AA-10 (R-27; NATO "Alamo")

The AA-10 has generally similar capabilities to those of the AA-9. It has a complex configuration, with long-span, reverse-tapered, cruciform control surfaces to the rear of small foreplanes. An 86-lb 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 and Su-27.

R-27T (Alamo-B). Short-burn, all-aspect, infrared homing version with fire-and-forget capability. Carried by MiG-29 and Su-27.

R-27RE (Alamo-C). Long-burn version for longer ranges. Guidance as R-27R. Carried by MiG-31 and Su-27.

R-27AE (Alamo-C). As R-27RE, but better able to deal with active maneuvering counterattacks and countermeasures. Length 15 ft 8¼ in.

R-27EM (Alamo-C). As R-27AE, 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.

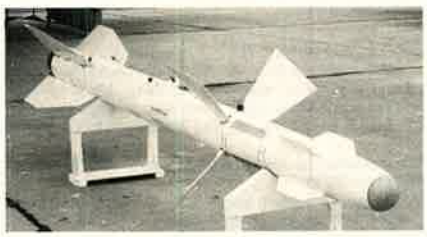
Dimensions: length 13 ft 1½ in (27R), 12 ft 1¾ in (27T), 15 ft 5 in (27RE), 14 ft 9 in (27TE), body diameter 9 in (27R/T), 10¼ in (all others), finspan 3 ft 2¼ in.
Weights: 558 lb (27R), 560 lb (27T), 772 lb (27RE), 756 lb (27TE).
Performance: max launching range (head-on) 50 miles (27R), 45 miles (27T), 80 miles (27RE/AE), 105 miles (27EM), 74 miles (27TE), min launching range (tail-chase) 1,640 ft.

AA-11 (R-73; NATO "Archer")

This close-range missile was first seen in 1989 and became standard armament on the MiG-29 and Su-27. 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 rocket efflux. They ensure great maneuverability, particularly when the missile is launched at large off-boresight target angles. Guidance is all-aspect infrared; a 16-lb fragmentation warhead is fitted. Two versions (RMD1 and 2) differ in launch weight and max range.
Dimensions: length 9 ft 6¼ in, body diameter 6¾ in, finspan 1 ft 8 in.
Weights: RMD1 232 lb, RMD2 243 lb.
Performance: max launching range (head-on) RMD1 18.6 miles, RMD2 24.8 miles, min launching range (tail-chase) 985 ft.

AT-9 (Vikhr) cluster on Su-25T (Nick Cook)

AA-9 (R-33 "Amos") (Linda Jackson)



AA-10 (R-27TE "Alamo-D") (Linda Jackson)

AAM-AE (R-77)

The capability of this air combat, multimission AAM has earned it the Western nickname "AMRAAMski." First seen at Machulische Airfield in February 1992, it is described as capable of destroying 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 IF homing guidance, with terminal lock-on, and is able to attack AWACS aircraft at a range of 100 miles or more. It will be standard armament on all late-model Russian aircraft and is distinguished by its unique lattice tailfins.
Dimensions: length 11 ft 9¾ in, body diameter 7⅞ in.
Weight: 385 lb.

AA-? (Kh-31 derivative)

The AAM derived from the Kh-31P (AS-17 Krypton) is identical to the ASM in dimensions, weight, warhead, and max speed. It is intended to be launched at all altitudes from 330 to 49,200 ft, to attack targets over a range of 6.2 to 125 miles.

Surface-to-Air Missiles

SH-11 (UR-96; NATO "Gorgon")

The world's only operational ABM (antiballistic missile) system is emplaced at eight sites around Moscow. Comprising the full 100 launchers permitted by the 1972 ABM Treaty, it is considered capable of engaging small numbers of reentry vehicles approaching from any direction during an accidental or unauthorized launch against the city. In its newly modernized (ABM-3) form, 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.

It is believed that 36 silo-based Gorgons have replaced the original SH-01 Galosh exoatmospheric intercept missiles, which were launched from above ground. Little is known about them, but they were identified initially as Modified Galosh, and the following details of the original SH-01 provide an indication of their likely characteristics:
Design Bureau: Vympel NPO.
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 thought to be silo-based around Moscow, as the second stage of the capital's antiballistic missile defenses. Gazelle is described as being similar in general configuration to the long-abandoned US Sprint, with a low-yield nuclear warhead. Like the exoatmospheric Gorgons, it is command-guided from the ground via the Pill Box phased-array radar at Pushkino. The following data are estimated:
Design Bureau: Vympel NPO.
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 (V-75 Dvina; NATO "Guideline")

By the time the last of some 2,000 currently deployed SA-2s has been replaced by SA-10s, this veteran SAM will have served for 40 years. It is land-transportable on a semitrailer and can be transferred to the standard single-round launcher in 12 minutes. Of six versions **(SA-2A** to **F),** 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** offers a home-on-jam capability.

The SA-2's effectiveness has been reduced dramatically by modern airborne countermeasures. Its "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. Unless the SA-2 picks up its narrow UHF line-of-sight guidance beam within six seconds of launch, it will go ballistic. It reaches its maximum velocity at 25,000 ft and has only limited maneuverability against modern tactical aircraft.

Design Bureau: Lavochkin OKB.
Type: medium-altitude, transportable, SAM.
Power Plant: liquid-propellant sustainer, burning nitric acid-kerosene mix; solid-propellant booster.
Guidance: radio command.
Warhead: high-explosive 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 3.75–18.65 miles, effective ceiling 300–82,000 ft.

SA-3 (S-125 Neva; NATO "Goa")

More than 300 battalion sites with SA-3 missiles are operational in the CIS, each equipped with four semimobile twin or fixed quadruple rail launchers. The system entered service in 1961, as a counterpart to the US Hawk, and was still in production at the beginning of the 1990s. **SA-3A** and **SA-3B** (from 1964) versions differ in the B's improved command guidance. The SA-3 was first used in action by a joint Egyptian-Soviet defense network covering the Suez Canal during the closing stages of the 1968–70 Egyptian-Israeli War of Attrition, shooting down five F-4E Phantoms. Like the SA-2, it has since been used in many campaigns and is road-transportable. 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 125 miles; the "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 latest Low Blow systems provide the fire-control team with the same information as that from the radar without affecting the command guidance function. See also Naval SA-N-1. *(Data for SA-3B.)*

Design Bureau: Lavochkin OKB.
Type: low/medium-altitude, transportable SAM.
Power Plant: two-stage solid-propellant.
Guidance: radio command.
Warhead: high-explosive fragmentation (132 lb), with Doppler radar proximity and contact fuzing. Lethal burst radius 41 ft.
Dimensions: length 20 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 1.5–12.4 miles, effective ceiling 150–39,375 ft.

SA-4 (9M8 Krug; NATO "Ganef")

Full deployment of the SA-4 began in 1969 and totaled 1,375 twin-round launchers in armies of the former USSR in the 1980s. Replacement with SA-11s and SA-12As has been under way through the past decade, but many SA-4s remain as air defense elements of Russian armies, with a peacetime strength of three batteries in each brigade. They are deployed normally six to 15 miles behind the FEBA, as elements of an integrated defense system embodying every type of SAM and antiaircraft gun. Each battery has three 2P24 SPU tracked mobile launchers, four Ural 375 TZM transport/reload vehicles each carrying one missile, and one SSNR "Pat Hand" mobile missile guidance radar. Acquisition range of Pat Hand is 75–80 miles, and tracking range, at which a single missile can be launched, is 50–56 miles. The radar can guide two missiles to a single target, if required. Reload time for the SPU is 10–15 minutes.

All elements of the SA-4 system are air-transportable in An-22 and An-124 military freighters. At least four variants of the missile were built. Major current versions, often mixed in a battery:

AAM-AE "AMRAAMski" (Brian M. Service)

SA-5 (S-200 Volga "Gammon") (Robert Hewson)

9M8M1 (SA-4A): 1967 version, with overall length of 28 ft 10½ in; slant range 5–34 miles; effective ceiling 330–82,000 ft.

9M8M2 (SA-4B): 1973 version, with shorter nose; improved close-range performance at expense of max range and effective ceiling. *(Data for SA-4B.)*
Type: medium-altitude, air-transportable SAM.
Power Plant: ramjet sustainer, burning kerosene; four wraparound solid-propellant boosters.
Guidance: radio command, with semiactive radar terminal homing.
Warhead: high-explosive fragmentation (300 lb), with proximity fuzing.
Dimensions: length 27 ft 7 in, body diameter 2 ft 10 in, wingspan 7 ft 6½ in.
Launch Weight: approx 5,500 lb.
Performance: max speed Mach 2.5, slant range 0.7–31 miles; effective ceiling 330–78,750 ft.

SA-5 (S-200 Volga; NATO "Gammon")

About 1,930 SA-5s are believed to be operational in the CIS, at 130 sites. They are the last known SAMs developed in the former USSR for deployment from static launchers and exist in three versions:

SA-5A. Initial production version with high-explosive warhead, operational from 1966.

SA-5B. As SA-5A, but with nuclear warhead. Entered service 1969–70.

SA-5C. As SA-5A, but with improved maneuverability and terminal guidance. Standard version from 1975–76.

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 240-mile-range P-50 "Bar Lock B" target search and acquisition radar, a 100-mile-range "Square Pair" missile guidance radar, and six single-rail missile launchers. SA-5s were launched against USAF SR-71s, without success. No better results were achieved by Libya against US aircraft equipped with ECM and armed with AGM-88 HARMs (high-speed antiradiation missiles) in March–April 1986.

Design Bureau: Grushin OKB.
Type: medium/high-altitude SAM.
Power Plant: initially liquid-propellant, later solid-propellant sustainer; four wraparound solid-propellant boosters.
Guidance: radio command, with semiactive radar terminal homing.
Warhead: high-explosive or (SA-5B only) nuclear (25 kilotons), with proximity and command fuzing.
Dimensions: length 34 ft 9 in, body diameter 2 ft 9½ in, wingspan 9 ft 4 in.
Launch Weight: 6,175 lb.
Performance: max speed above Mach 4, slant range 93 miles, effective ceiling 1,000–65,000 ft.

SA-6 (9M9 Kub; NATO "Gainful")

This self-propelled tactical weapon system was first seen on its three-round tracked TEL in a military parade through Red Square in November 1967. It caused considerable dismay in NATO when the Egyptians and Syrians used SA-6s to destroy about 20 Israeli aircraft during the 1973 war in the Middle East. Their unique integral solid rocket/ramjet propulsion system was far ahead of comparable Western technology, and US-supplied ECM that enabled Israeli aircraft to survive attack by other missiles proved ineffective against the SA-6. Today the armies of the CIS have about 850 SA-6 TELs, deployed in antiaircraft regiments at divisional level. Each regiment consists of an Hq. with EW, IFF, and height-finding radars, and five SA-6 batteries.

Each battery has an IS-91 "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 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 ten minutes. All elements of the SA-6 system are air-transportable in An-22, An-124, and Il-76 freighters.

Pending availability of the SA-11 Gadfly weapon system, one of the original **SA-6A** TELs in some batteries was replaced with a TELAR (transporter-erector-launcher and radar) with added SA-11 "Fire Dome" engagement radar. The TELAR carries modified **SA-6B** missiles.

Design Bureau: Toropov OKB.
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: high-explosive fragmentation (130 lb), with proximity and contact fuzing. Lethal burst radius 16 ft.
Dimensions: length 19 ft 0¼ in, body diameter 1 ft 1⅜ 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 100–49,000 ft.

SA-7 (9M32 Strela-2; NATO "Grail")

This shoulder-fired, tube-launched, passive infrared homing missile saw considerable service in Vietnam, where 528 SA-7s were fired by the North Vietnamese, destroying 45 US and South Vietnamese aircraft, most of them relatively slow battlefield support airplanes and helicopters. Since then, in many areas, they have continued to hit their targets and have forced pilots to fly above the minimum effective range of defensive radars, making them more vulnerable and degrading their ground-attack accuracy and ability to support friendly troops.

The initial **SA-7A** Grail could be fired only from behind a target at a very hot exhaust area, over a narrow field of fire, and tended to home on the sun if pointed within 20° of that heat source. Solar reflection from clouds or heat from sun-exposed rocks could guide it astray, limiting its usefulness against low-flying aircraft. In 1971, the improved **SA-7B** Grail Mod

1 (Soviet **9M32M Strela-2M**) entered service, with 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 since 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.

The SA-7 is also carried by vehicles, including ships, in batteries of four, six, and eight, for both offensive and defensive employment.

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: high-explosive 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 1.55, slant range 0.5–2.6 miles, effective ceiling 165–7,550 ft.

SA-8 (9M33 Romb; NATO "Gecko")

This all-weather, low-altitude SAM was developed to fill the gap between the SA-7/SA-9 and the SA-6. It is categorized as a ZRK-SD integrated missile system, able to self-deploy over medium ranges, and was the first tactical air defense weapon system of the former USSR in which all components necessary to conduct a target engagement are carried by a single vehicle. In the original **SA-8A** Gecko Mod 0 (**9M33**), two pairs of exposed single-stage missiles were carried, ready to fire. The later **SA-8B** Gecko Mod 1 (typically **9M33M3**) system has six dual-thrust, increased-performance missiles in launcher/containers. Fire-control equipment and launcher 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.

The SA-8A was first displayed in a 1975 military parade through Moscow. Together with the SA-6, it largely replaced S-60 57-mm towed antiaircraft guns in CIS service and has itself replaced some SA-6s. Five batteries are deployed with each divisional antiaircraft regiment. A battery comprises, in peacetime, four BAZ-5937 launch vehicles and two TZM reload vehicles, supported by 24 ZIL 131 trucks to serve as missile transporters. More than 1,000 systems are operational in the CIS. In Iraqi service, they destroyed a number of Tomahawk cruise missiles during the Persian Gulf War. *(See also SA-N-4; data for SA-8A.)*

Design Bureau: Grushin OKB.
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: high-explosive 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.
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-9 (9M31 Strela-1; NATO "Gaskin")

The SA-9 mobile amphibious weapon system has been largely replaced in CIS armies with the SA-13. It comprises a BRDM-2 four-wheel vehicle carrying a box launcher for two pairs of infrared homing solid-propellant missiles in place of the normal turret. The launcher rests flat on the rear of the vehicle when not required to be ready for action. Sixteen SA-9 TELs formerly equipped each CIS division, in four batteries. Surveillance is provided by a "Dog Ear" radar vehicle, supplemented by "Flat Box" passive radar antennas on one TEL in each battery. Early **SA-9A** Gaskin Mod 0 (**9M31**) missiles were followed by **SA-9B** Gaskin Mod 1 (**9M31M**) with improved cooled seeker and longer range. *(Data for SA-9B.)*

Type: low-altitude, mobile SAM.
Power Plant: dual-thrust solid-propellant.
Guidance: infrared passive homing.
Warhead: high-explosive fragmentation (5.75 lb), with proximity fuzing. Lethal burst radius 16 ft.
Dimensions: length 5 ft 11 in, body diameter 4¾ in, wingspan 1 ft 2¾ in.
Launch Weight: 66 lb.
Performance: max speed Mach 1.5, slant range 0.35–5 miles, effective ceiling 32–20,000 ft. Range is reduced considerably in head-on engagement and extended to a possible 6.8 miles in tail-chase.

SA-10 (S-300; NATO "Grumble")

Russia's counterpart to the US Army's MIM-104 Patriot, the all-altitude SA-10 also arms nuclear-powered battle cruisers. It replaces SA-2s, SA-3s, and SA-5s and 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 fixed-base **SA-10A** (Grumble Mod 0) began in 1980. An SA-10A regiment is reported to comprise 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 racar ("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 missiles are launched vertically by compressed air, with ignition after launch. The track-via-missile (TVM) system guidance, like that of Patriot, enables up to six targets to be engaged simultaneously, with one or two missiles per target. A battery can fire three missiles per second, against targets traveling at up to 2,610 mph. Max range is 28, 47, or 56 miles, according to model.

For improved mobility, the land-mobile **SA-10B** (Grumble Mod 1) version was developed in the mid-1980s, with four-axle, four-round TELs based on the MAZ-7910 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. At least 10,000 SA-10s are believed to be in service, including exports, with production continuing at a rate of 1,600 a year.

Design Bureaus: Grushin and Raspletin OKBs.
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: high-explosive (285 lb) or low-yield nuclear.
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 Gang; NATO "Gadfly")

Since 1980, this weapon system has 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 medium altitudes. The SA-11 system is self-contained on a GM-569 tracked vehicle, which carries a 360° traversing four-rail launcher and "Fire Dome" monopulse guidance and tracking radar. The missile resembles the US Navy's Standard MR1 RIM-66 in general appearance and can sustain 23*g* maneuvers.

An SA-11 regiment is made up of five batteries, each with four TELs, and similar GM-569 vehicles carrying early warning and acquisition radars and reload missiles. The same chassis is also used to carry the regiment's long-range early warning radar. If this is not available, the SA-11 TELs can be integrated into an SA-6 battery, using the latter's "Straight Flush" fire-control radar.

Design Bureau: Altair NPO.
Type: low/medium-altitude, mobile SAM.
Power Plant: solid-propellant.
Guidance: semiactive monopulse radar command.
Warhead: high-explosive fragmentation (154 lb).
Dimensions: length 18 ft 4½ in, body diameter 1 ft 3¾ in, wingspan 3 ft 11¼ in.
Launch Weight: 1,520 lb.
Performance: max speed Mach 3, slant range 1.85–18.5 miles, effective ceiling 100–72,000 ft.

SA-12A (S-300V; NATO "Gladiator")

Deployment of the land-mobile tactical SA-12A began in 1986, primarily for use against aircraft and ASMs. The total number currently operational is unknown, but several dozen launchers were stationed with Soviet Army units in East Germany before reunification. All components of the SA-12A system are based on the tracked MT-T chassis, a derivative of the T-64 main battle tank. The three batteries of an SA-12A battalion each have three TELs, a "Grill Pan" fire-control vehicle, and a reload transporter. The main "Bill Board" long-range target search and acquisition radar vehicle and additional reload transporters are held at battalion Hq. level. Three battalions make up a brigade, with further Bill Boards assigned to Hq.

Each TEL carries four missile container/launchers that can be raised independently to a vertical position for launch and a telescopic missile guidance radar. The latter is believed to control the missile in flight after its target has been tracked and handed on by Grill Pan.

Design Bureau: Antey NPO.
Type: all-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: radar command and midcourse inertial, with semiactive radar terminal homing.
Warhead: high-explosive fragmentation (330 lb) with possible low-yield nuclear option.
Dimensions: length 26 ft 11 in, body diameter 2 ft 3½ in.
Launch Weight: 2,800 lb.
Performance: max speed Mach 3, slant range 47 miles, effective ceiling 2,950–98,400 ft.

SA-12B (S-300V; 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 is believed to be deployed to defend road-mobile SS-25s, and as part of the rail-mobile SS-24 Mod 1 ICBM system with its MT-T two-round tracked TELs carried on low-loader railcars. After an SS-24 train emerges from its tunnel concealment to move to its launch area, the SA-12Bs are intended to disperse into the surrounding area to defend the Scalpel launchers from attacking enemy aircraft, short-range ballistic missiles, and possibly strategic missile reentry vehicles. If they have the ability to intercept ICBM and SLBM warheads, the SA-12Bs, capable of nationwide deployment, would contravene the terms of the ABM Treaty.

Design Bureau: Antey NPO.
Type: all-altitude, mobile SAM.
Power Plant: two-stage solid-propellant.
Guidance: as SA-12A, with possible active homing under development.
Warhead: as SA-12A.
Dimensions: length 34 ft 5½ in, body diameter 3 ft 3½ in.
Launch Weight: 4,250 lb.
Performance: max slant range 62 miles.

SA-13 (9M37 Strela-10; NATO "Gopher")

Since this tracked mobile weapon system entered service in 1978, as a replacement for the SA-9, at least two improved versions have appeared. About 900 four-missile launchers were operational with Russian Army and Naval Infantry units by 1987, and production of the missiles has continued at the rate of around 2,800 a year. The basic **9M37** missile was followed by the **9M37M Strela-10M2,** offering choice of an uncooled lead sulphide, near-IR homing seeker, or cooled indium altimonide mid-IR homing type, in each case with all-aspect and IRCCM capabilities. The missiles are carried in two twin-box launchers on TELAR vehicles of two types. The only apparent difference is that TELAR-1 has four "Flat Box B" passive radar detection antennas on its upper surface; TELAR-2 has none. It is suggested that TELAR-1 is used only by the battery commander. Eight reload missiles are normally carried by each of the vehicles, which are fully amphibious. The associated "Dog Ear" acquisition/tracking radar vehicle of the SA-9 is retained, with range-only radar 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/infrared seeker to improve adverse weather operation. *(Data for 9M37M; 9M333 in parentheses.)*

Design Bureau: OKB-134.
Type: low-altitude, mobile SAM.
Power Plant: solid-propellant.
Guidance: infrared passive homing in two frequency bands (optical photocontrast/IR).
Warhead: high-explosive fragmentation rod; 6 lb and 100 rods. Lethal burst radius 16 ft. Contact and active xenon lamp proximity fuzing (contact and active laser proximity fuzing).
Dimensions: length 7 ft 2½ in, body diameter 4¾ in, wingspan 1 ft 3¾ in.
Launch Weight: 87 lb (93 lb).
Performance: max speed Mach 2, slant range 0.3–6.2 miles, effective ceiling 33–16,400 ft.

SA-14 (CIS Strela-3; NATO "Gremlin")

This development of the SA-7 shoulder-fired SAM, with much-improved effective altitude capability, began to replace the earlier weapon one for one in 1978. Compared with the SA-7, it has an uprated rocket motor, a more powerful warhead, and a cryogenically cooled IR seeker with proportional guidance that is effective in head-on as well as tail-chase firings and against targets maneuvering at up to 8*g*. Effectiveness against targets equipped with flare dispensers and IR jammers is claimed to be much enhanced. A passive RF direction-finder antenna system is optional. *(See also SA-N-8.)*

Type: low-altitude, man-portable SAM.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: high-explosive fragmentation (4.4 lb), with contact and graze fuzing.
Dimensions: length 4 ft 7¼ in, body diameter 3 in.
Launch Weight: 21.8 lb. Launcher: 13.4 lb.
Performance: max speed Mach 1.76, slant range 0.37–3.7 miles, effective ceiling 33–18,000 ft.

SA-15 (9M330 Tor)

In service since 1988, this large, highly automated, mobile SAM system is immensely more formidable than the SA-8 that it was designed to replace. Its modified GM-569 tracked vehicle is air-transportable but not amphibious. A box-like turret on top of the hull houses eight vertically mounted missiles in two rows and carries the engagement radars. Above the rear of the box is a 3-D pulse-Doppler G-band surveillance radar able to detect up to 48 targets over a range of 15 miles. It then assesses in order of priority, and tracks, the ten most threatening targets. The pulse-Doppler phased-array K-band target tracking and missile guidance radar at the front is able to simultaneously track and engage two targets traveling at 22–1,565 mph, by day or night, in all weather, and in dense ECM environments. It is supplemented by an autonomous automatic TV tracking system that enhances the SA-15's capability in battlefield clutter and dense ECM. Reaction time is five to eight seconds from target detection. The missiles are cold-launched, at minimum 3 sec intervals and able to maneuver at 30*g* against fixed-wing aircraft, helicopters, UAVs, precision guided weapons, and some types of guided missiles. Long-range surveillance for the SA-15 is provided by the "Dog Ear" type of radar vehicle. The SA-15 vehicle carries a crew of three and is equipped with IFF. The missile is thought to be similar to that used in the naval SA-N-9 system. More than 200 Tors are operational with the Russian Army.
Design Bureau: Antey NPO.
Type: low/medium-altitude, mobile SAM.
Power Plant: single-stage solid-propellant.
Guidance: radar command and active radar terminal homing, supplemented by TV/IR trackers.
Warhead: high-explosive fragmentation (33 lb), with proximity fuzing.
Dimensions: length 11 ft 6 in, body diameter 1 ft 1¾ in, wingspan 2 ft 0 in.
Launch Weight: 368 lb.
Performance: max speed Mach 2.5, slant range 1–7.5 miles, effective ceiling 33–19,700 ft.

SA-16 (Igla-1; NATO "Gimlet")

The third-generation SA-16 destroyed more Coalition aircraft than any other shoulder-fired SAM used in the 1991 Persian Gulf War, including four Marine Corps AV-8B Harrier IIs. Together with the self-propelled 2S6 antiaircraft weapon system (see SA-19), it has been replacing the SA-7, SA-14, and ZSU-23-4 gun system for the past decade. Its configuration is similar to that of the SA-7 and SA-14, but it is an entirely new weapon, with a conical nose. Deployment time is 13 seconds, and launch time from target acquisition is five seconds. Guidance is by proportional navigation, and the cooled IR seeker improves resistance to countermeasures. Maximum target-bearing angle for launch is ±40°.
Type: low-altitude, man-portable SAM.
Power Plant: dual-thrust solid-propellant.
Guidance: infrared passive homing.
Warhead: high-explosive fragmentation (4.4 lb), with contact and graze fuzing.
Dimensions: length 5 ft 1 in, body diameter 3⅛ in.
Launch Weight: 23.8 lb. Launcher: 9.25 lb.
Performance: average speed Mach 1.68, slant range 0.37–3.1 miles, effective ceiling 33–11,500 ft.

SA-17

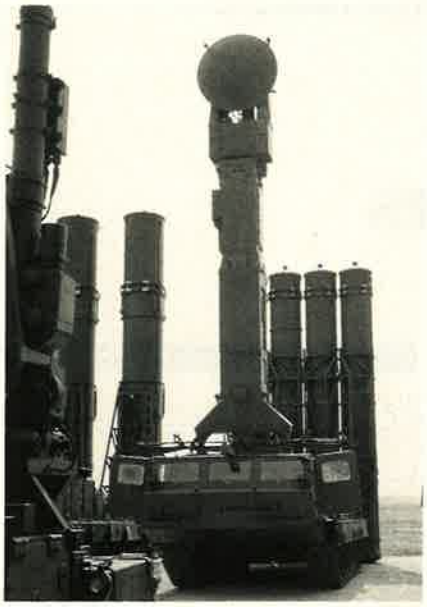
Intended to supersede the SA-11 "Gadfly," this new low/medium-altitude SAM was identified by NATO in 1986–87 and was expected to achieve initial operational status during the current year. It has a similar configuration to the SA-11 and is based on the same GM-569 tracked vehicle. A major innovation is a new surveillance radar known to NATO as "Snow Drift," also carried on a modified GM-569, which replaced the SA-11's "Tube Arm."

SA-18

First mentioned in the 1990 edition of DoD's *Soviet Military Power,* this fourth-generation, shoulder-fired SAM is described as "highly capable." It is said to be in service in small quantities for field testing.

SA-19 (9M311)

This tube-launched hypersonic missile was developed as one element of the 2S6 Tunguska gun/missile tracked regimental air defense vehicle, which entered service in 1986 as an SA-13 replacement, for use against low-flying aircraft and ASMs. Eight SA-19s are mounted in clusters of four on each side of a turret that also carries four 30-mm guns, and fire-control and "Hot Shot" surveillance and target acquisition radars. (See also SA-N-11 entry.)
Type: tube-launched, low/medium-altitude SAM.
Power Plant: two-stage solid-propellant.
Guidance: semiautomatic command to line-of-sight (SACLOS), supplemented by thermal imaging sight, TV, and laser rangefinder/designator.
Warhead: high-explosive fragmentation (19.8 lb).
Dimensions: length 8 ft 2½ in, body diameter 5⅞ in.
Launch Weight: 93 lb.
Performance: speed hypersonic, max range 1.5–5 miles.



SA-12A (S-300V "Gladiator"), with two SA-12B "Giant" container/launchers on left (Linda Jackson)

2S6 Tunguska, with SA-19 (9M311) missiles (Linda Jackson)

Naval Surface-to-Air Missiles

SA-N-1 (S-125 M1 Volga-M; NATO "Goa")

The SA-N-1 was the first SAM installed in ships of the former Soviet Navy, from 1961. Data for the current SA-N-1B (Goa Mod 1) are similar to those given for the landbased SA-3, with which it was developed. It is carried on a roll-stabilized twin launcher by older cruisers and destroyers.

SA-N-3 (4K65; NATO "Goblet")

Goblet is the only SAM known to have been developed exclusively for use by the Navy of the former USSR. More effective than the SA-N-1, it is carried by larger vessels, including the *Kiev*-class carrier/cruisers, helicopter cruisers *Moskva* and *Leningrad,* and *Kara* and *Kresta II* cruisers. Compared with the original **SA-N-3A** Goblet Mod 0 version, the **SA-N-3B** Goblet Mod 1 has internal improvements and greater range but is otherwise similar. Both versions are fired from a twin launcher and have a secondary antiship capability.
Type: short-range, shipborne, theater defense missile.
Power Plant: dual-thrust, solid-propellant.
Guidance: radar command, with semiactive homing.
Warhead: high-explosive fragmentation (176 lb).
Dimensions: length 20 ft 0 in, body diameter 1 ft 11½ in.
Launch Weight: 1,863 lb.
Performance: speed approx Mach 2.5, slant range 1.85–18.5 miles (SA-N-3A), 1.85–34 miles (SA-N-3B), effective ceiling 300–82,000 ft.

SA-N-4 (9M33 Osa-M; NATO "Gecko")

This close-range ship-to-air missile system preceded the landbased mobile SA-8B system, which embodies the same missile. It equips more than 160 ships of 12 classes in the navies of Russia and associated states, giving them also a limited antiship capability. The retractable twin-round "pop-up" launcher is housed in a drum below deck.

SA-N-5 (NATO "Grail") and SA-N-8 (NATO "Gremlin")

Both the original SA-7 (Grail) and SA-14 (Gremlin) shoulder-fired infrared homing SAMs have been adapted for ship defense, under the designations SA-N-5 and SA-N-8, respectively. Four of the missiles, in their launchtubes, are normally mounted on a framework that can be slewed for aiming. A few installations have only two missiles. They provide simple antiaircraft protection for small ships of the navies of Russia and associated states.

SA-N-6 (S-300 Rif; NATO "Grumble")

Developed simultaneously with the landbased SA-10 and using the same basic missile, this system has been operational for more than a decade. It superseded the SA-N-1 and SA-N-3 in major warships and is assumed to deal with the same multiple threats as the US Navy's AEGIS area defense system. However, it is doubtful the SA-N-6 could intercept sea-skimming cruise missiles of low radar cross section. This may explain why it is partnered by the smaller SA-N-9 system in later ships of the *Admiral Ushakov* class. Standard installation in each of these ships comprises 12 eight-round rotary magazines below the foredeck, from which the missiles are launched vertically. *Slava*-class cruisers have eight magazines, with a total of 64 missiles. *(Data as for the SA-10.)*

SA-N-7 (9M38 Shtil; NATO "Gadfly")

The SA-N-7 system was developed in parallel with its landbased counterpart, the SA-11, and uses the same basic missile. Sea trials began in 1981. Subsequently, the SA-N-7 became standard armament on the *Sovremennyy* class of guided missile destroyers, with two single-rail launchers and 48 missiles in each ship. The sophistication and rapid-fire potential of the weapon system are indicated by the requirement for six associated "Front Dome" fire-control/target illuminating radars on each ship. *(Missile data as for the SA-11.)*

SA-N-9 (9M330 Klinok)

This vertically launched, short-range missile is similar to the landbased SA-15 and is capable of both antiaircraft and antimissile defense. The carrier *Admiral Kuznetsov* has four six-round launchers and a total of 192 missiles. The battle cruiser *Frunze* has 128 SA-N-9s, in addition to SA-N-4 and SA-N-6 SAMs. They are distributed between two rows of four vertical launchers, on each side of the stern helicopter pad, and two rectangular groups of four launchers on the forecastle. The same system is carried by *Udaloy*-class antisubmarine ships (each eight launchers, 64 missiles), the carrier/cruisers *Novorossiysk* and *Admiral Gorshkov* (each 24 launchers, 96 and 192 missiles, respectively), and the new *Neustrashimyy*-class frigates (four six-round launchers).

SA-N-10

This close-range SAM system is installed in the naval missile range ship *Kapusta.* The four quadruple launchers differ from those used for the SA-N-5 and SA-N-8 by being reloaded automatically instead of by hand. The missile is reported to be similar to the Army's SA-16 "Gimlet."

SA-N-11 (9M311 Kashtan; NATO CADS-N-1)

Naval counterpart of the landbased 2S6 combined air defense system is the Kashtan (NATO CADS-N-1), mounting eight SA-N-11 SAMs and two 23-mm or 30-mm Gatling-type guns, together with a "Hot Flash" fire-control radar. Eight CADS-N-1 systems are installed in the carrier *Admiral Kuznetsov,* two on each side of the fore and aft decks. Also equipped with these systems are the new battle cruiser *Admiral Nakhimov* and *Neustrashimyy*-class frigates. The missile is similar to the SA-19 (which see). ■

AEF's tuition program has benefited some 270 Air Force enlisted troops.

Eagle Scholars

By Arthur C. Hyland

AFA's Aerospace Education Foundation has moved into the second year of its Eagle Plan, a tuition assistance program that provides a total of $60,000 per year to active-duty Air Force enlisted personnel.

The Eagle Plan was initiated by AEF in 1991. The foundation gives unconditional $250 grants to selected graduates of the Community College of the Air Force (CCAF). To date, the foundation has handed out more than 270 Eagle Grants.

Enlisted personnel in Grades E-4 through E-7 are eligible for the grants. The awardee must be the top CCAF graduate at his or her base and be seeking a bachelor's degree from an accredited college. Grants are presented during the biannual graduation ceremonies held each April and October. AEF held the third such event in fall 1992.

Winners are chosen by a committee composed of the base Senior Enlisted Advisor, the base education officer, and a local AFA representative. Details are available from each base education officer or by calling the Aerospace Education Foundation. ■

Fall 1992 Recipients

SrA. Brian A. Alexander, MacDill AFB, Fla.
TSgt. Valarie J. Alford, RAF Chicksands, England
SSgt. Brian J. Arsenault, Malmstrom AFB, Mont.
SSgt. Larry L. Baker, Robins AFB, Ga.
SSgt. Todd W. Barnes, Columbus AFB, Miss.
TSgt. Thaddeus J. Bednarski, Osan AB, Korea
MSgt. Patricia J. Bogert, Castle AFB, Calif.
MSgt. Hugo J. Bonacci, Jr., Dyess AFB, Tex.
SSgt. Dennis J. Boucher, Plattsburgh AFB, N. Y.
MSgt. Michael C. Bransten, Pope AFB, N. C.
TSgt. Larry K. Brenden, Kadena AB, Japan
Sgt. Michael W. Brown, Grissom AFB, Ind.
Sgt. Glenn E. Burns, Luke AFB, Ariz.
Sgt. Marilyn Campiz, Cannon AFB, N. M.
SSgt. Ida F. Cardwell, Rhein-Main AB, Germany
MSgt. Richard J. Cargill, Patrick AFB, Fla.
SSgt. Robert A. Clapp, Hill AFB, Utah
SSgt. John H. Clouse, Sheppard AFB, Tex.
TSgt. Charles E. Crews, Goodfellow AFB, Tex.
Sgt. Kelly A. Dallas, England AFB, La.
SSgt. Barbara J. Davis, Shaw AFB, S. C.
SSgt. Yvonne Doner, McClellan AFB, Calif.
Sgt. Giya M. Drakeford, Lajes Field, Azores
TSgt. David W. Drescher, McChord AFB, Wash.
TSgt. Vincent K. Edwards, Andrews AFB, Md.
MSgt. Charles W. Eldridge, Charleston AFB, S. C.
SrA. Mickey R. Evans, Izmir AS, Turkey
SSgt. Zimbalist J. Favors, RAF Alconbury, UK
MSgt. Jean P. Fleming, Altus AFB, Okla.
MSgt. Robert M. Feeley, Grand Forks AFB, N. D.
SSgt. Robin L. Franzen, Malmstrom AFB, Mont.
Amn. Kimberly P. Gougis, McGuire AFB, N. J.
MSgt. Gregory S. Greaves, USAF Academy, Colo.
TSgt. Kevin M. Green, Griffiss AFB, N. Y.
SSgt. Perry L. Grimes, NAS Keflavik, Iceland
SSgt. Tronsela S. Grimes, Whiteman AFB, Mo.
MSgt. Douglas W. Gruber, Norton AFB, Calif.
TSgt. Arthur C. Gunn, Langley AFB, Va.
Sgt. Henry A. Hall, Misawa AB, Japan
Sgt. Clifford W. Hatch, Holloman AFB, N. M.
TSgt. William C. Hinman, McGhee Tyson Airport, Tenn.
SSgt. Katherine I. Holder, RAF Bentwaters, UK
TSgt. Sharon B. Holland, Randolph AFB, Tex.
MSgt. Jean M. Holt, Hanscom AFB, Mass.
Sgt. Lisa M. Karns, Keesler AFB, Miss.
Sgt. John W. Keeler, Aviano AB, Italy
Sgt. Stephanie L. Lambert, Iraklion AB, Greece
MSgt. Roger G. Langevin, Eglin AFB, Fla.
SSgt. Robert D. Lorton, Bitburg AB, Germany
SSgt. Marvin Lugo, Lindsey AS, Germany
SSgt. Steven A. Lundmark, Sembach AB, Germany
TSgt. Peter F. Mackowski, Edwards AFB, Calif.
SSgt. Gary E. McCullers, RAF Lakenheath, UK
SrA. Karla J. McKinney, RAF Upper Heyford, UK
Sgt. Jade M. M. Mesa, Scott AFB, Ill.
Sgt. Todd L. Metcalf, Myrtle Beach AFB, S. C.
SSgt. Lori A. Mitchell, Offutt AFB, Neb.
SSgt. Randall J. Muennink, Ellsworth AFB, S. D.
TSgt. Daniel J. Nelson, Fairchild AFB, Wash.
SSgt. Veronique S. Nicklas, Beale AFB, Calif.
MSgt. Larry E. Ogletree, McConnell AFB, Kan.
TSgt. Ralph S. Olguin, Reese AFB, Tex.
SSgt. Paul H. Orth, Tyndall AFB, Fla.
TSgt. Pasquale J. Pallotta, Little Rock AFB, Ark.
SSgt. Kevin R. Panet, Los Angeles AFB, Calif.
Sgt. Michelle L. Paquet, Peterson AFB, Colo.
SSgt. Juan C. Peguero, Tinker AFB, Okla.
SSgt. Mark A. Pennington, Brooks AFB, Tex.
MSgt. Ramsay M. Pryce, Jr., Hickam AFB, Hawaii
SSgt. Mark E. Rosson, RAF Mildenhall, UK
MSgt. Gary E. Rutledge, Moody AFB, Ga.
TSgt. Alan M. Sagocio, Travis AFB, Calif.
SSgt. Thomas P. Schwenk, Lackland AFB, Tex.
SrA. Kevin L. Shaffer, Kelly AFB, Tex.
TSgt. Sherry F. Slye, Seymour Johnson AFB, N. C.
MSgt. Sahin Sonmez, Mountain Home AFB, Idaho
TSgt. Michael J. Strassmaier, Bergstrom AFB, Tex.
TSgt. Jeffrey A. Styers, Hurlburt Field, Fla.
Sgt. Ruby D. Thomas, Incirlik AB, Turkey
TSgt. Timothy M. Thomas, Howard AFB, Panama
TSgt. Frank D. Tomisch, K. I. Sawyer AFB, Mich.
SSgt. Mark W. VanMeter, Eielson AFB, Alaska
Sgt. Thomas J. Villano, Kunsan AB, South Korea
SSgt. Kelvin D. Walden, Wurtsmith AFB, Mich.
MSgt. Eppie L. Walker, Nellis AFB, Nev.
Sgt. Warlinda Walker, Ramstein AB, Germany
SSgt. Glenn T. Walter, Wright-Patterson AFB, Ohio
SrA. David G. Waters, San Vito dei Normanni AB, Italy
SSgt. Michael A. Whitaker, Andersen AFB, Guam
TSgt. David D. Wiley, Chanute AFB, Ill.
SSgt. Anthony B. Willis, Carswell AFB, Tex.
Sgt. Brian F. Wollak, Williams AFB, Ariz.
SSgt. LaTanya A. Young-Stephens, Barksdale AFB, La.

Valor

By John L. Frisbee, Contributing Editor

Super Ace

It was nearly two years after Pearl Harbor before Charles H. MacDonald got into combat. He quickly made up for lost time.

IT WOULD be something of an exaggeration to say that Col. Charles H. MacDonald has been slighted by history. He is, after all, the highest-scoring P-38 pilot to survive World War II. Among AAF aces, his twenty-seven confirmed victories are exceeded only by Dick Bong, Thomas McGuire, and Francis "Gabby" Gabreski. Nevertheless, he has been somewhat overshadowed by Bong and McGuire in the Pacific and by several aces in Europe—a favorite stomping ground for World War II journalists. A quiet, thoughtful man, he was (and is) concerned less with personal glory than are some of his contemporaries.

"Mac" MacDonald completed pilot training in 1939 after graduating in three and a half years from Louisiana State University, where he studied philosophy. He was in Hawaii with the 20th Pursuit Group when the Japanese struck on December 7, 1941. MacDonald led the remaining P-36s and P-40s of his squadron in patrol of Oahu until shortage of fuel forced them to return to Wheeler Field. They were greeted by a hail of flak thrown up by friendly forces, nearly ending MacDonald's combat career before it was well started.

USAAF assignments kept MacDonald in Hawaii for two years before he returned to the mainland as commander of the 340th Fighter Squadron, 348th Group—a newly formed unit earmarked for the southwest Pacific. The 348th moved to New Guinea in June 1943, where MacDonald spent three months flying uneventful patrols. His chance for air-to-air combat finally came in October, when he was assigned as executive officer of the P-38-equipped 475th Fighter Group, then based at Dobodura.

Before he was thoroughly acquainted with the P-38, MacDonald had his first opportunity for combat when a large, well-escorted formation of enemy bombers attacked allied shipping in Oro Bay. Separated from his wingman, MacDonald was the first to attack the enemy armada. In a wild melee, he shot down two fighters and was lining up on a third when he was hit hard from the rear, damaging the hydraulics and knocking out one engine, his electrical systems, and most of his coolant. Everything held together for a wave-top return to land over forty miles of uninviting water, ending in a belly landing.

Ten days later, MacDonald led a force of P-38s from four groups that were to cover a B-24 attack on Rabaul. The weather turned sour, and all the P-38s except MacDonald's flight turned back, but for him the mission was the thing. He took his men high to cover the lead bomb squadron, and for the next forty-five minutes the eight P-38s stayed with the bombers, chasing off many attacking enemy fighters. MacDonald shot down one Zeke. After the mission, he quietly filled out his report and said little about the mission, for which he was awarded the first of his two Distinguished Service Crosses.

In November 1943, Lt. Col. Charles MacDonald was named commander of the 475th when George Prentice returned to the States. By the following summer, MacDonald, who believed that a group commander's job was to lead, not to administer, had become a double ace with his tenth victory. That summer, the 475th had a distinguished visitor, Charles A. Lindbergh, who was in the Pacific to study fighter tactics—and to show P-38 pilots how to extend the range of their fighters. Fifth Air Force Commander Lt. Gen. George Kenney gave Lindbergh permission to fly missions in safe areas. The Lone Eagle spent most of the next six weeks with MacDonald's 475th Group at Hollandia, flying often with its commanding officer. MacDonald and Lindbergh, who were much alike in intellect and temperament, became close friends.

On one mission, a solitary reconnaissance plane showed up directly ahead of Lindbergh's P-38 and was shot down by the famous pilot. Later, a flight of P-38s led by Colonel "Mac" was unexpectedly attacked by several enemy fighters, one of which latched onto Lindbergh's tail and was shot down by MacDonald. That ended civilian Lindbergh's combat career. He was asked by General Kenney to go home. For allowing him to fly in actual combat, Colonel MacDonald was ordered home on "punitive leave," administered by headquarters with tongue in cheek.

Colonel MacDonald returned to command of the 475th Group in October 1944. Before he relinquished command in July 1945, he shot down fourteen more enemy planes for a total of twenty-seven. According to pilots who flew with him, he was an outstanding pilot, an exceptional marksman, and a combat tactician who had few equals. This quiet, unassuming man who rarely betrayed anger was respected and loved by the officers and enlisted men who served under him. He was, in short, one of the great air combat leaders of World War II.

Charles MacDonald retired as a colonel in 1966 and now lives in Florida, cruising the Caribbean in his sailboat. ■

Thanks to Lt. Col. Joe Forster (nine confirmed), who flew with Colonel MacDonald, and to Col. Ward Boyce, Executive Director, American Fighter Aces Museum.

Books

By Frank Oliveri, Associate Editor

Captain Hook: A Pilot's Tragedy and Triumph in the Vietnam War, by Capt. Wynn F. Foster, USN (Ret.). The author, a former Navy aviator, was severely wounded in combat over Vietnam. He tells of the agonizing process of physical recuperation and discusses his eventual reinstatement to active duty, despite the loss of his right arm. Naval Institute Press, 2062 Generals Hwy., Annapolis, MD 21401. Including photos, appendix, and index, 242 pages. 1992. $26.95.

Desperate Venture: The Story of Operation Torch, the Allied Invasion of North Africa, by Norman Gelb. By recreating the story of the Allied invasion of German-held North Africa in 1942, the author lays out the essential elements of a campaign that helped produce the strategy and tactics used to defeat the Axis powers in World War II. Fielding Publications, 1350 Avenue of the Americas, New York, NY 10019. Including photos, notes, bibliography, and index, 365 pages. 1992. $25.00.

Future Wars: The World's Most Dangerous Flashpoints, by Col. Trevor N. Dupuy, US Army (Ret.). In this effort to pinpoint the regions of the world where major armed conflict will erupt, Colonel Dupuy gives a brief history of the trouble spots and their unique dangers. He describes the probable course of war, including the military potential of each contending force, the overall scenario, a typical engagement, and the probable outcome of the conflict. Warner Books, Time & Life Building, 1271 Avenue of the Americas, New York, NY 10020. Including, maps, charts, glossary, appendix, and index, 334 pages. 1993. $21.95.

General Chennault's Secret Weapon: The B-24 in China, by A. B. Feuer. This book recounts the World War II experiences of pilot Capt. Elmer E. Haynes, who flew low-altitude night radar strikes against Japanese shipping in the South China Sea and daylight raids against various landbased installations in eastern and central China. Greenwood Publishing Group, 88 Post Rd. W., Box 5007, Westport, CT 06881. Including appendix, glossary, and index, 196 pages. 1992. $45.00.

The Leverage of Sea Power: The Strategic Advantage of Navies in War, by Colin S. Gray. The author analyzes the impact of naval power on the outcome of the great wars of the past and how it is used today. The Free Press, 866 Third Ave., New York, NY 10022. Including notes, bibliography, and index, 372 pages. 1992. $24.95.

Lines in the Sand: Desert Storm and the Remaking of the Arab World, by Deborah Amos. A journalistic veteran of the Middle East offers an overview of the Persian Gulf War, including a thorough account of Arab policies, US support of Hussein prior to the war, and how the collapse of the Soviet Union affected US policy in the region. Simon & Schuster, 1230 Avenue of the Americas, New York, NY 10020. Inclucing index, 223 pages. 1992. $21.00.

Pearl Harbor: Final Judgment, by Henry C. Clausen and Bruce Lee. Mr. Clausen, the independent investigator appointed by Secretary of War Henry Stimson in 1944 to assess the causes of the Pearl Harbor disaster, discusses and elaborates on the secret report he completed in 1945. This report led to the formation of the National Security Agency, the central collector and analyzer of electronic signals. Crown Publishers Inc., 201 E. 50th St., New York, NY 10022. Including photos, appendix, anc index, 485 pages. 1992. $25.00.

The Persian Gulf Crisis: Power in the Post–Cold War World, edited by Robert F. Helms II and Robert H. Dorff. Here is a new examination of the implications of the Persian Gulf crisis for the emerging post–cold war international system. Greenwood Publishing Group. Including references and index, 205 pages. 1992. $45.00.

Storm Over Iraq: Air Power and the Gulf War, by Richard P. Hallion. Dr. Hallion recounts in detail the use of air combat and support forces in the Persian Gulf War—a conflict that marked the ascendancy of airpower in warfare. Smithsonian Institution Press, 470 L'Enfant Plaza, Suite 7100, Washington, DC 20560. Including photos, notes, and index, 383 pages. 1992. $24.95.

Triumph Without Victory: The History of the Persian Gulf War, by the staff of *US News and World Report.* Here is the newsmagazine's detailed roundup of the forty-two days of Desert Storm, disclosing some new details not contained in previous accounts of the war. Times Books, 201 E. 50th St., New York, NY 10022. Including appendix and index, 477 pages. 1993. $14.00.

Other Titles of Note

Army Dictionary and Desk Reference, Capt. Tim Zurick, USAR. Terms and acronyms for just about anything you want to know about the Army. Stackpole Books, P. O. Box 1831, Cameron and Kelker Sts., Harrisburg, PA 17105. 263 pages. 1992. $12.95.

The Green Berets in Vietnam, 1961–71, by Francis J. Kelly. The successes and failures of Green Beret efforts in Vietnam over a ten-year period. Brassey's (US), Inc., 8000 Westpark Dr., First Floor, McLean, VA 22102. Including appendix, index, photos, and diagrams, 227 pages. 1992. $12.95.

Rogues' Gallery: America's Foes from George III to Saddam Hussein, by Larry Hedrick. An assessment of the history of US international conflicts told in terms of specific leaders of adversary nations. Brassey's (US), Inc. Including notes, references, and index, 224 pages. 1992. $24.00.

Scars and Stripes: Healing the Wounds of War, by Gail A. Olson, P.A.C., and Michael J. Robbins. A reference manual to help veterans with personal adjustment problems. TAB Books, Blue Ridge Summit, PA 17294-0850. Including appendix, bibliography, and index, 194 pages. 1992. $8.95.

She Went to War: The Rhonda Cornum Story, by Rhonda Cornum as told to Peter Copeland. The story of an Army flight surgeon and helicopter pilot and her ordeal as a prisoner of war in the hands of Iraqi armed forces. Presidio Press, 505 B San Marin Dr., Suite 300, Novato, CA 94945-1340. Including photos, 203 pages. 1992. $19.95.

Silent Wings at War: Combat Gliders in World War II, by John L. Lowden. Recollections of thirty-nine "suicide jockeys" of glider warfare in World War II. Smithsonian Institution Press. Including photos, appendix, and index, 187 pages. 1992. $24.95.

The United States and World War II, by Robert James Maddox. A concise, one-volume overview of the war's causes, conduct, and consequences. Westview Press, 5500 Central Ave., Boulder, CO 80301-2847. Including photos and index, 358 pages. 1992. $55.00.

Vietnam, We've All Been There: Interviews With American Writers, by Eric James Schroeder. A unique collection of interviews with writers who made the Vietnam War a prime subject. Greenwood Publishing Group. Including photos, bibliography, and index, 219 pages. 1992. $21.95. ■

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AFA/AEF Report

By Daniel M. Sheehan, Assistant Managing Editor

Capt. Steven Flowers (center) was chosen Navigator of the Year by MAC (now AMC) out of a navigator force numbering in the thousands. The Altus (Okla.) Chapter, led by Chapter President Gary Thompson (left), recognized the award's prestige and honored Captain Flowers with an AFA plaque. Former National Vice President (Southwest Region) Aaron Burleson assisted in the presentation.

President McCoy Denounces Lifting of Homosexual Ban

AFA President James M. McCoy issued a strongly worded statement denouncing the Clinton Administration's decision to lift the ban against homosexuals in the US military. He said, "The Clinton Administration is on a disaster course. Open admission of homosexuals to military service would do great harm, more than the President may realize. A fighting force is not just an accumulation of individuals and weapons. Its effectiveness depends critically on cohesion and morale. The course President Clinton is taking would undermine these qualities in the force."

President McCoy noted that AFA had been joined by nineteen other military and veterans' groups in the Military Coalition in writing a letter urging President Clinton to reconsider. The Military Coalition represents nineteen associations with more than 3.5 million members. He also issued a call to legislative action, requesting all AFA members to write their representatives and senators to register their support for a continuation of the ban. President McCoy concluded his statement by saying, "The course of action Mr. Clinton has announced will no doubt earn him the applause of gay-rights groups. We find it deplorable that this apparently counts for more than the morale and feelings of the overwhelming majority of men and women who serve in our armed forces."

Banner Year for Anthony Chapter

Chapter Vice President (Aerospace Education) Charles X. Suraci, Jr., of the **Thomas W. Anthony (Md.) Chapter** reports that efforts on behalf of aerospace education were more strenuous than ever in 1992. In addition to maintaining close ties with area Civil Air Patrol wings and squadrons and helping to keep them informed of advances in aerospace education, the chapter has sponsored informative "Visions of Exploration" programs at ten local elementary schools in conjunction with *USA Today*. The chapter is also heavily involved in promoting aviation at the middle school and high school levels through its participation in aviation career days around the area. Members of the chapter sit on selection boards to name recipients of Eagle Plan scholarships for top graduates of the Community College of the Air Force *[see "Eagle Scholars," p. 84].*

Most innovative is the chapter's involvement in the Opportunity Skyway program, which helps underprivileged young people stay in school. Opportunity Skyway, a program of the Prince George's County (Md.) Private Industry Council, encourages youngsters to seek careers in aviation. Students take a five-week instruction course and, if they pass a test administered by the Federal Aviation Administration, are eligible for fifteen hours of free flight instruction at an approved flight school. The chapter, along with such other sponsors as the Aircraft Owners and Pilots Association and the National Air and Space Museum, helps to defray the considerable expense of the program. Mr. Suraci, Chapter President Sam O'Dennis, and former State President Ron Resh have high hopes for the program and encourage other chapters to take part in this worthwhile effort.

Chapter News

The **Tennessee Ernie Ford (Calif.) Chapter** had two special guests at its Annual Awards Dinner late last year: Air Force Chief of Staff Gen. Merrill A. McPeak and CMSAF Gary R. Pfingston. The chapter presented

awards to outstanding performers from Onizuka AFB, NAS Moffett Field, the Defense Logistics Agency, and local AFROTC, AFJROTC, and CAP detachments. Gen. Robert E. Huyser, USAF (Ret.), joined Beverly Ford, the chapter namesake's widow, in presenting the eleventh annual Tennessee Ernie Ford Distinguished Aerospace Achievement Award to General McPeak.

Introduced by Chapter President Ed Lewis, General McPeak described for the audience the Air Force's responses to rapidly changing global circumstances and the challenges posed by reductions in the defense budget.

Before the banquet, General McPeak met privately with AFROTC cadets from the University of California at Berkeley and San Jose State University, and Chief Pfingston was able to confer with senior NCOs from local Air Force units.

Also in California, the **General Doolittle Los Angeles Area Chapter** is under new management. Its new chapter officers include President Ed Reynolds, Executive Vice President William Brady, Secretary Lou Kridelbaugh, and Treasurer Sidney Greene. The new officers were installed by National Vice President (Far West Region) H. A. Strack, as were chapter directors Bruce Bauer, Bud Chamberlain, James Cobb, Phillips Copeland, Donald Keeffe, and Donald Zweifel.

The guest speaker at the event was Dr. John Foster, chairman of the Defense Science Board. His topic was "What the New Defense World Will Look Like."

Cornelius Vanderbilt Whitney (1899–1992)

Former National Director Cornelius V. "Sonny" Whitney died late last year after a life marked by service to both AFA and the nation. In addition to two terms as National Director, he served as the first assistant secretary of the Air Force from 1947 to 1949 after rising to the rank of colonel during World War II. He was a true aviation pioneer, earning his wings and getting his commission as a second lieutenant in the Signal Corps at seventeen. Between the wars, he founded Pan American Airways, among other business ventures.

The February 1948 issue of AIR FORCE Magazine cites him as a founding father of AFA and credits him with bringing "an atmosphere of briskness and efficiency around the new United States Air Force's departmental headquarters." The magazine quoted him as pledging "to do everything in my power to make [the new Defense Department's] unification work."

The process by which the Defense Department and the Air Force came into being would have been much more difficult without men like Mr. Whitney.

Recognition of Headquarters Staff

Thanks to the generosity of National Director and former Chairman of the Board Jack B. Gross, AFA is now giving an additional reward to outstanding performers on its national headquarters staff. Mr. Gross set up a fund to be used to reward one employee each quarter, with one of those named Employee of the Year. The quarterly winners for 1992 were Lisa DeCourcey of the administrative staff, Doreatha Major of the communications department, Pearlie Draughn of the magazine staff, and Susan Rubel of the membership department. Ms. Major was named Employee of the Year.

Have AFA/AEF News?

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

AFA was well represented at 1992's commemoration of the first powered flight at Kitty Hawk, N. C. Here, Board Chairman O. R. Crawford accepts a flag flown on the eighty-ninth anniversary from First Flight Society President (and Life Member) Will Plentl, as (from left) National Director James E. Smith, North Carolina President William Michael, and Kitty Hawk Chapter President Alton V. Jones look on.

Coming Events

March 13–14, **Southwest Region Workshop,** Austin, Tex.; March 19–21, **Great Lakes Region Workshop,** Chicago, Ill.; May 7–9, **North Carolina State Convention,** Seymour Johnson AFB, N. C.; May 14–16, **South Carolina State Convention,** Clemson, S. C.; May 21–22, **Tennessee State Convention,** Nashville, Tenn.; June 4–5, **Alabama State Convention,** Montgomery, Ala.; June 11–13, **Louisiana State Convention,** New Orleans, La.; June 12, **Massachusetts State Convention,** Boston, Mass.; June 18–20, **New York State Convention,** Griffiss AFB, N. Y.; June 18–20, **Ohio State Convention,** Mansfield, Ohio; June 25–27, **Oklahoma State Convention,** Oklahoma City, Okla.; July 9–11, **Georgia State Convention,** Columbus, Ga.; July 16–17, **Arkansas State Convention,** Jacksonville, Ark.; July 16–17, **Missouri State Convention,** Whiteman AFB, Mo.; July 16–18, **Kansas State Convention,** Wichita, Kan.; July 16–18, **Pennsylvania State Convention,** Trevose, Pa.; July 30–August 1, **Florida State Convention,** Cypress Gardens, Fla.; August 5–7, **California State Convention,** Sacramento, Calif.; August 6–7, **Colorado State Convention,** Colorado Springs, Colo.; August 13–14, **Mississippi State Convention,** Jackson, Miss.; September 13–15, **AFA National Convention and aerospace exhibition,** Washington, D. C.

Unit Reunions

N. C. ANG Pilots and Navigators
Former North Carolina ANG pilots and navigators will hold a reunion June 11–12, 1993, at the Ramada Inn in Charlotte, N. C. **Contact:** Blaine Nash, 918 Hartford Ave., Charlotte, NC 28209. Phone: (704) 523-3054.

Scouting Forces
Scouting Force veterans who served in the 1st, 2d, and 3d Air Divisions, 8th Air Force, between 1944 and 1945 will hold a reunion April 1–3, 1993, in Kansas City, Mo. Scouting Force veterans of the 2d Division will also hold a reunion in conjunction with the 355th Fighter Group May 12–16, 1993, in Cambridge/Steeple Morden, England. **Contact:** Lt. Col. E. Richard Atkins, USAF (Ret.), 1304 Cochise Dr., Arlington, TX 76012. Phone: (817) 261-3007.

Tachikawa AB Personnel
Former civilian and military personnel assigned to Tachikawa AB, Japan, between 1959 and 1960 will hold a reunion August 23–26, 1993, at the Peppermill Hotel-Casino in Reno, Nev. **Contact:** Whitey Jones, 13769 Endicott Cir., Magalia, CA 95954. Phone: (916) 873-3209.

9th Bomb Group
Veterans of the 9th Bomb Group will hold a reunion September 30–October 3, 1993. **Contact:** Herbert W. Hobler, 295 Mercer Rd., Princeton, NJ 08540. Phone: (609) 921-3800.

14th Air Force Ass'n
The 14th Air Force Association "Flying Tigers," which includes the American Volunteer Group (1941–42), China Air Task Force (1942–43), and 14th Air Force (1943–45), will hold a reunion May 26–28, 1993, at the Crystal Gateway Marriott in Arlington, Va. **Contact:** Bob Lee, 717 19th St. S., Arlington, VA 22202-2704. Phone: (703) 920-8384.

29th Bomb Squadron
Veterans of the 29th Bomb Squadron will hold a fiftieth-anniversary reunion June 17–19, 1993, at the Holiday Inn in Spearfish, S. D. **Contact:** Jerry Junek, 1115 W. Oliver, Spearfish, SD 57783. Phone: (605) 642-3724.

Classes 58-B, C, and D
Members of Classes 58-B, C, and D are planning to hold a reunion October 9–11, 1993, in Houston, Tex. **Contacts:** Bob Symmes, P. O. Box 472, Pass Christian, MS 39571. Phone: (601) 868-2776. Col. Ben Welch, 21st AF/RF, McGuire AFB, NJ 08641. Phone: (609) 723-0591 or DSN 440-3293.

Readers wishing to submit reunion notices to "Unit Reunions" should mail their notices well in advance of the event to "Unit Reunions," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

76th ATS/76th MAS
The 76th Air Transport Squadron and the 76th Military Airlift Squadron will hold a reunion May 20–22, 1993, in North Charleston, S. C. **Contact:** Darrell Parker, P. O. 61101, North Charleston, SC 29419-0101.

80th Fighter Group
Veterans of the 80th Fighter Group "Burma Banshees" will hold a reunion September 1–4, 1993, at the Sheraton Hotel in Spokane, Wash. **Contact:** Dodd V. Shepard, 13123 E. 24th Ave., Spokane, WA 99216. Phone: (509) 926-0365.

81st Troop Carrier Squadron
The 81st Troop Carrier Squadron, 436th Troop Carrier Group (World War II), will hold a reunion September 14–16, 1993, in Colorado Springs, Colo. **Contact:** G. R. Ammerman, 210 Quail Trail, Aliceville, AL 35442. Phone: (205) 373-8930.

86th Fighter-Interceptor Squadron
The 86th Fighter-Interceptor Squadron and 79th Fighter Group will hold a reunion in summer 1993. **Contacts:** Ronald E. Meinert, 8725 Vanderstel, Newaygo, MI 49337. Phone: (616) 652-1774. Dick Holland, 2561 Guntley Rd., Philo, CA 95466. Phone: (707) 895-2136.

310th Bomb Wing
Veterans of the 310th Bomb Wing who served between 1952 and 1965 at Schilling AFB (formerly Smoky Hill AFB), Kan., will hold a reunion September 30–October 3, 1993, in Portsmouth, N. H. **Contacts:** Lt. Col. Nils A. Ohlson, USAF (Ret.), 7 Evergreen Rd., Hampton, NH 03842-1116. Phone: (603) 926-2901. Frank Wagner, 17 Carolan Ave., Hampton, NH 03842-1116. Phone: (603) 926-6677.

314th Fighter Squadron
Veterans of the 314th Fighter Squadron, 324th Fighter Group, will hold a reunion July 16–18, 1993, in Seattle, Wash. **Contact:** Joe Resnik, 3110 W. Lake Sammamish, Bellevue, WA 98008. Phone: (206) 641-5077.

347th Fighter Squadron
Veterans of the 347th Fighter Squadron (World War II) will hold a reunion June 3–6, 1993, at the Red Lion Hotel in Colorado Springs, Colo. **Contact:** Col. Andrew W. Freeborn, USAF (Ret.), 5222 Borrego Dr., Colorado Springs, CO 80918. Phone: (719) 598-8373.

388th Fighter Wing
The 388th Fighter Wing will hold a fiftieth-anniversary reunion March 12–13, at Hill AFB, Utah. All members of the 388th, past and present, are invited. **Contact:** Judy Lemmons, Public Affairs Division, 388th Fighter Wing, Hill AFB, Utah 84056-5000. Phone: (801) 777-2552.

934th Signal Battalion
Veterans who served in the Korean War in the 934th Signal Battalion, 5th Communications Group, 1st Radio Squadron, 1st T&C Squadron, 2d Communications Squadron, 2d Radio Relay Squadron, and 7th Communications Squadron (1950–54) are planning to hold a reunion in spring 1993. **Contact:** Richard D. Feiler, P. O. Box 405, Ardmore, OK 73402. Phone: (405) 657-8601.

Class 43-C
Seeking contact with graduates of Aviation Class 43-C (Moody Field, Ga.) interested in a reunion. **Contact:** John L. Maddray, 1601 Amberly Rd., Charleston, SC 29407. Phone: (803) 766-8753.

3906th Special Security Squadron
Searching for former members of the 3906th Special Security Squadron, also known as the SAC Elite Guard, to help organize a reunion in summer 1994 or 1995. **Contact:** MSgt. Donald A. Quigley, 4855 Iron Horse Trail, Colorado Springs, CO 80917. Phone: (719) 380-7955 or DSN 560-5603. ■

Bulletin Board

Seeking information on the mission on which **Lt. Oscar James** was killed. He was a pilot in the 436th Squadron, 7th Bomb Group, flying out of India in 1944–45. **Contact:** Roberta James Mandel, P. O. Box 3066, San Rafael, CA 94912.

Seeking information on anyone who flew the **P-39 Airacrobra** in combat (any unit, any theater). **Contact:** Lt. Col Robert L. Brown, USAF (Ret.), 814 Bay Blossom Ave., Sumter, SC 29150.

Seeking contact with anyone who knew **Lt. Charles Gottschalk**, pilot of a B-17 reported missing five hours after departing Goose Bay, Labrador, on October 22, 1944, en route to Iceland. **Contact:** Lt. Col Robert L. Dean, USAF

(Ret.), 724 Monmouth Way, Winter Park, FL 32792.Collector and historian seeking **AAF memorabilia** from World War I and World War II. Interested in leather flight jackets, uniforms, flight equipment, and photo albums. **Contact:** Jon G. Cerar, 425 John St., Carlinville, IL 62626.

Seeking contact with anyone associated with **Ephrata AAB,** Wash., (1941–49). Collecting information, anecdotes, photos, or mementos for a comprehensive history of the base and for future reunions. **Contact:** Pat Dunston, 97 Rd. 18.5 N. E., Soap Lake, WA 98851.

Seeking information on the following members of **Capt. Desmond Albright's B-24 crew** who served with the 513th Squadron, 376th Bomb Group, 47th Wing, 15th Air Force, at San Pancrazio, Italy, July 1944 to March 1945. 1st Lts. Robert Garrison, copilot; Robert Belgrave, navigator; Charles Walker, bombardier; TSgts. Frank Giljim, flight engineer; Charles Nace, radio operator; and William Walford, waist gunner. **Contact:** Walter E. Michener, 2012 Malabar Lakes Dr., Palm Bay, FL 32905.

Seeking information on the whereabouts of **Terry Tinter,** who served at Spangdahlem AB, Germany, from January 1987 to 1991. **Contact:** Robert Blahnik, 4118 Florida Dr., #136, Rockford, IL 61108-7765.

Seeking a USAAF patch for the **400th Bomb Group** (B-24), which was stationed at Charleston AAF, S. C., in 1943–44. **Contact:** Edward W. Hardy, 1129 Onondago St., Pittsburgh, PA 15218-1123.

Seeking contact with **Bernard M. "Mike" Hornbrook**. He was stationed with USAF at RAF Chicksands, England, from 1962 to 1963. He is originally from Knoxville, Tenn. **Contact:** Margaret Gibbs, 1 Medway Close, Kings Heath, Northhampton NN5 7PD, England.

Seeking contact with **Weather Service** veterans and those now serving in Air Force weather units (AWS, Majcom, ANG/AFRES, Recon.) **Contact:** Air Weather Assn., 5301 Reservation Rd., Placerville, CA 95667-9745.

Seeking contact with **Melvin Sinquefield**, 483d Bombardment Group Association. His last known address was in California. **Contact:** Guy Venier, 13185 Picadilly Dr., Sterling Heights, MI 48312.

Seeking information on pilot **John "Slip" Madigan**, killed in action during World War II. Trying to find particulars, such as the date he was killed, where, plane number, and unit, so a duplicate model of the aircraft can be made. His home town was Queens Village, N. Y. I recall that he was killed flying over the Ploesti oil fields. **Contact:** William Pierce, 2020 Arundel Pl., Mount Pleasant, SC 29464.

Seeking contact with members of the **38th Troop Carrier Squadron** from the time of activation, at Patterson Field, Ohio, until July 1943 at Laurinburg-Maxton AB, N. C. A Captain Morton flew four of us to Pope Field, N. C. where I joined the 75th Squadron. **Contact:** Robert C. Richards, 266 Woodlawn Dr., Tipp City, OH 45371.

World War II researcher would like to hear from ex-crewmembers of an 8th Air Force 401st Bombardier Group B-17, ***Hells Henchmen***. **Contact:** Mike Merryman, 2613 Foron Rd., Centralia, WA 98531.

Seeking information on **John and Lou Mourning**. They were at Vance AFB, Okla., in 1968. **Contact:** Ellie Coote, 25 Arrowhead Rd., Oakland, NJ 07436.

Seeking information on **Sgt. Dale Randall**, 13th Service Squadron, 10th Service Group, USAAF, stationed at Fort Dix, N. J., in September 1943 before going overseas. He furnished transportation for me, September 9, 1943, to Quartermaster Depot, Philadelphia, Pa., upon my appointment as warrant officer. **Contact:** Floyd M. Black, 1356 Skyridge Dr., Crystal Lake, IL 60014-8933.

Seeking contact with anyone previously stationed at **Hahn AB, Germany**, in civil engineering. Any photos, history items, or stories may be published in "Hahn CE Yearbook." **Contact:** SSgt. Brian K. Zimmerman, Box 4382, APO AE 09109.

Author needs all types of personal stories, photos, other documentation, concerning your **duty and liberty time in Japan** during 1940–60. Material will be returned after copying. You will be credited in the book for information you give. **Contact:** Capt. Gordon R. Shevis, USAF, 2400 Porto Rico, Alamogordo, NM 88310.

Collector seeks **patches** (subdued or color) from flying USAF, ANG, or AFRES units. **Contact:** Steve G. Freston, 1806 S. W. 3d St., Lee's Summit, MO 64081-1705.

Collector seeks military **payment certificates** for five cents to $20 notes from 1946 to 1973—Series 46 to 692 (Vietnam). Will trade or buy notes for collection. Not redeemable by the US government, only of interest to collectors or as souvenirs. **Contact:** Nick Schrier, Box 60104, Sacramento, CA 95860.

Seeking **patches** or pocket devices for the following: Airways and Air Communications Service, 5th Air Force, 315th Air Division, Continental Air Command, 10th Air Force, NATO, 6th Allied Tactical Air Force, and Land Forces Southeastern Europe. **Contact:** MSgt. Gerald M. Johnson, USAF (Ret.), 1005 Harbor Cove, Ocean Springs, MS 39564.

Seeking contact with **Harold Buffo**, aerial photographer who flew out of Africa and Italy. He lived in Lansing, Kan. **Contact:** Kenneth D. Hinman, VA Medical Center, 1030 Jefferson Ave., Memphis, TN 38104.

Seeking contact with two airmen, **Mutt and Jeff,** who were in my hut with 509th Bomb Squadron, 351st Bomb Group, four months before V-E Day. They worked in headquarters in the personnel section. SSgt. Mutt was six feet tall and had a mustache. Jeff, an amateur artist, was a buck sergeant. **Contact:** TSgt. Abe Rubel, USAF (Ret.), 2016 Restington Ln., Memphis, TN 38119-6856.

Seeking information on and photos of my father, **1st Lt. Rodney Smith,** who was killed in an F-100 at England AFB, La., March 16, 1961. He was in the 613th TFS. Previous assignments were Moore AFB, Tex., Greenville AFB, Miss., Luke AFB, Ariz. (August 1960), and Nellis AFB, Nev. (October 1960). **Contact:** Scott Josey, 7314 Muirfield Valley Ln., Houston TX 77095.

Avid collector wishes to purchase new or used **military fire department patches**. **Contact:** James P. Bart, P. O. Box 461, Cheektowaga, NY 14225.

Seeking information on **Lt. Col. Jean B. Pitner,** formerly with the 41st Troop Carrier Squadron in Vietnam, flying C-130s into Cam Ran Bay Naval Station. His last known address was in San Francisco, Calif. He may have been transferred to Korea. **Contact:** Arthur L. Harrison, 5817 Copperwood, Apt. 1123, Dallas, TX 75248.

Seeking information on **Sgt. Robert Schelby,** who served on Saipan with the 500th Bomb Group, 73d Bomb Wing. He was a radio operator on a B-29 that ditched near Japan. **Contact:** Eugene S. Bartels, 5830 Eastbrook Ave., Lakewood, CA 90713.

Collector seeking patches from the **27th, 71st,** and **94th Tactical Fighter Squadrons** and the **1st Tactical Fighter Wing**, Langley AFB, Va. Also seeking contact with any F-15 pilots stationed at Langley AFB. **Contact:** Thomas Montgomery, 412 S. Devinney St., Lakewood, CO 80228.

Seeking information on **A1C Anthony J. Sadoques** and **A1C Joseph A. Lello**. They served with my husband, Donald J. Hingle, while he was stationed in Portsmouth AFB, N. H., in the 1950s. **Contact:** Anne Hingle, 5731 Wright Rd., New Orleans, LA 70128.

Seeking information on **Col. Bud J. Peaslee** from September 1943, when he left the 384th Bomb Group, to June 1944, when he organized the Scouting Forces. Also seeking information on his activities from December 1944 to April 1945 with the 25th Bomb Group and the details of his prewar assignments and postwar activities. **Contact:** Lt. Col. E. Richard Atkins, USAF (Ret.), 1304 Cochise Dr., Arlington, TX 76012.

Seeking contact with **Col. Robert H. "Whip" Damico**, former commander of the 49th FIS at Hanscom Field, Mass., in the early 1950s. His F-86D is being restored, and information is needed on the markings. **Contact:** Lt. Col. Henry L. Marois, Jr., USAF (Ret.), 360 Pinellas Bayway S., Unit E, Tierra Verde, FL 33715.

Retired RCAF airman would like to exchange **Canadian and USAF squadron crests** for UN and NATO enameled pocket badges. Also have RCAF/CAF flying jackets and flight suits for exchange. **Contact:** Gordon Biss, Site 50, Comp. 19, R. R. 1, Comox, British Columbia V9N 5N1, Canada.

Seeking information on **Aviation Cadet Gene W. Poland**. He was in pilot training Class 44-F, at Independence AAB, Kan. He was killed in a mid-air collision during night training. **Contact:** Jacob Warren Hamm, Rte. 1, Box 159, Pratt, KS 67124-9801.

Seeking contact with **Lt. Matthew J. Beebe**. He last known address was in Mississippi or Louisiana. **Contact:** John Crocker, 100 Glenn Dr., Goldsboro, NC 27530.

In order to develop a roster, I am seeking names and addresses of **Class 42-E** graduates who attended at Tulare, Calif., Merced, Calif., Luke AFB, Ariz., or Stockton, Calif. A copy will be mailed to each respondent. **Contact:** Donald W. Brennan, 1848 Elevado Ave., Arcadia, CA 91006-1709.

Seeking information on **Warren Icenhaur**, who served at Larson AFB, Wash., during the late 1950s. **Contact:** Kevin Spelts, 801 N. E. 183d, #2, Portland, OR 97230-7167.

Serious collector seeks assistance in obtaining any type of patch or badge (cloth or metal) pertaining to **USAF Security Police**, regardless of time period, condition, or authorization. **Contact:** Louis C. Nicastro, P. O. Box 73320, Fort Bragg, NC 28307.

Seeking information on the **4750th Test Squadron, 475th Test Squadron,** and **4484th Fighter Weapons Squadron** to be used in a unit history of the 84th Test Squadron. **Contact:** Capt. Michael DeKam, USAF, 839 Suwanee Rd., Tyndall AFB, FL 32403-5435.

Seeking career information on **Richard Wood**, a student at Jackson State College, Miss., in 1956 before joining the US Air Force. **Contact:** Brenda Brooks, 4421 Mission Ave., F209, Oceanside, CA 92057.

Seeking contact with USAF **ex-servicemen** for a book on bombings on Cambrai, France, during World War II. **Contact:** André Verriez, Saint Cloud, Rue de Carnieres, 59400 Cambrai, France.

Seeking information on **Lts. A. W. Robertson, Herbert E. Rice, R. E. Waller** and **L. H. Douthit**. All were pilot graduates in the mid-1920s. **Contact:** Col. William L. Evans, USAF (Ret.), 4390 N. 125 W., Ogden, UT 84414.

Author seeks **F-16 photographs** and transparencies-particularly of aircraft operated by foreign nations, ANG aircraft, and now defunct aggressor squadrons. May be used in *F-16 in Action*, being rewritten for Squadron/Signal Publications. Contributors whose photos are used will be compensated with a copy of the book. **Contact:** Maj. Richard M. Cole, USAF (Ret.), 5549 Winford Ct., Fairfax, VA 22032-4017.

Seeking examples of air-to-ground **codes and ciphers** from World War II to Vietnam (Syko to Whiz Wheel). **Contact:** Fred Wrixon, 214 N. 7th St., Martins Ferry, OH 43935.

Collector seeks flight scarves, patches, and stickers from all squadrons and wings that have operated F-111A/D/E/F/Gs, EF-111As, and **FB-111As**. Willing to trade scarves from the 55th Fighter Squadron, 715th Bomb Squadron, and 390th Electronic Combat Squadron for other F-111 scarves. Also seeking a 55th FS seventy-fifth anniversary patch. **Contact:** Curtis J. Lenz, 32 June St., Nashua, NH 03060-5345.

Seeking contact with former members of the **460th Tactical Reconnaissance Wing**, Tan Son Nhut AB, South Vietnam, February 1966 to August 1971. Photos and personal stories are needed for comprehensive unit history. **Contact:** Bill Spidle, 5008 Sparrows Point, Plano, TX 75023.

Seeking contact with or information on **Ronald Byrd**, an Air Force veteran from Virginia who was stationed at Brize Norton and Upper Heyford, England, from 1953 to 1955. He is approximately sixty years old. **Contact:** Hilary Jane Aldis, 3 Moody Rd., Hill Head, Fareham Hants, PO14 2BP, England.

Seeking World War II veterans of the **81st Fighter Squadron**, 50th Fighter Group (P-47s). Personal accounts and photograph copies are needed for a unit history. Information on Joe Wilkinson, shot down June 10, 1944, is also needed. **Contact:** Robert Wilkinson, Rte. 1 Box 696, Saint Matthews, SC 29135.

Seeking contact with museums needing a World War II **Norden bombsight**. To be eligible, the recipient must not already have a Norden bombsight, must be an established institution expected to remain in existence permanently, and must safeguard the bombsight and display it under suitable security. I also have a Bombardiers' Information File, the "bible" of World War II and Korean War bombardiers. It can be donated with the bombsight. **Contact:** Capt. Reginald H. Thayer, Jr., USAF (Ret.), 15 Closter Rd., Palisades, NY 10964.

Seeking serial numbers and photos of the airframes of four dismantled **Me-262** jet aircraft. This information is required for a book on captured enemy equipment, *War Prizes*. **Contact:** Norman Malayney, 519 Semple St., Pittsburgh, PA 15213-4315.

Collector wants to trade **colored slides** and photographs of any type of military aircraft. **Contact:** Demet Duyar, TBMM Bloklari, B-Blok, 1, Telsizles, Ankara, Turkey.

Seeking contact with **Debbie Rubenstein**. Her father, Colonel Rubenstein, was stationed at Langley AFB, Va., from 1969 to 1970. **Contact:** Kathy Riley Crawford, P. O. Box 1945, Anna Maria, FL 34216.

Seeking contact with anyone who can lend good quality photographs, negatives, or color slides depicting the mission markings on **305th ARW EC-135Ls #61-0269** and **#61-0283** following their involvement in Desert Storm. I believe these markings were removed shortly after their return to Grissom AFB, Ind., in March 1991. **Contact:** Robert Archer, 36 Longacre Gardens, Bury St., Edmunds, Suffolk IP33 2DX, England.

Seeking **identification models** of aircraft from World War II to present, all scales and countries of issue; Kix Cereal promotional 1/432 aircraft models; and Wings cigarette cards and albums depicting aircraft. **Contact:** James A. Dorst, 115 Beach Rd., Hampton, VA 23664-2054.

Seeking contact with graduates and nongrads of **1947C starter training** at Randolph AFB, Tex., September 1946. The class was known as the "Guinea Pigs." **Contact:** William R. Forrester, Jr., 304 Lynch St., Edgefield, SC 29824-1238.

Seeking information and history on **Birch Military Airfield** near Colchester, England. Also seeking contact with members of the following units that visited Birch between 1942 and 1945: 13th

Replacement Control Depot Squadron, 308th Station Complement Squadron, 315th Station Complement Squadron, 843d Engineer Aviation Battalion, 846th Engineer Aviation Battalion, 852d Engineer Aviation Battalion, and 862d Engineer Aviation Battalion. **Contact:** P. R. Trout, 203 Grove Rd., Tiptree, Nr. Colchester, Essex C05 0JB, England.

Seeking contact with German survivors and American airmen who participated in a **World War II rescue** of crewmen from the destroyer *Roma* on September 10, 1943. B-24 Liberators were also involved. All the German crewmen and sixty-nine Italian seamen were taken to San Raphael, Italy, at noon the following day. **Contact:** George R. Delgado, 1820 Delki St. N. W., Palm Bay, FL 32907.

Seeking contact with a **pilot who crashed in Laos** in August or September 1965. The plane went down in the province called Houaphanh or Samneoun, close to the North Vietnam border. The pilot ejected and landed in a field. My father hid him in a field for half a day. My father was short, bald, and stout, with a very red face, and wore a red sash around his waist. The pilot was rescued by helicopter. **Contact:** Phong Lor, E1203 Longfellow, Spokane, WA 99207.

Seeking information on **Lt. William "Bill" Jakeway**, an Army Airways Communications Service officer who arrived in the CBI theater in June 1945. He was a member of Cohn's "22 Tigers" platoon and attended the University of Iowa in 1943. **Contact:** 1st Lt. John W. Hardebeck, 7430 Jackson Dr., San Diego, CA 92119.

Seeking contact with members of the **36th, 48th, 50th, and 406th Fighter Groups** for a book on the Republic P-47 Thunderbolt. Stories, historical material, and photos of their units during combat in World War II are needed. All material will be copied and returned. **Contact:** William N. Hess, 11706 Meadowtrail Ln., Stafford, TX 77477.

Seeking contact with relatives of former military personnel who served with the **2d Air Division,** 8th Air Force, during World War II. The 2d AD was stationed near Norwich, England, from 1942 to 1945 and made bombing raids over Europe. **Contact:** Billy Sheely Johnson, President, Heritage League of 2d Air Division, 600 Sandhurst Dr., Petersburg, VA 23805.

Seeking **old issues of AIR FORCE Magazine** from the early 1950s to the late 1960s. **Contact:** Pete Hjelmstad, Jr., 237 Shirley St., Waco, TX 76705.

Seeking information on **Charles D. Wilson,** who was stationed with the 433d Tactical Fighter Squadron, 8th TFW, Ubon RTAFB, Thailand, in 1968. His home at the time was near Corinith, Ky. His last known duty was at George AFB, Calif. **Contact:** Wendell Wray, Rte. 2, Box 145, Quincy, IL 62301. ■

If you need information on an individual, unit, or aircraft, or if you want to collect, donate, or trade USAF-related items, write to "Bulletin Board," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Letters should be brief and typewritten; we reserve the right to condense them as necessary. We cannot acknowledge receipt of letters. Unsigned letters, items or services for sale or otherwise intended to bring in money, and photographs will not be used or returned.—THE EDITORS

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30-34	250,000	187,500	125,000	40,000	5,000
35-39	180,000	135,000	90,000	30,000	5,000
40-44	100,000	75,000	50,000	20,000	5,000
45-49	60,000	45,000	30,000	10,000	5,000
50-54	40,000	30,000	20,000	7,500	5,000
55-59	28,000	21,000	14,000	5,000	5,000
60-64	18,000	13,500	9,000	3,000	5,000
65-69	8,000	6,000	4,000	2,000	5,000
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75-79	4,000	3,000	2,000	1,000	5,000
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Daytime Phone: _____ Social Security #: _____ Date of birth: _____ Height: _____ Weight: _____
Area code/Number Month/Day/Year

Primary beneficiary: _____
Name/Relationship

Secondary beneficiary: _____
Name/Relationship

In the past twelve months, I ☐ have ☐ have not used any tobacco products.

This insurance can only be issued to AFA members. Please check the appropriate box below:
☐ I enclose $25 for annual AFA membership dues (includes $18 for subscription to Air Force Magazine). ☐ I am currently an AFA member.

Please issue coverage as follows: ☐ Member Only ☐ Member and dependents

(Please select your preferred payment frequency and indicate the correct premium amount.)

Plan of Insurance	**Standard**		**High Option**		**High Option Plus**	
	Member Only	w/Dependents	Member Only	w/Dependents	Member Only	w/Dependents
Monthly Government allotment. I enclose 2 months premium to cover the necessary period for my allotment (payable to Air Force Association) to be established.	☐ $10.00	☐ $12.50	☐ $15.00	☐ $17.50	☐ $20.00	☐ $22.50
Quarterly. I enclose amount checked.	☐ $30.00	☐ $37.50	☐ $45.00	☐ $52.50	☐ $60.00	☐ $67.50
Semi-Annually. I enclose amount checked.	☐ $60.00	☐ $75.00	☐ $90.00	☐ $105.00	☐ $120.00	☐ $135.00
Annually. I enclose amount checked.	☐ $120.00	☐ $150.00	☐ $180.00	☐ $210.00	☐ $240.00	☐ $270.00

I am currently insured under the ☐ Standard ☐ High Option Plan. My certification number is _____.
Please increase my coverage to the ☐ High Option ☐ High Option Plus Plan.

☐ Monthly Government allotment. I enclose 2 months premium to cover the necessary period for my allotment (payable to Air Force Association) to be established.
☐ AFA Visa or AFA MasterCard No._____ Expiration date_____ ☐ Monthly ☐ Quarterly ☐ Semi-annually ☐ Annually

Names of Dependents to be insured, relationship, DOB, height, weight

_____

_____

The following questions should be answered for you and any dependents for whom you are requesting coverage:

1) Have you been hospitalized during the preceding 90 days? ☐ Yes ☐ No
2) In the past three years, have you received treatment or been told you had:
a. cancer, leukemia, Hodgkins Disease, or other associated malignancies? ☐ Yes ☐ No
b. heart disease, stroke, or other cardiovascular disease? ☐ Yes ☐ No
3) Within the past two years, have you had persistent cough, pneumonia, chest discomfort, muscle weakness, unexplained weight loss of ten pounds or more, swollen glands, patches in mouth, visual disturbance, recurring diarrhea, fever, or infection? ☐ Yes ☐ No
4) Has any application made by you for life or health insurance been declined, postponed or issued other than as applied for? ☐ Yes ☐ No
5) Are you receiving, entitled to receive or would be entitled to receive upon timely application any benefits due to sickness or injury (other than medical expense benefits) under any private policy or plan or government program, whether insured or non-insured? ☐ Yes ☐ No

If you answered "Yes" to any of the above questions, please give the names of the persons to whom your answer applies and provide details, dates, diagnosis, treatment and the names and addresses of the health care provider(s) and hospital(s). Use additional sheets of paper if necessary.

_____

_____

Information in this application, a copy of which shall be attached to and made a part of my certificate when issued, is given to obtain the plan requested and is true and complete to the best of my knowledge and belief. I agree that no insurance will be effective until a certificate has been issued and the initial premium paid. I understand that the coverage will not become effective until approved by MetLife.

I understand that if on the Effective Date I am not eligible for such insurance by reasons of (i) age or (ii) membership status, insurance will not become effective on my life. "Hospitalized" means inpatient confinement for: hospital care, hospice care, or care in an intermediate or long-term care facility. It also includes outpatient hospital care for chemotherapy, radiation therapy, or dialysis treatment.

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Member's Signature _____ Date _____ 19_____

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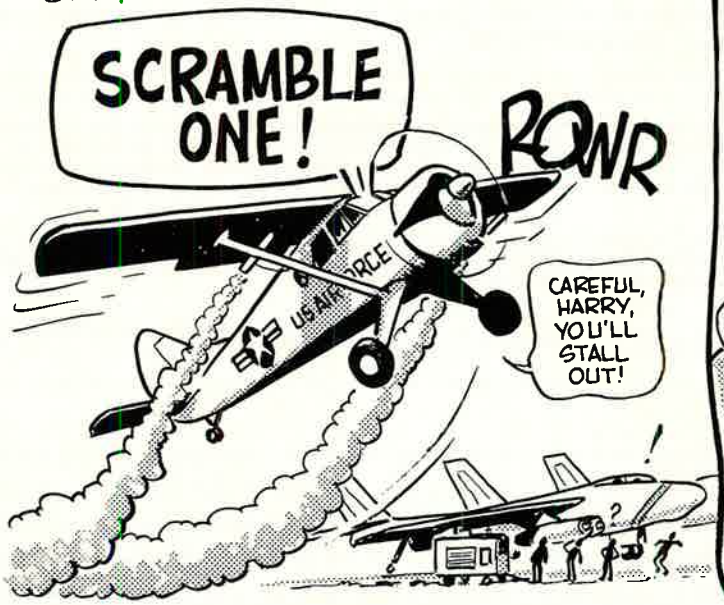

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This is precisely the strength of America's F-22 Advanced Tactical Fighter.

The F-22 has the remarkable ability to clear the 21st century airspace of enemy aircraft and protect friendly forces, while keeping ownership cost low.

It arrives in theater ready to fight using airlift requirements that are less than half of those currently in the inventory. It also requires fewer support personnel. Once airborne, the F-22 dominates anything in the sky through low observability, advanced avionics, supercruise, thrust vectoring, and revolutionary F119 engines.

Because of the F-22, the United States' ability to achieve and maintain air superiority in the 21st century is secure and affordable.

You're Pushing Mach 1, In Total Darkness At 200 Feet.

No problem. You're in a McDonnell Douglas F-15E—a fighter with avionics so advanced, it can elude adversaries by flying incredibly fast at alarmingly low altitudes. The F-15E is the world's premier multirole fighter. It was instrumental in destroying Scud missiles and launchers during Desert Storm. And it's just one in a long line of McDonnell Douglas success stories—from the revolutionary C-17 to the dependable Delta Rocket. It's this record of proven performers that has made us a world leader in aerospace technology.

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