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AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

The Warthog Round at Gunsmoke

March 1992, Vol. 75, No. 3

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About the cover: An A-10 from the 354th Fighter Wing, Myrtle Beach AFB, S. C., prepares for a bombing sortie during Gunsmoke '91. With the LASTE upgrade, A-10 units took three of the top seven spots, faring better than units with higher-technology aircraft. Staff photo by Guy Aceto.

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Once again, the Air Force shatters another speed record.

1918

The SPAD S.XIII was the U.S.A.'s fastest (139 mph) pursuit plane of World War I.

1924

The Curtiss PW-8 was the first aircraft fast enough to make it from coast to coast between dawn and dusk.

1926

Dubbed the "fastest pursuit in the world," the Curtiss P-6 Hawk was among the first to test turbo-chargers.

1939

Aptly nicknamed Lightning, the Lockheed P-38 was the first to cross the U.S. in just 7 hours.

1944

The Republic P-47 Thunderbolt was the first propeller-driven aircraft to exceed 500 mph in level flight.

1944

Originally built for the RAF, the North American P-51 Mustang could outrun all its contemporaries.

1949

The Republic XF-91 Thunderceptor used 4 rocket motors to pass the "century mark"—1000 mph.

1953

The North American F-86 Sabre captured three world speed records between 1948 and 1953.

1955

First U.S. supersonic fighter, the North American F-100 Super Sabre pushed the world record past 800 mph.

1958

Called the "missile with a man in it," Lockheed's F-104 set records for altitude (91,000') and speed (1403 mph).

1959

A new world record of 1525 mph was set in December by the Convair F-106 Delta Dart.

1961

Still in service after 30 years, McDonnell Douglass' F-4 Phantom II moved the world record to 1600 mph.

1935

Boeing's P-26 'Peashooter,' America's first all-metal monoplane, topped speeds of 230 mph.

1938

The Curtiss P-36 test-dove at 500+ mph, and later downed several attackers at Pearl Harbor.

1938

The turbo-charged Bell P-39, prototype of the Airacobra, achieved flying speeds of 400 mph.

1945

Never put into service, the Northrop XP-56 flew above 400 mph, powered by a 2000-hp radial engine.

1947

The Lockheed P-80 Shooting Star set a world speed record of 623 mph, and was a great success in Korea.

1948

Two Mustang fuselages sharing one wing, the North American F-82 was the first to fly Hawaii to NYC nonstop.

1956

At its debut, the Convair B-58 Hustler topped 1300 mph, unprecedented for a plane of its size.

1957

Heaviest of the "Century Series" fighters, the McDonnell F-101 Voodoo pushed the world record to 1207 mph.

1992

The time it takes to acquire a Sun™ SPARCstation™ 2 system suddenly drops from months to days.

1975

Lockheed's SR-71A Blackbird spy plane set 12 world records, routinely exceeding 2000 mph.

1975

The McDonnell Douglass F-15 Streak Eagle climbs to 98,424' in a record 207.8 seconds.

The Air Force has broken more speed records than you can shake a joystick at. But here's one that's long overdue:

Instead of waiting months to procure an ordinary desktop computer, you can now get a Sun SPARCstation 2 (the world's most popular UNIX workstation) in a matter of days. And at a price that's something of a record itself. To learn more, call (800) 247-8111, and ask about Sun's Tactical Air Forces-Workstation contract.

Sun Microsystems Federal, Inc.

Editorial

By John T. Correll, Editor in Chief

The Source Tax

A RETIRED Air Force officer worked for twenty years in the Washington office of a California firm before retiring for the second time. Naturally enough (or so it seemed), he paid taxes on his annuities to the District of Columbia.

Imagine his surprise, then, when California sent him an $11,000 bill for overdue taxes, penalties, and interest. He lived in California years ago, and the source of his second pension was a company headquartered there. After six months of writing and calling, he reached an ombudsman, who has promised to help.

The plight of Gertrude Eberly, aged seventy-two, generated speeches in Congress. Nine years after Mrs. Eberly retired and moved to Nevada, California hit her for $4,000 in delinquent taxes on her pension but allowed her to make installment payments of $50 a month on her debt. Mrs. Eberly lived on less than $13,000 a year.

The "source tax" is a new trick state legislatures have found to raise money without risking complaints from their own voters. They assess pension income derived from a source within the state, whether the taxpayer lives there or not.

It is not entirely clear which forms of income are vulnerable. Making contributions to an Individual Retirement Account while living in a state, for example, may set former residents up for a source tax later.

Incredibly, this is perfectly legal, based on a 1920 Supreme Court ruling about oil lease revenues. Thirty-two states have source tax laws on their books, but they were seldom used before computers made it easy to track down annuitants.

The implications are chilling for military retirees, who may—through no choice of their own—have lived in a dozen locations in the course of their military careers.

Various groups are circulating long lists of states said to have source taxes. Some of these lists are inaccurate, but a quick telephone survey establishes that at least half a dozen states tax nonresident pensioners. The most aggressive is California, which raises $10 million annually from nonresident pensioners and whose windfall is an inspiration for other states.

Retirees who live (and vote) in other states make ideal targets.

The source taxers tend to nail their victims singly as they find them. Notices show up in new mailboxes daily. California hires collection agencies, files liens, and adds a fifty-five percent penalty and daily interest to the bills it presents after the passage of time. Many—but not all—of the targets are retirees who moved to states that have no income tax.

Concerned by the spreading trend, the Air Force Association and other organizations in the Military Coalition back legislation that would prohibit "source taxing" of pensions.

"With regard to military personnel and some federal retirees, oftentimes the only reason they were ever in the taxing state was as a result of their federal employment," the Coalition said in a recent statement.

"Additionally, these people are subjected to multiple moves during the course of their careers, often living and working in several different states. Under the source taxing authority presently extant in these states, it is entirely possible that at the end of their careers, these people could have source taxes applied on their retired incomes by each of these states simultaneously and yet not reside in any of them."

The individual who has done most to bring this outrage to light is William C. Hoffman, who heads Retirees to Eliminate State Income Source Tax (RESIST). Thirty-four organizations, including the Air Force Association, have joined Hoffman's campaign.

Strangely, the American Association for Retired Persons is not among them. AARP "discourages" source taxes at the state level but does not support a "federal remedy." A spokesman told AIR FORCE Magazine that AARP opposes double taxation but feels that states are justified in taxing the pensions of former residents who move to states without an income tax.

It is difficult for retirees to "discourage" policies in states where they cannot vote. California demonstrated that when RESIST's Hoffman and a delegation that included an AFA representative arrived to testify on source tax to the state's Revenue and Taxation Committee.

They were told curtly that the body had no time for them. The committee had more pressing interests: a two-hour pitch on tax exemptions for businesses that grow ostriches for food, after which it adjourned for an ostrich barbecue.

Legislatures are strapped for money, but an interstate shakedown of each other's senior citizens is intolerable. This is a classic case where a "federal solution" is indicated, and the sooner Congress imposes one, the better.

Letters

Thunder in Perspective

In "From Vietnam to Desert Storm" *[January 1992, p. 71]*, Rolling Thunder is disparaged as "bankrupt." To show Rolling Thunder in its proper perspective, consider the following: A planning group was assembled at Hq. CINCPAC shortly after hostilities commenced in Vietnam. It comprised members from CINCPAC staff, Hq. PACAF, CINCPACFLT, USARPAC, and FMFPAC [Fleet Marine Forces Pacific].

J-35, war game branch, CINCPAC staff (where I was assigned), determined the number of sorties required to achieve desired damage levels and determined the attendant weapon loads. The loads were based on available munitions. Those quantities were obtained from Lt. Col. Robinson Risner, USAF, who monitored worldwide USAF munitions for CINCPAC (initially Adm. Harry D. Felt, USN; then Adm. U. S. Grant Sharp, USN).

The figures generated by J-35 were provided to the group, where the plan evolved. Rolling Thunder, as presented to CINCPAC, was an air operation to be completed in two weeks. It was never "envisaged [as a] measured application of airpower gradually increasing in intensity," as the article stated. That was the unfortunate decision made by "Foggy Bottom," and it enabled North Vietnam to grow from a relatively lightly defended country to a highly sophisticated, multiweapon-system environment. That decision and its consequences cost the US dearly in aircraft and, tragically and unnecessarily, aircrews.

Col. Peter E. Boyes,
USAF (Ret.)
Rancho Murieta, Calif.

The Painful Drawdown

In "Drawdown and Pain" *[January 1992, p. 38]*, Bruce Callander wrote, "So far, the pain has been felt largely by a small number of Air Force members forced to retire earlier than they had planned."

I do not know his source, but all the members I've talked with have expressed the same sentiments of apprehension, disappointment, anger, and resentment. For those who cannot retire, the Voluntary Separation Incentive does not seem to be an acceptable substitute for continued service.

Col. Frank Schnekser,
USAF (Ret.)
Murrells Inlet, S. C.

"Only" a Silver Star

I feel I must respond to the letter written by Maj. Patrick M. St. Romain regarding "discrimination" against helicopter pilots *["Credit the Helicopters," December 1991 "Letters," p. 7]*. Although Major St. Romain begins his letter by asserting that he does not "want to take anything away from Capt. Paul Johnson of the 354th Tactical Fighter Wing," he does just that by implying that the role of the A-10 was somehow less than that of the rescue helicopter. I cannot help but feel that he has somehow missed the point of a rescue team effort.

When I flew combat search-and-rescue missions in southeast Asia, we in the SAR business knew that one component could not do the job without the other. Each participant in the SAR had his own role. The airborne rescue coordinator was the link from the various headquarters to the other airborne participants. The FAC (if available) often coordinated airstrikes in the surrounding threat areas. The "Sandys" as on-scene commanders (in this case, Captain Johnson and his A-10 flight) would locate the survivor, determine and eliminate the threat, and coordinate with the Jolly Greens to effect the pickup. There was never an assertion that one was more, or less, important than the other.

To read Major St. Romain's question, "Is this just one more example of the difference between 'bonus boys' (stiff-wing) and the 'helicopter force' (fling wing)?", causes me to reflect on the mutual admiration that existed between the Sandys and the Jollys of my day. Major St. Romain's apparent attitude was nonexistent. To a man, the Jollys had the attitude that said, "Show us the way, Sandy, and we'll follow you anywhere."

Combat is inherently dangerous. To infer that the relative importance of the award received for a given mission translates to the importance of the role each participant played is just plain silly.

I cannot describe the deeply emotional feeling I get when I know my actions have led to the rescue of an allied airman. It is not the award I did or did not receive, it is the comfort I have knowing that I did my job as well as I knew how. Ask the aircraft commander of the MH-53J whether he feels less about his efforts because he "only" got the Silver Star. I think I know his answer.

Lt. Col. Byron E. Hukee,
USAF
Logan, Utah

Night Fighters Remembered

"Night Fighters" *[January 1992, p. 84]* was a most pleasant surprise. I did not know that AIR FORCE Magazine was intending to do any coverage on us, nor did I believe that anyone except ourselves had any interest in our elite group of airmen. Like our mission during World War II, your article was a closely held secret.

Mentioning that Lt. Herman Ernst and his radar observer were aces made the omission of another crew, Paul A. Smith and his RO Bob Tierney, very noticeable. They were the highest-scoring night fighter aces in Europe, with seven confirmed victories.

Another night fighting Smith, Carrol C., or "Snuffy," commander of the 418th Night Fighter Squadron in the

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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Letters

Pacific, and his RO, Phil Porter, are also credited with seven kills. They got four in one night.

I have recently confirmed an interesting fact concerning night fighter ground controlled intercepts. They were originally set up for controlling us on individual or very small flights, and it was not until later, specifically in Europe, that they began controlling a large number of aircraft. . . .

Lt. Col. Frank L. Bosch,
USAF (Ret.)
WW II Night Fighters
Annandale, Va.

Kudos to John L. Frisbee for his excellent "Night Fighters." It has been almost fifty years since Lt. Col. Winston W. Kratz's article on this type of warfare, "Night Fighters—Commandos of the Air," appeared in your magazine *[January 1944, p. 9]*. Now deceased, "Winkie," as he was known in the night fighter world, commanded the 481st Operational Training Group, whose squadrons, the 348th, 349th, 420th, and 424th Night Fighter Squadrons, were responsible for training the sixteen night fighter squadrons that operated in the Pacific, ETO, and CBI.

It was very appropriate, and of historical significance, that USAF selected the World War II designators of the 415th, 416th, and 417th Night Fighter Squadrons for the F-117A Stealth fighter squadrons. The 37th Tactical Fighter Wing's three tactical fighter squadrons played a prominent role in Desert Storm. The 417th provided training support for the 415th and 416th, who were again demonstrating tactics and techniques of night electronic warfare—this time in a much more sophisticated and devastating manner.

Lt. Col. Don Flaherty,
USAF (Ret.)
Albuquerque, N. M.

It is always a pleasure to see a picture taken by oneself published in such a fine periodical as AIR FORCE Magazine.

The crewmen standing on the F-15A Reporter in the picture on p. 87 of the January issue are Lts. John Biddle and Robert Brown. The photo was taken while they were preparing for a functional flight check out of Clark AB, the Philippines, in the spring of 1948. I cannot identify the airman in the foreground.

The aircraft and crews were a detachment of the 8th Photoreconnaissance Squadron (Johnson AB, Japan), participating in the Post-Hostilities Low-Level Mapping Program in the Philippines.

Maj. Anthony T. Linkiewicz,
USAF (Ret.)
Ventura, Calif.

Understanding G-LOC

I just finished Robert van Patten's "G-Lock and the Fighter Jock" *[October 1991, p. 50]*. Excellent! I found his presentation outstandingly clear and highly understandable.

As a Reserve officer, I am assigned to the San Antonio Air Logistics Center, Kelly AFB, Tex. As a stress expert, I am periodically asked to lead stress briefings for a range of Reserve and active-duty audiences. In that role, I first learned about the G-LOC issue seven years ago from a friend who commands an F-16 unit. He had me sit through a TAC fighter briefing over at Brooks Aerospace Medicine Center about that time, and it gave me an enriched perspective to complement my briefings. The van Patten article brings an important issue to the wide-ranging aerospace audience you reach.

Lt. Col. James Campbell Quick,
AFRES
Arlington, Tex.

"G-Locked" Out

As an aerospace physiologist who has worked in the USAF Centrifuge Training Program for some time, I read "G-Lock and the Fighter Jock" with great interest. While I appreciate the exposure and impact such an article provides, I must point out several inaccuracies contained in it.

The classroom lecture is always taught by an Aerospace Physiology Officer (APO), never by a flight surgeon. A physiology tech coaches the student in the centrifuge, and the APO, not the flight surgeon, debriefs the student by replaying his videotape and analyzing his performance. There is always a flight surgeon in the building during "spinning," and their support is essential. However, they are present to treat any injuries that may occur to students, not to train them. Also, the "pilot" pictured on p. 51 experiencing G-induced loss of consciousness (G-LOC) is actually a former physiology tech at Holloman AFB, N. M. All APOs, techs, and flight surgeons at Holloman have to meet TAC centrifuge standards, just like aircrews.

The pilot pictured on p. 53 is wearing Combat Edge, a positive pressure breathing system designed to enhance G-tolerance, not just an anti-G suit. Combat Edge is scheduled to go to F-16s in FY 1992, followed by F-15s. No other current USAF airplane will have a Combat Edge system.

Finally, G-LOC is not just a problem for F-16 drivers. G-LOC mishaps have been documented in every current USAF fighter-attack-reconnaissance airplane, and every TAC aircrew member is required to attend centrifuge training at Holloman.

It would be an injustice to the APOs and techs who have worked the program if they were not credited for their efforts.

1st Lt. Thomas B. Walker,
USAF
Holloman AFB, N. M.

Pucket's Courage

The leadership of the 98th Bomb Group (H) Association has asked me to respond to E. P. Morgan's distasteful letter on Don Pucket's Medal of Honor *["Pucket at Ploesti," November 1991 "Letters," p. 12]*. Don Pucket was my squadron mate (343d Bomb Squadron, 98th Bomb Group) and flew many missions with me as tail-end Charlie in my box. Time and time again, he showed himself to be a courageous aircraft commander with a gallant crew.

On May 29, 1944, I brought him back from Wiener Neustadt, Austria, when air-to-air rockets took out his number three engine. He had no electricity, and only his waist guns were operative. I "wig-wagged" him to get up under my tail turret, which he did so well that the brass from my tail guns broke his windshield.

Both our aircraft made it home that day. Three Ju-88s did not. I went down on my next mission, and Don went in a little later. His crew—those who got out—put him in for the Medal of Honor when they returned from a Romanian POW camp. I know the whole story all too well. Don deserved every decoration he got and richly so. . . .

Alexander MacArthur
Barrington Hills, Ill.

A Brat at Pearl Harbor

As a seventeen-year-old Air Corps brat living at Hickam Field, Hawaii, on December 7, 1941, I obviously let my curiosity get the better of my fear because I spent the morning watching the attack from the roof of our quarters. Among the many details etched in my memory was the sight of a B-17 on final approach being shot up by Japanese fighters. Then I read "Shot Down at Pearl Harbor" *[December 1991, p. 72]* and realized I had a sequel that your readers may enjoy.

Since the Honolulu schools closed down for several weeks after the attack, I decided to keep busy by working at Tripler Hospital, which was sorely pressed in caring for the wounded. My job consisted of carrying bedpans, feeding and shaving the patients, and anything else I was directed to do. Among the patients in my ward was Aviation Cadet Beale, the bombardier on Lt. Ernest L. Reid's crew. Beale was my favorite patient because his story made him a hero in my eyes.

According to Beale, he evacuated the burning aircraft as soon as it stopped and ran for the hangar line. He realized that he had not secured his Norden bombsight—a major violation of the training he had received in bombardier school. This highly classified equipment was to be protected at all costs. He ran back to the plane, placed the bombsight in its carrying case, and was running back to the hangars when his thigh was shattered by a strafing aircraft.

When I met Beale at Tripler, he was in a cast from waist to toes. I felt honored to be at his bedside when he simultaneously received the Purple Heart and his commission as a second lieutenant. You bet I remember Pearl Harbor and that B-17.

Col. Robert F. Hegenberger,
USAF (Ret.)
Colorado Springs, Colo.

What Is AFA?

As a charter member of the Air Force Association I could not help but chuckle at the statement AFA uses periodically to identify itself. *["This Is AFA," November 1991, p. 99.]* It reads as follows:

"The Air Force Association is an independent, nonprofit, aerospace organization serving no personal, political, or commercial interests; established January 26, 1946; incorporated February 4, 1946."

In my opinion, the above statement is as obsolete as the airplanes flown in 1946. If AFA desires to have its identification statement honestly reflect its current activity, it should revise the statement to read as follows:

"The Air Force Association is an independent, nonprofit, aerospace organization serving the special interests of Air Force personnel and the aerospace industry by fostering political action to promote such interests."

I am all for what AFA does, but I think we should be more open about what we do rather than make misleading statements about what we don't do.

Col. Peter P. Dawson,
USAF (Ret.)
La Verne, Calif.

The Chart Page

Edited by Tamar A. Mehuron, Associate Editor

Characteristics for Nuclear Weapon Systems, Circa 2006

Key:
MM: Minuteman ICBM
SICBM: Small ICBM
ALCM: Air-launched cruise missile
SLCM: Sea-launched cruise missile
SRAM: Short-range attack missile
ACM: Advanced cruise missile
SS: US designation for Soviet ICBM
SS-N: US designation for Soviet SLBM
n.a.: Not applicable

	Weapon	Throw-weight (kilograms)	Yield per warhead (kilotons)	Circular error probable (meters)	Single-warhead kill probability	Two-warhead kill probability: No fratricide	Two-warhead kill probability: Fratricide
US WEAPONS	MM III	1,100	170	200	.26	.45	.39
	MM IIIA	1,100	335	200	.36	.59	.49
	Peacekeeper	3,600	300	100	.76	.94	.92
	SICBM	600	500	150	.65	.88	.79
	D5/Mark 5	2,400	475	150	.59	.83	.73
	D5/Mark 4	2,400	100	150	.31	.52	.43
	C4	1,400	100	300	.09	.17	.16
	ALCM	n.a.	200	100	.69	.90	.84
	SLCM	n.a.	200	100	.69	.90	.84
	SRAM	n.a.	200	350	.11	.21	.20
	ACM	n.a.	200	100	.69	.90	.84
	SRAM II	n.a.	200	100	.69	.90	.84
	Bomb	n.a.	1,000	150	.81	.96	.93
SOVIET WEAPONS	SS-24	3,600	100	150	.50	.75	.63
	SS-25	1,400	550	150	.80	.96	.92
	SS-18	7,600	500	150	.79	.95	.91
	SS-19	3,400	550	150	.75	.94	.89
	SS-17	2,700	500	150	.74	.93	.88
	SS-N-20	1,800	200	350	.18	.33	.30
	SS-N-23	1,800	200	350	.18	.33	.30
	SS-N-18	1,100	200	350	.17	.31	.28

Uncertainty about the capabilities of strategic weapons has long sparked heated debate. Breakup of the USSR puts the debate in a drastically new light, but many current weapon types probably will be deployed for years. The Congressional Budget Office recently estimated the capabilities of major systems fifteen years hence. The CBO report assumes that by 2006, SS-N-20 and SS-N-23 warhead yields could increase to 200 kilotons from current estimated values of 100 kilotons. Single-warhead kill probability incorporates net reliability plus accuracy plus yield.

Source: Congressional Budget Office, *The Start Treaty and Beyond*, October 1991.

Capitol Hill

By Brian Green, Congressional Editor

The $50 Billion Drop

The Pentagon's 1992–97 six-year defense budget has been chopped and rearranged once again.

Secretary of Defense Dick Cheney gave Congress a chopped and reshaped Fiscal Year 1993 national defense budget that seeks $280.9 billion in spending authority.

That figure represents a real, inflation-adjusted decline of $10 billion from Fiscal 1992 levels—a one-year drop of seven percent. Moreover, it is $8 billion less than the amount that planners had projected only a few months ago. If Congress approved the new budget without change, defense authority in 1993 would come out thirty percent below Fiscal 1985.

Fiscal 1993 begins October 1. "Budget authority" is the amount of money that the services and agencies can obligate for operations, hardware, construction, research, and personnel in 1993 or ensuing years. Total outlays—the amount of money that actually will be paid out in Fiscal 1993—is pegged at $285.9 billion.

A percentage of the loss in this year's plan stems from new inflation assumptions, but the real, additional cut in the basic defense program is huge: $50.4 billion through 1997.

The Air Force's share of the Fiscal 1993 budget is $83.9 billion, a modest increase over 1992. Secretary Cheney's proposal, submitted in late January, is built around deep reductions in the size of the strategic nuclear force, major terminations of military programs, and savings projected as a result of a significant change in defense acquisition.

Under the 1993 plan, the US would terminate virtually all current strategic nuclear modernization programs, including the Small ICBM and its mobile launcher and the mobility portion of the Peacekeeper ICBM. The Air Force, which had planned to buy 1,000 stealthy advanced cruise missiles, would stop at only 640.

The Secretary called on Congress to approve $4 billion to finance production of four more B-2 Stealth bombers but to terminate the big bomber program after that buy. That would leave the US with a total of twenty aircraft, well short of the planned fleet of seventy-five B-2s. The Pentagon chief argued that halting the B-2 was part of efforts to induce restraint in the nuclear-armed states of the late USSR.

In addition to these program actions, the new budget also incorporates President Bush's strategic nuclear force reduction initiative, announced during his State of the Union message. These include eliminating the existing force of fifty silo-based Peacekeeper ICBMs, reducing the Minuteman III ICBM's load from three warheads to one, and removing from service about one-third of warheads based at sea on strategic submarines. These steps—to be taken only if Russia reciprocates—would reduce "accountable" US strategic warhead totals from about 13,000 in 1990 and about 9,500 under the START agreement to about 4,700.

Many of the remaining B-52H, B-1B, and B-2 bombers would be converted from strategic nuclear to conventional use. Gen. Colin Powell, Chairman of the Joint Chiefs of Staff, said that the bombers might still count as strategic systems under future arms-control counting rules.

The new acquisition approach focuses more on carrying out research and development of advanced technologies for weapon systems but would defer full-scale production of weapon systems based on these technologies. High-rate production would occur only after a technology had been proven, a relevant threat had emerged, and the technology was shown to be a cost-effective solution to the threat.

Deputy Secretary of Defense Donald Atwood noted that the new approach involves prototyping, extensive exploration of manufacturing technologies, and acquisition of a number of test articles to gain some operational experience with a system.

Still, contractors must recognize that the future will see production of far fewer new systems, according to the Deputy Secretary, and not "buy into" an R&D program expecting to recoup losses during a large procurement run. He advocated eliminating fixed-price contracts for programs involving technical risk and moving toward "cost plus" contracts.

Some major Air Force programs did well in the recent Pentagon budget deliberations. Funding requested for the C-17 is $2.9 billion; for the F-22 Advanced Tactical Fighter engineering and manufacturing development, $2.2 billion; for the E-8 Joint STARS aircraft, $700 million; and for the Milstar satellite, $1.3 billion.

The health of the F-22 program was attributed by Secretary Cheney and Deputy Secretary Atwood to the successful prototype program, the lack of technical problems, the extended development time before it would enter service, the age of the USAF air-superiority fighter fleet, and the importance of air superiority to successful military operations.

Twenty-four F-16s are funded in the budget, but, as planned, procurement would stop after Fiscal 1993.

The reinvigorated Strategic Defense Initiative ballistic missile defense effort was funded at $5.4 billion.

Active-duty personnel will be reduced at a somewhat steeper slope in Fiscal 1993 than was originally anticipated. General Powell attributed this acceleration to the slower-than-expected manpower reductions in Fiscal 1991 and 1992, the result of the demands of the Persian Gulf War.

The Pentagon still plans to reduce the active-duty force in Fiscal 1995 to about 1.6 million, some twenty-five percent lower than the 2.2 million that the Pentagon fielded in 1987, the peak year. The Air Force will drop from 607,000 (in 1987) to 429,000 (in 1995).

National Guard and Reserve levels are slated to fall from 1.12 million to 920,000 by FY 1995. General Powell noted that the Pentagon will request the elimination of specific Guard and Reserve units that were to provide support to active-duty forces that have themselves been eliminated. ■

By **James W. Canan,** Senior Editor

Aspin's Agenda

Rep. Les Aspin has come into his own and is leading a bold assault on the underpinnings of the Pentagon's budget.

Rep. Les Aspin is at the top of his game as chairman of the House Armed Services Committee. Through most of his twenty years in Congress, the Wisconsin Democrat was known as an intellectual gadfly who never had much impact. Now he has shown another side. He can make things happen, and he is going about it this year in a very big way.

Mr. Aspin is leading a congressional assault on the Bush Administration's $267.6 billion Fiscal Year 1993 defense budget that transcends the customary battles between the two branches of government over how much money goes for defense. He is questioning the policies, strategies, and threat assessments—or lack of them—on which the Bush budget is based. He planned to preempt it with a "zero-based budget" for the weapons and forces that Congress itself decides are needed in the multipolar post-Soviet world.

His is a highly ambitious—some say presumptuous—undertaking. He outlined it at a meeting with defense reporters late last January, just before the new Pentagon budget came out. He said his committee planned to "hold hearings on our own defense budget first," a budget that would reflect "the position of the House of Representatives—at the very least, the position of the House Armed Services Committee endorsed by the House Democratic leadership."

In support of his homemade budget, Mr. Aspin has come out with position papers on such major defense topics as nuclear and conventional forces and weapons, the industrial base, and the technology base. He calls them "blueprints for the future of defense" and sees them as springboards to a defense consensus that the Democratic party and its presidential candidates can call their own.

"That's a big damn agenda," declared the Congressman. Indeed it is. It implies something that has never been done before: Congress taking the lead in shaping defense policy rather than reacting, as usual, to modify the Administration's budget on the margins. In ordinary times, the notion that Congress could succeed at such a seemingly high-handed endeavor would be laughed out of town. But the times are by no means ordinary. Amid radical geopolitical changes, Congress has a rare opportunity to steal the Administration's thunder.

Thus Mr. Aspin proposes, in the name of Congress, "a new threat-based method for shaping and sizing our new forces" in the post-Soviet world. "It is impossible to overstate the influence that the Soviet Union has had on our defense budgets," the Congressman declares. "It has driven the size and shape of the budgets and, indeed, the design of our weapons."

From the Bottom Up

The big question now, he says, is "how do we build our defense budget and forces without the old Soviet threat?" His answer: "From the bottom up, starting from scratch—not by taking the old Soviet-threat budget and forces and cutting from the top" as, he claims, the Pentagon has done.

Top Pentagon officials say Mr. Aspin has gone off on a tangent. Gen. Colin Powell, Chairman of the Joint Chiefs of Staff, contends that the latest JCS assessment of threats and the Administration's FY 1993 defense budget both begin to reflect changes in US military requirements to meet post–cold war contingencies. General Powell maintains that it is impossible to make wise judgments in a big hurry on all such requirements. Meanwhile, he says, the US "must continue to be a superpower" and must shape its forces and buy its weapons in keeping with that responsibility.

"I don't apologize for a robust force structure," the JCS Chairman declares.

Mr. Aspin claims that the Pentagon is begging the question. By the end of January, he had expressed in position papers and speeches the rationale for his threat-based budget. One paper, titled "An Approach to Sizing American Conventional Forces for the Post-Soviet Era," postulated various forces for different contingencies.

Mr. Aspin wrote, "By laying out clear linkages between force structure and the threats they deal with, perhaps we can leave behind us the old cold war politics over defense spending and build a new consensus based on a commonsense assessment of our needs."

Details were yet to come. Mr. Aspin's next step, he wrote, would be "to develop some specific options and to cost them out, so that risk can be balanced against cost. The debate over defense in the coming years can revolve around these sorts of concrete judgments about what we need to keep us safe in the new era, rather than around percentages of GNP or other non-threat-related yardsticks." He promised "systems-specific" proposals for such forces later: "how many aircraft, divisions, battle groups, and so on."

As they awaited those specifics, Mr. Aspin's detractors and some supporters suspected that he was overreaching. His harshest critics said he was mostly interested, if true to form, in preserving "pork" for his fellow Democrats. They also accused him of acting in his own political interests, of angling to become Secretary of Defense should his party capture the presidency this year.

One thing everyone seems to agree on: Mr. Aspin is far more likely to succeed at anything he undertakes than he would have been in the past. He has changed his image and now has the look of a winner. Once regarded as a leadership-baiting, free-lancing liberal who was all over the lot, Mr. Aspin is now seen more as a centrist who values consistency and consensus and who has taken firm command of his committee with telling effect.

Surpassing Senator Nunn

Mr. Aspin has also become a key figure in the Democratic power structure of the House. He is now very likely the Democratic party's top leader and spokesman—the voice of the opposition, in effect—on national defense. Over the last couple of years, he may have surpassed his only rival for that mantle, Sen. Sam Nunn (D-Ga.), chairman of the Senate Armed Services Committee.

Mr. Aspin stole a march on Senator Nunn on several big questions, such as whether the US should go to war in Operation Desert Storm, how many B-2 bombers to approve, the collapse of the Warsaw Pact and the breakup of the Soviet Union and what to do about it, and how to go about reshaping US armed forces and redirecting development and production of US weapons. As a consequence, Mr. Aspin seems to have piled up more political and analytical chits than his Senate counterpart has.

His stance on the Persian Gulf War brought him bipartisan plaudits and may have done more for him than anything else, in a political sense. All through the tense prewar period, Mr. Aspin, unlike Senator Nunn, supported President Bush's decision to forgo diplomacy and to threaten Saddam Hussein with military force. He hung tough amid angst and hand-wringing on Capitol Hill. He also predicted the allied military blowout when almost everyone else expected a tough war. He now says he would have kept the military pressure on Saddam Hussein for "a day or two longer," but he refuses to second-guess President Bush's decision to call it off when he did.

Mr. Aspin maintains that the war was justified, if for no other reason than to expose the shockingly advanced state of Iraq's nuclear weapons development program. He takes a tougher line than the Administration on rooting out Iraq's nuclear facilities. In his view, UN inspection teams should be stationed in Iraq at all times, backed up by UN military units.

Nothing seems to concern Mr. Aspin more than the prospect of nuclear weapons, nuclear technology, and nuclear scientists falling into the wrong hands. This is why he was quick to propose giving the Commonwealth of Independent States—the former Soviet Union—$1 billion to help it get through hard times and thus avert social and political chaos. He also would send US nuclear technicians and logistical gear to the CIS to help safeguard its nuclear arsenal.

Mr. Aspin's apprehensions about "loose nukes," as he calls them, prompted him to switch last year from opposing to advocating ballistic missile defenses. He led the way as the House, for the first time ever, voted to deploy a land-based antiballistic missile (ABM) system to defend the US and its overseas forces.

"Enormous changes in the military dangers we face are forcing a basic realignment of the way we think about defenses," Mr. Aspin declared. "Ballistic missile defenses look more attractive in this new world."

The Uncontested Voice

Given his increasing activity and impact, Mr. Aspin appeared to be uncontested as the voice of defense for the Democratic Congress at the beginning of this year. Senator Nunn had pretty much kept his silence. He was said to be biding his time with his own proposals until he had a better handle on what the Bush Administration intended to spend on and do about defense in FY 1993.

Some Congress-watchers noted that the reactive, cautious approach has always been a Nunn characteristic and that Mr. Aspin's more flexible turn of mind may be better suited to these turbulent times.

"Nunn was more comfortable in dealing with the cold war, with all the pieces in place," says one congressional staff member. "His strengths—and there are lots of them—lie in doing the things that have always been done and doing them better every time."

Mr. Aspin seems at his best amid turmoil. "He is one of the very best original thinkers on defense and on a lot of other things, at a time when original thinkers are clearly in demand," says a House colleague. He can also be dynamic—something you can't say for Nunn."

It took Mr. Aspin a long time to make his mark in Congress. He came to the House and to its Armed Services Committee in 1971 at age thirty-two, with eye-catching credentials as an economist and educator. A Yale graduate with advanced degrees from Oxford and MIT, he began his career in 1960 on the staff of Sen. William Proxmire (D-Wis.) and moved on to the White House as staff assistant to Walter Heller, chairman of President Kennedy's Council of Economic Advisors. He then served two years at the Pentagon as an Army officer on the staff of Defense Secretary Robert McNamara, returned to his home state to teach economics at Marquette University in Milwaukee, and was elected to Congress in 1970.

Expectations were high on Capitol Hill for this whiz kid from Wisconsin, but he never quite lived up to them. He became stereotyped as one who had a lot of ideas but never did much to put them into practice, who was more comfortable hobnobbing with strategists and theorists in the halls of academe than with fellow lawmakers on the floor of the House.

The Successful Coup

Over time, Mr. Aspin's reputation as a maverick liberal willing to do battle with the Pentagon and with the House Armed Services Committee's conservative and hawkish Democratic leadership served him well. He gained a liberal following on the committee and, on defense issues, elsewhere in the House. This enabled him to wrest the committee chairmanship from the venerable Melvin Price in January 1985, despite the pro-Price pleas of House Democratic leaders. Speaker Thomas P. "Tip" O'Neill, who had summarily removed Mr. Aspin from the House Intelligence Committee in 1981 on grounds that Mr. Aspin was "suspect" as an information-leaker, made an especially impassioned anti-Aspin pitch.

Mr. Aspin's hold on the narrowly won chairmanship soon proved slippery. His fellow liberals were wary of him. They suspected he was more of a hawk than he had let on. There were more and more signs of this. They watched him closely, waiting for him to show his true colors, not sure that they liked some of the things he was saying.

One of those things was that the Democrats had better change their antidefense image. On assuming the chairmanship, Mr. Aspin said he saw his rise to power as "a signal that the Democratic party ought to be doing some serious looking at defense." He declared, "If we want to make defense policy in the White House and the Pentagon, then we had better stand for something. The voters are not attracted to national security naysayers."

Such talk raised the level of curiosity about the stands that the new chairman would take on major defense issues, such as whether to keep producing Peacekeeper ICBMs.

Two years earlier, he opposed a move by House liberals to kill Peacekeeper and opted for compromise, approving a limited deployment of the ten-warhead ICBM in return for the Administration's agreement to begin developing the single-warhead Midgetman ICBM. He explained that he favored Peacekeeper not as a weapon but as a bargaining chip in arms-control negotiations with the Soviet Union and as a vehicle for Democrats to show that they were not soft on defense. He left the impression with anti-Peacekeeper Democrats that he would vote to kill Peacekeeper later, when the time was ripe.

He never did, and he denied that he had ever said or implied that he would. He claimed that he had managed the best possible deal for anti-Peacekeeper forces—capping deployment at fifty missiles.

He had been too soft on Peacekeeper and on the Pentagon in general to suit many of his former backers, and they turned against him. In January 1987, the Democratic Caucus unseated him with a "no-confidence" vote of 130 to 124. He fought back and regained the chairmanship two weeks later, defeating three challengers including one backed by his old nemesis Speaker O'Neill.

Mr. Aspin set about mending fences. He strengthened his partisan credentials by virtue of tough stands against a number of major Pentagon programs, notably the B-1B bomber, and by serving as a top advisor to Democratic presidential nominee Michael Dukakis through most of 1988.

The Collegial Approach

After Mr. Dukakis went down to defeat, Mr. Aspin seemed detached. To some observers, it appeared that his heart wasn't in the work of drafting the FY 1990 defense authorization bill. There was speculation that he had seen himself as Secretary of Defense in a Dukakis Administration and had gone into a funk after the Dukakis defeat.

What he was doing was pulling back and taking another look at things. "He was all too aware that he hadn't filled the space as chairman and that he had to quit playing it so close to the vest," a confidante explains. "He was all done with trying to be a free agent. He felt he could be a very influential chairman if he became a collegial chairman, the leader of a team. So he set about making it happen."

Mr. Aspin also exploited the collegial approach in raising his game outside his committee rooms. He led a bipartisan contingent of his committee, together with civilian experts and US intelligence specialists on Soviet affairs, on an inspection trip to the Soviet Union. They were the first Americans ever to visit Soviet units in the field, to see for themselves whether Soviet President Gorbachev was following through on his December 1988 promise to begin drawing down his forces. They came away convinced that Gorbachev had meant what he said.

Then the Berlin Wall came down, and the Warsaw Pact collapsed. In December 1989, Director of Central Intelligence William Webster told the Aspin committee, at the prodding of its chairman, that the changes in eastern Europe were "irreversible" and that a Warsaw Pact military comeback was out of the question.

Defense Secretary Richard Cheney questioned Mr. Webster's assessment and took him to task for voicing it. Mr. Cheney knew what was coming, and it did. Mr. Aspin played off the CIA against the Pentagon. He used the CIA chief's assessment as the foundation of his case for cutting the Pentagon budget and remolding its cold war mindset.

In January 1990, shortly after Mr. Webster testified, Mr. Aspin made what is now seen as a seminal speech on the future of defense. He claimed that the US could safely cut forces and weapons upon reexamination and rearrangement of the threats now facing and likely to face the US.

The Congressman also said that the US should take fresh approaches on several fronts, including the development and production of major weapons. He proposed, for example, sustaining as many production lines as possible, but at lesser rates; building prototypes of advanced weapons without necessarily producing them; putting more emphasis on R&D; and concentrating more on incorporating advanced technologies in existing systems.

Two years later, in January of this year, the Pentagon proposed just such a "rollover" approach—rollover of new technology to the next generation of weapons without producing them right away or ever.

Striking Gold

Mr. Aspin's speech struck political gold. "It thrust him into a new phase of leadership," says a colleague.

Through 1990, he became a key member of the House Democratic inner circle and thus broadened and strengthened his political power base. Thomas Foley of Washington had succeeded Tip O'Neill, after the brief tenure of Rep. Jim Wright (D-Tex.), making life easier for Mr. Aspin. He worked closely with Speaker Foley, Majority Leader Richard Gephardt, and Budget Committee Chairman Leon Panetta, at their request, on how best to deal with the Pentagon's newly announced plans to cut military forces. His handiwork showed up in a House budget resolution on paying for and scheduling the drawdown. He also had a big hand in the agreement that Congress and the Pentagon reached on defense spending guidelines and ceilings through FY 1995.

That agreement was doomed almost from the start. Mr. Aspin was first to foreshadow its fall. At the Air Force Association's National Convention last September in Washington, shortly after the failed coup against Gorbachev, Mr. Aspin declared that it seemed all over for the Soviet monolith.

He asserted, "If the reductions in the Soviet military threat are the right kind—and can't be reversed—then we can safely reduce our defense spending. That means a new budget deal."

Once again, Messrs. Foley, Gephardt, and Panetta sought his counsel on how to go about it. He told them that the House had to come up with more than just another new set of defense budget numbers to throw at the Pentagon. What was needed, he said, was a whole new concept, a fresh strategy, from which the House—perhaps all of Congress—could specify the size, shape, and costs of new sets of US military forces in the post-Soviet era. They told him to go to it.

Over the next several months, Mr. Aspin took his collegiality to new heights in his quest for suggestions. He met time and again with Democratic notables in national security affairs, such as former Defense Secretary Harold Brown, drawing on their experience and expertise. He noted that he intended to "talk to Senator Nunn and the [Democratic] presidential candidates" later about his game plan.

Last December, Mr. Aspin's Defense Policy Panel held hearings on "the threat." Once again, he summoned top intelligence officials, notably Robert Gates, who had succeeded Mr. Webster as Director of Central Intelligence, to testify. They affirmed that the Soviet military threat was a thing of the past and that other threats elsewhere would have to be reckoned with.

By then, Mr. Cheney was saying the same thing and claiming that the Administration's defense budget and posture for FY 1993 would reflect it. But Mr. Aspin had long since staked out the territory in establishing what one editorialist called "a quantitative form of reference" for Congress to use in seizing the initiative on defense. He had come far. ■

Aerospace World

By Frank Ollverl, Associate Editor

Conventional ALCM Revealed

A classified, conventional variant of the AGM-86B air-launched cruise missile hit Iraqi targets in the first hours of the Persian Gulf War. The Pentagon lifted the secrecy from the USAF system in mid-January, revealing that seven B-52G bombers had launched thirty-five of the Boeing-built ALCM weapons.

Pentagon spokesman Pete Williams said that, of the thirty-five missiles launched, thirty-one hit their targets.

In the operation, a group of B-52Gs of the 2d Bomb Wing took off from Barksdale AFB, La., at 6:35 a.m., local time, on January 16, 1991. The aircraft flew a nonstop round-trip, refueling four times in flight. Each B-52 flew for some thirty-five hours over 14,000 miles. Mr. Williams said it was the longest air combat mission in history.

Air Force officials said that the B-52s had on board a total of thirty-nine conventional ALCMs but that four failed to launch. The ALCMs were used against eight "high-priority" targets, which included power generation and transmission facilities and military communications sites.

The new missile, designated "AGM-86C," has a 1,000-pound, high-explosive blast and fragmentation warhead. The guidance system is slightly modified from the nuclear variant. In place of the nuclear ALCM's terrain contour matching (TERCOM) guidance system, the AGM-86C packs an integrated system comprising both the TERCOM equipment and links to the Global Positioning System.

Externally, the conventional and nuclear systems are identical. Boeing modified AGM-86B missiles into the C variant at a cost of $380,000 each, according to Mr. Williams. Development of the conventional variant began in June 1986 and achieved operational capability in 1988.

USAF photo by SrA. Chris Putman

B-52G bombers from Barksdale AFB, La., delivered thirty-five conventionally modified AGM-86B air-launched cruise missiles against targets in Iraq in the early hours of the Desert Storm air campaign. The "AGM-86C" is equipped with a 1,000-lb. blast and fragmentation warhead.

U-2 Crashes in Sea of Japan

An Air Force U-2 reconnaissance aircraft crashed into the Sea of Japan on January 15, killing the pilot and destroying the highly sophisticated plane.

The U-2 was on a routine mission over South Korea, with that government's knowledge and consent, south of the demilitarized zone (DMZ) between North and South Korea. Radio communications and radar contact were lost shortly after 5:30 a.m. Eastern time. Early indications were that the single-engine, single-seat aircraft developed engine trouble. The nature of the engine problem is being investigated.

Mr. Williams said there was no indication of hostile action and that a South Korean Navy vessel found part of the wreckage about ten miles off the Korean coast about forty miles south of the DMZ at about 10:45 p.m. Eastern time. Searchers found the body of Capt. James M. McGregor, thirty-three, of Flagstaff, Ariz., at about 12:30 a.m. Eastern time.

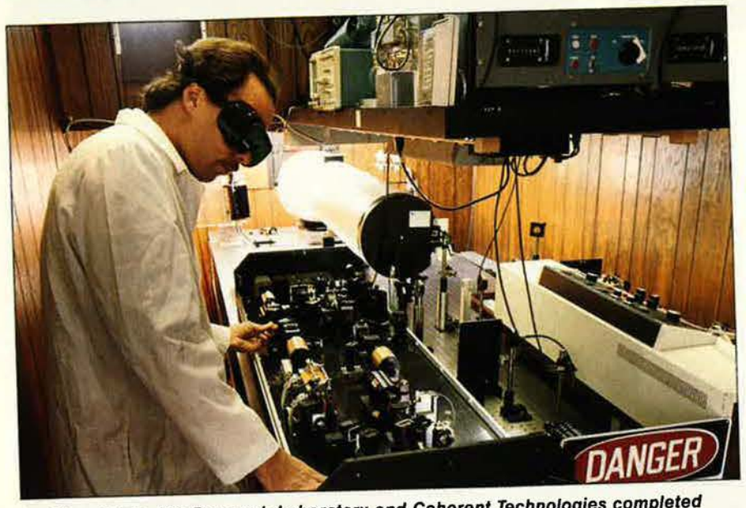
"SPOs of the Year"

In January, Air Force Systems Command (AFSC) honored the F-15 System Program Office and the Training SPO, each of which is part of Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Each won the title "SPO of the Year" in separate categories.

The F-15 SPO won the Gen. Bernard A. Schriever award for the "major program" category. The Training SPO was selected in the "non-major program" category. Presenting the awards, which are named for the former (1959–66) AFSC commander, were Gen. Ronald W. Yates, AFSC commander, and John J. Welch, Jr., Assistant Secretary of the Air Force for Acquisition.

The award cited the F-15 SPO's strong support of forces in Operations Desert Shield and Desert Storm during Fiscal 1991. The service said that "the SPO created a focused support group called the 'Desert Eagle' team to expedite delivery of critical assets and resolve all F-15 technical issues." The group solved such problems as the formulation and integration of software updates to the F-15. The APG-70 radar, central computer, and tactical electronic warfare systems were updated. The SPO also provided real-time solutions to combat-related problems.

The Training SPO supported the Air



Lockheed Palo Alto Research Laboratory and Coherent Technologies completed field testing at Kennedy Space Center of the Coherent Launch-Site Atmospheric Wind Sounder, the world's most powerful solid-state coherent laser radar. It will detect wind shear in the atmosphere above the space shuttle launch site.

Force's major commands. It provided the tactical forces with the F-15 weapons tactics trainer within fourteen months of the contract award, integrated high-angle-of-attack stall training into the F-16 weapon system trainer, and delivered the LANTIRN night simulator to TAC eight months ahead of schedule.

Block 50 F-16s Enter Fleet

In December, the Air Force accepted the first Block 50 F-16, which features a more powerful engine, new-technology avionics, additional weapon capabilities, and cockpit enhancements.

The Block 50 fighter, the newest product of the F-16 Multinational Staged Improvement Program, will sport both variants of the Increased Performance Engine, the Pratt & Whitney F100-PW-229 and the General Electric F110-GE-129. Each is rated in the 29,000-pound-thrust class, about 4,000 pounds more than previous F-16 engines. This added power will enhance the maneuvering agility of the F-16. The first Block 50 fighter carries the GE IPE.

Some of the avionics added to the F-16 in the Block 50 configuration include the APG-68V5 radar with advanced signal-processing capabilities; an upgraded, programmable display generator and improved data modem; the ALR-56M radar warning receiver and improved ALE-47 chaff/flare system; an integrated, high-speed antiradiation missile employment capability; and a ring-laser gyro inertial navigational system. Most of these changes are incorporated during production, though some were installed through retrofits.

Advances in the cockpit include a new-generation, wide-angle, conventional head-up display for projection of critical flight data. Block 50s will become operational this year.

"Team Spirit" Postponed

The United States announced in January the cancellation of "Team Spirit," the combined US and South Korean defense exercise that has long ranked as one of the largest of its kind. The two nations have conducted Team Spirit in and around South Korea each year since 1976.

The announcement came after North and South Korea issued a joint nonaggression pledge in December and agreed in principle to conduct inspections of North Korean nuclear facilities.

The Pentagon said that the cancellation decision was made by Seoul and that the US supported it. Spokesmen said that Team Spirit had not been killed so much as postponed.

Typically, the exercise features deployments of more than 100,000 US and South Korean troops, including several Air Force fighter wings and Army divisions. Smaller exercises will continue, according to the Pentagon.

Subic Bay to Close

The US accelerated preparations to vacate Subic Bay naval facility when the Philippine government told Washington in December to get its forces out by the end of 1992. The move will bring to an end the huge military presence the US has maintained there almost continuously since forces commanded by Adm. George Dewey and Maj. Gen. Wesley Merritt defeated and drove out Spanish forces in 1898.

The closing of the base will necessitate the relocation of 5,800 officers and enlisted men and women, 600 civilians working for the Defense Department, and about 6,000 dependents. The US and Singapore tentatively agreed to move a US Navy logistics command task force for the Seventh Fleet to that Asian nation, announced President Bush and Singapore's Prime Minister Goh Chok Tong.

Lockheed and LTV are developing a proposal for an early warning aircraft based on the Navy's proven S-3 Viking, originally built in the 1970s. The proposal will include an electronically scanned phased-array radar, housed atop the fuselage, which would provide a full 360-degree view of the surrounding airspace.

The Philippine government's decision ended an impasse between negotiators who had worked for the past year to resolve the issue. The Philippine Senate refused to extend the US bases agreement, characterizing the American presence as an extension of colonial rule. The US already has withdrawn from Clark AB. The Subic Bay pullout is one of the largest US military reductions anywhere. The 60,000-acre base is the Navy's principal supply and ship-repair station in the region.

Crotone Plans Canceled

NATO defense ministers canceled plans to relocate the Air Force's 401st Air Wing from Torrejon AB, Spain, to a new base at Crotone, Italy. The December decision seems to result from congressional action that denied some of the funds needed to move the wing. The 401st, made up of seventy-two F-16s, is still required to leave Spain by May.

The US planned to ask its Allies to pick up the additional costs. NATO defense ministers, however, said they were concerned about the price of the base.

NATO is studying alternative basing plans because "the Alliance is fundamentally interested in keeping these fighters in the southern region," NATO Secretary-General Manfred Wörner said in December.

Paring the Base Force

If Congress tries to meet the fiscal goals laid out in the 1990 Budget Enforcement Act without cutting social programs, the Pentagon will not be able to maintain Base Force troop levels because the defense budget reductions will be too great.

That is the conclusion of a memo prepared by the Congressional Budget Office (CBO). It maintains that the US military, under the aforementioned scenario, would lose another $58 billion through Fiscal 1995, beyond currently programmed reductions.

The memorandum, "Fiscal Implications of the Administration's Proposed Base Force," was released in December. Under the 1990 Act, defense spending was to increase (in inflated dollars) to about $298 billion in Fiscal 1995. The collapse of the Soviet empire brought pressure to reduce that figure.

To meet this goal, CBO offered such options as termination of the C-17 airlifter and B-2 bomber programs; reducing the Strategic Defense Initiative effort; and canceling the National Aerospace Plane program, the F-22 Advanced Tactical Fighter program, construction of a new *Nimitz*-class aircraft carrier, and the SSN-21 submarine program. These cuts were not necessarily recommendations, but if DoD wishes to protect personnel, investment accounts will have to suffer.

In December, Kaman Corp. first flew its new multimission intermeshing rotor aircraft (MMIRA) technology demonstrator. Its two contrarotating rotors provide increased payload capacity and endurance compared to other currently fielded helicopters. Mission applications include surveillance, resupply, and ordnance delivery.

Sasser's Reduction Plans

Senate Budget Committee Chairman Sen. Jim Sasser (D-Tenn.) proposed cutting the Defense Department's budget to $150 billion over the next five years. In January, the Senator said he hoped to move legislation through his committee early in the year to amend the 1990 Budget Enforcement Act and allow transfer of defense funds to domestic programs. Defense budget authority for Fiscal 1993 had been set at $288 billion before President Bush reduced that figure further.

Senator Sasser said that defense spending could be reduced by nearly $400 billion over ten years. House Budget Committee Chairman Rep. Leon Panetta (D-Calif.) indicated in December that he would propose a plan to cut about $100 billion from defense through Fiscal 1998.

ESD Reorganization

AFSC's Electronic Systems Division (ESD) at Hanscom AFB, Mass., has created a Mission Planning Systems Directorate. At the same time, it dissolved two directorates and renamed three others, completing the first phase of a planned reorganization.

ESD announced the moves in December. The reorganization emphasizes primary ESD product lines, such as mission planning, air surveillance, and command-and-control systems.

ESD dissolved the directorate for the over-the-horizon backscatter (OTH-B) radar system, transferring program tasks to the Air Surveillance and Control Systems Directorate. Also dissolved was the Tactical Control and Mission Planning Systems Directorate, with many of the program tasks transferred to the new Mission Planning Directorate. The Caribbean Basin Radar Network program, a system of radar sites that will provide increased air surveillance information in the Basin, was also shifted from this organization to the newly named Air Surveillance Directorate under the control of TAC. The network will achieve initial operational capability with the formal turnover of the initial increment of the sites to TAC in ceremonies at ESD headquarters.

The Tactical Air Control System Improvements program group moved under the old Strategic Systems Program Directorate, which was renamed the Combat Command, Control, and Communications Systems Directorate. Tactical Communications moved under the Airspace Management Pro-

gram Directorate, which was renamed the Communications and Airspace Management Systems Directorate.

Thailand F-16 Deal

Representatives of Thailand and the Defense Department signed a letter of offer and acceptance in late December for that Asian country's order of eighteen F-16 fighters from General Dynamics. The sale is valued at $547 million.

The order is a follow-on to Thailand's previous buys of twelve and six of the multirole fighter aircraft, delivered in 1988 and 1991, respectively. The new order will be delivered in 1995.

Currently, the Royal Thai Air Force flies F-16A/Bs with upgraded operational capabilities. The new order is for twelve single-seat A model aircraft and six two-seat F-16Bs.

A-X Concept Contracts

The Navy awarded $20 million contracts to five firms in January for concept definition work on the future A-X carrier-based attack aircraft. The plane would replace the aging fleet of A-6 medium bombers. The Navy expects the companies to complete their efforts by October 1992. The participating companies are Rockwell International, McDonnell Douglas, Lockheed Aeronautical Systems, Grumman Aerospace Corp., and General Dynamics. The A-X development effort is slated to cost about $14 billion.

To Mars in 180 Days

An advanced nuclear rocket engine could cut the time for a manned mission to Mars by as much as one-third and significantly reduce spacecraft mass and launch costs, according to a Sandia National Laboratories study released in January. Using current varieties of rocket systems, a mission to Mars could be expected to take 270 days. The Sandia study says that use of a nuclear rocket engine could cut that to 180 days. In addition to time and mass savings, the engines would lessen the adverse effects of prolonged space travel on the crew due to radiation exposure and microgravity.

Naval Aircraft Shortage

Even with substantial increases in investment from 1998 through 2010, the Navy will face a shortage of about 400 aircraft if it maintains the current number of aircraft carrier battle groups, according to a CBO report released in December. However, the report, "The Costs of the Administration's Plan for the Navy Through the Year 2010," states that Congress may deal with the pressure for budget increases by reducing the Navy further than currently planned and by cutting certain modernization programs.

Navy Seeks 450-Warship Limit

If the US Navy dips below the level of 450 battle fleet ships, the US may not be able to respond adequately to crises overseas or retain sailors willing to endure longer tours at sea, Vice Chief of Naval Operations Adm. Jerome Johnson said.

Admiral Johnson's statements in January indicate that the Navy leadership does not plan to accept willingly a cut in the size of the fleet below 450 ships, about the number on hand at the end of the Carter Administration. Admiral Johnson told the Armed Forces Communications and Electronics Association that most Navy studies center on holding the 450-ship number.

Comanche Gains Weight

In submitting its Fiscal 1993 budget, DoD decided to restructure the RAH-66 Comanche light helicopter development program by deferring production, concentrating on building prototypes, developing avionics, upgrading the engine, and incorporating the Longbow advanced fire-control radar system.

The late January submission indicated that because of the shift of threat from Warsaw Pact to regional conflicts, the Army could effectively use its Apache fleet, upgraded with Longbow; OH-58D reconnaissance light attack helicopters; and unmanned aerial vehicles, instead of the Comanche. This move cuts about $3.4 billion from the Comanche program through 1997. The Army had set total program costs at $8.9 billion.

In addition, the Army will boost by twelve percent the power of the T800 engine planned for the aircraft. Growth in the power of the Comanche's engine could cost the service as much as $200 million because it must repeat hundreds of hours of testing, according to program manager Brig. Gen. Orlin Mullen.

Thus far, the T800 has accumulated 13,000 hours of testing. However, there is flexibility to adjust funding, with permission from the Army and Congress. The engine is built by the Allison/Garrett Light Helicopter Turbine Engine Co. consortium.

Survivability/combat kits will be added to the Comanche's empty weight, even though they were not included in the original combat configuration. The kits consist of crew floor armor, a radio frequency interferometer, an HF radio, and future aircraft survivability equipment. The Army said that combat experience in Desert Storm indicated that combat kits will be needed on board the aircraft at all times rather than being applied only as needed. The Longbow radar system, which weighs 540 pounds, is not included in the empty weight estimate.

Top Priority for ABM

Antiballistic missile (ABM) systems are likely to become a top priority for many industrialized nations as ballistic missiles proliferate, the Strategic Deterrence Study Group reported in January.

The panel, formed by the Defense Department, was headed by former Air Force Secretary Thomas C. Reed. He said an inventory of 5,000 US strategic nuclear warheads would be sufficient for the next few years. That number is some 4,000 warheads below START levels.

SFW Initial Testing

The Sensor-Fuzed Weapon (SFW) successfully completed the final test in its initial operational test and evaluation program in December.

The wide-area cluster munition under development by the SFW and Airfield Attack SPO at Eglin AFB, Fla., is designed to target many tanks and armored vehicles in a single drop.

The test, the last in a series of twenty-nine begun in September 1990, called for a "ripple release" of SFWs carried on an F-16 in a realistic operational configuration. Four SFWs were dropped at one-second intervals. Each weapon contains ten submunitions with four projectiles each. The SFWs hit multiple targets, exceeding requirements, according to the Air Force.

FEWS Passes DAB Review

Under Secretary of Defense for Acquisition Donald Yockey will approve the Air Force's release of a request for proposal for a two-year demonstration/validation effort for the Follow-On Early Warning System (FEWS). The FEWS program seeks to develop a replacement for the current Defense Support Program satellite.

The information was released in a synopsis of the December 19 Acquisition Decision Memorandum. The Defense Acquisition Board met December 11 to decide the fate of the FEWS program. FEWS will be a network of satellites providing information to ground commanders on ballistic missile launches anywhere in the world. Two teams have announced that they would compete for the FEWS contract: TRW, Inc., will team with Grumman, and Rockwell will team with Aerojet.

Goshawk Carrier Tests

In December, the Navy's T-45 Goshawk prototype trainer aircraft successfully landed for the first time on

Recipients of Joint Meritorious Service Awards for Action in Desert Shield and Desert Storm

Unit	Dates
Joint Special Operations Task Force	January 28, 1991–March 4, 1991 (third oak leaf cluster)
US Pacific Command Cruise Missile Support Activity	August 2, 1990–March 15, 1991
Office of Defense Cooperation, the Netherlands	August 2, 1990–March 25, 1991
Office of Defense Cooperation, Spain	August 2, 1990–March 25, 1991
Joint Task Force Proven Force	December 13, 1990–March 31, 1991
US Liaison Office, Abu Dhabi	January 1, 1987–March 31, 1991
Joint Communications Support Element, US Central Command	August 4, 1990–April 21, 1991 (second oak leaf cluster)
US Military Training Mission to Saudi Arabia	July 2, 1989–April 30, 1991 (third oak leaf cluster)
Defense Courier Service	August 9, 1990–May 31, 1991 (second oak leaf cluster)
US Transportation Command	August 2, 1990–July 31, 1991 (first oak leaf cluster)

The Navy's T-45 training system began sea trials in December, successfully landing and taking off from USS John F. Kennedy. The Goshawk demonstrated all aspects of carrier suitability, logging thirty-three catapult launches and thirty-three arrested landings, with a total of 12.1 hours during six flight periods.

an aircraft carrier. The plane recovered on USS *John F. Kennedy* off the US southeast coast. The prototype also successfully completed its first catapult launch from the *Kennedy.*

The first production aircraft made its first overland flight in December. This aircraft sports the fully modified wing ordered by the Navy to fix early design problems.

More C-17s Needed

A new mobility requirements study will likely recommend that the Air Force procure more C-17s than currently budgeted in its long-range plans, Gen. H. T. Johnson wrote in a letter to Secretary of Defense Dick Cheney. The Commander in Chief of US Transportation Command and Military Airlift Command said that the study, now nearing completion, recognizes that budget constraints will likely limit the Air Force to 120 planes. The issue of buying more aircraft, he said, will wait until later in the decade, when the Air Force faces the prospect of closing down the C-17 line.

In other C-17 news, the airlifter exceeded the eighty-hour mark in its flight test program in mid-December. It completed its thirtieth mission December 17.

The C-17 program has moved into its second phase, beginning structural and aerodynamics damping investigations. These tests should verify the aircraft's structural stability. The first phase dealt primarily with the C-17's airworthiness.

The Air Force accepted the first production T-1A Jayhawk trainer aircraft in January. The Jayhawk will be used to train student pilots to fly tanker and transport aircraft. This is the first of seventy-seven ordered by the service, of a planned total of 180 aircraft at a program cost of $750 million.

Senior Staff Changes

RETIREMENT: B/G Harold B. **Adams.**

CHANGES: B/G George P. Cole, Jr., from Spec. Ass't, DCS/Personnel, Hq. USAF, Washington, D. C., to Cmdr., 2d Wing, SAC, Barksdale AFB, La., replacing Col. Ronald C. Marcotte . . . **M/G Lewis E. Curtis III,** from DCS/Engineering & Tech. Mgmt., Hq. AFLC, Wright-Patterson AFB, Ohio, to Cmdr., San Antonio ALC, AFLC, Kelly AFB, Tex., replacing M/G Richard D. Smith . . . **B/G Phillip J. Ford,** from DCS/Ops., and Dep. Dir., Ops., STRACOS, Hq. SAC, Offutt AFB, Neb., to DCS/P&P, Hq. MAC, Scott AFB, Ill., replacing M/G James C. McCombs . . . **B/G John H. Garrison,** from student, Air Attaché Training, DIA, Arlington, Va., to Def. Attaché to the People's Republic of China, DIA, USDAO, Beijing, China.

B/G Orin L. Godsey, from IG and Vice Cmdr., Survivable, Endurable Cmd. Ctr., Hq. SAC, Offutt AFB, Neb., to DCS/Ops., and Dep. Dir., Ops., STRACOS, Hq. SAC, Offutt AFB, Neb., replacing B/G Phillip J. Ford . . . **B/G Kenneth F. Keller,** from Dir., Command Control, Hq. SAC, and Ass't Dep. Dir., Command Control, STRACOS, Offutt AFB, Neb., to Ass't DCS/Ops., Hq. SAC, Offutt AFB, Neb., replacing B/G Patrick P. Caruana . . . **Gen. Donald J. Kutyna,** from CINCNORAD, CINC, Hq. USSPACECOM, and DoD Mgr. for Space Transportation Sys. Contingency Support Ops., Peterson AFB, Colo., to CINCNORAD, CINC, Hq. USSPACECOM, DoD Mgr. for Space Transportation Sys. Contingency Support Ops., and Cmdr., Hq. AFSPACECOM, Peterson AFB, Colo. . . . **B/G Robert E. Linhard,** from DCS/P&R, Hq. SAC, Offutt AFB, Neb., to Dir., USSTRATCOM (Prov. Hq.), Offutt AFB, Neb.

M/G James C. McCombs, from DCS/P&P, Hq. MAC, Scott AFB, Ill., to Dir., Plans, Policy, & Doctrine, J-5, Hq. USSOCOM, MacDill AFB, Fla. . . . **L/G Thomas S. Moorman, Jr.,** from Cmdr., Hq. AFSPACECOM, Peterson AFB, Colo., to Vice Cmdr., Hq. AFSPACECOM, Peterson AFB, Colo. . . . **M/G Richard D. Smith,** from Cmdr., San Antonio ALC, AFLC, Kelly AFB, Tex., to DCS/Log., Hq. AFLC, Wright-Patterson AFB, Ohio, replacing retiring B/G Patricia A. Hinneburg . . . **M/G Thad A. Wolfe,** from Spec. Ass't to Cmdr., 8th AF, SAC, Ellsworth AFB, S. D., to Ass't Dep. Dir., Ops., NSA, Fort Meade, Md.

SENIOR EXECUTIVE SERVICE (SES) CHANGES: Robert D. Bauerlein, to Dep. Under Sec'y for International Affairs, Under Sec'y of the Air Force, OSAF, Washington, D. C. . . . **Anthony J. Perfilio,** from Principal Ass't Staff Judge Advocate, Hq. AFSC, Andrews AFB, Md., to Command Counsel, Hq. AFSC, Andrews AFB, Md. . . . **Frank P. Weber,** from Chief, Mobile Div., DCS/Ops. & Plans, Hq. USA, Washington, D. C., to Dep. Dir., Plans and Resources, Hq. USTRANSCOM, Scott AFB, Ill. ■

News Notes

• President Bush signed into law the Conventional Forces in Europe Treaty on December 12. The CFE accord aims to make massive cuts in conventional weapons in Europe and on the territory of the old Soviet Union. US officials indicated that the treaty will also discourage the formation of large armies in the newly independent republics of the late USSR.

• The Air Force has accepted Northrop's plans to correct problems found in developmental testing of the Triservice Standoff Attack Missile (TSSAM), a classified, stealthy missile. This acceptance enables development and production. However, doubts remain about Northrop's ability to manage the $15.1 billion program. The service has pledged continued monitoring of Northrop's progress.

• The performance of the Bradley Fighting Vehicle and the M1A1 tank suffered as a result of faulty fuel pumps, outdated radios, and limited spare parts during Operation Desert Storm, according to a General Accounting Office report released in January.

• McDonnell Aircraft Co., Beech Aircraft, and Quintron Corp. delivered the first production Beechcraft T-1A Jayhawk training aircraft to the Air Force in January. Beech will build 180 Jayhawks for the Tanker/Transport Training System program.

• In January, Donald C. Fraser was sworn in as deputy under secretary of defense for Acquisition, while Victor Reis was sworn in as director of Defense Research and Engineering. Dr. Reis had been the director and deputy director of the Defense Advanced Research Projects Agency. Mr. Fraser was deputy director of Operational Test and Evaluation for Command, Control, Communications, and Intelligence Systems.

• An Air Force sergeant was sentenced to thirty-eight years in prison in December after pleading guilty to charges of desertion, espionage, and conspiracy to commit espionage. Over a two-and-a-half year period at Tempelhof Central Airport AS, Germany, and Goodfellow AFB, Tex., Sgt. Jeffrey Carney reportedly copied classified documents and transferred them to agents of the East German government.

• The advanced fighter technology integration (AFTI)/F-16 completed its 500th flight test at Edwards AFB, Calif., in January. The AFTI/F-16 program is run by the Flight Dynamics Directorate, Wright Laboratory, Aeronautical Systems Division, and has aided the testing of advanced upgrades for the multirole aircraft.

• An F-16 successfully launched a Maverick missile equipped with a Hughes Aircraft Co. millimeter-wave radar seeker at an air defense unit vehicle target at Eglin AFB, Fla., in December. After being launched at a range of five miles, the missile searched for and recognized the air defense unit. The missile guided to and hit the target without further communication with the launching aircraft.

• TRW selected in December the Pegasus air-launched space booster, built by Orbital Sciences Corp., to provide services for TRW's Space and Defense Sector's spacecraft in the predevelopment phase of SDIO's Brilliant Pebbles program.

• Taiwan has signed a letter of offer and acceptance to purchase twelve OH-58D Kiowa Warrior armed scout

helicopters from the US in a deal worth $110 million. Deliveries will begin in July 1993.

• Greece joined the ranks of nations that operate the CH-47D Chinook heavy-lift rotorcraft with its recent approval of a contract to modernize its fleet of helicopters. The modernization contract was signed in December.

• The Martin Marietta–built Hellfire optimized missile system successfully completed its first high-temperature-environment ground launch test, scoring three direct hits in January. The missiles were fired at targets up to seven kilometers away.

• Two engines in the second B-2 aircraft suffered foreign object damage during ground run tests in December. One engine had to be replaced.

• The Dassault Aviation Rafale M01 preproduction naval prototype began flight testing in December, joining its French Air Force Rafale counterpart in the test phase. The first flight lasted one hour, reaching a speed of Mach 1.4 and an altitude of 42,000 feet.

• The first of fifty-three Fairchild Aircraft C-26B twin turboprop support aircraft was delivered to the National Guard Bureau at San Antonio, Tex., in January. Under the $235 million contract, the firm must provide the rest of the aircraft over a five-year period.

Purchases

The Air Force awarded a $5.9 million face-value increase to a firm fixed-price contract to General Electric for an engineering change proposal for improved exhaust nozzle hinge design retrofit kits for the F101-GE-102 engine used on the B-1B. Expected completion: December 1993.

The Air Force awarded a $39.9 million face-value increase to a fixed-price incentive fee contract to Douglas Aircraft Co., for advanced buy/long lead for two of the eight authorized Lot V C-17s. Expected completion: August 1994.

The Navy awarded General Dynamics–Westinghouse's Advanced Air-to-Air Missile joint venture a $44 million increment to a cost plus incentive fee contract for the demonstration and validation of the AAAM program. Expected completion: February 1993.

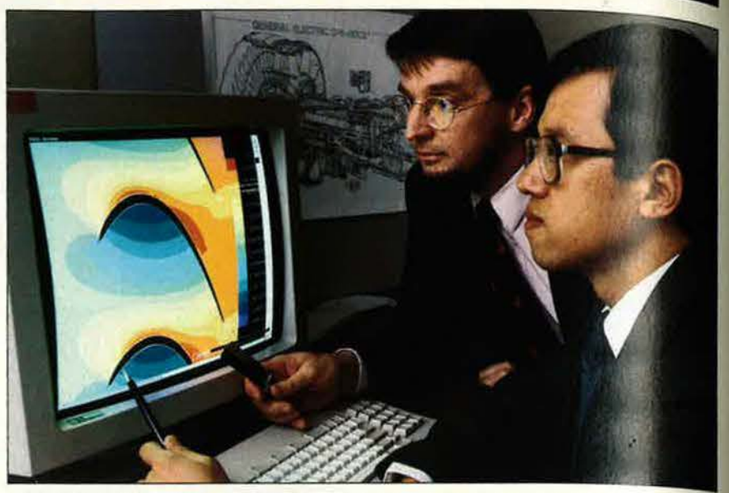
The Navy awarded General Electric a $37 million modification to exercise an option to a firm fixed-price contract for the procurement of forty-two T64-GE-416A engines for the C/MH-53E helicopter. Expected completion: March 1993.

The Air Force awarded Boeing a $9.6 million face-value increase to a cost plus award fee contract for various efforts for the Lightweight Exoatmospheric Advanced Projectile, including a hover test at Edwards AFB, Calif., the purchase of additional component hardware, and modification of the test schedule for LEAP-3 and LEAP-5. Expected completion: September 1992.

The Navy awarded General Electric a $270 million fixed-price incentive contract option for the production of five Aegis weapon systems for the *Arleigh Burke*-class destroyers DDG-68, -69, -70, -71, and -72. Expected completion: November 1995.

The Navy awarded McDonnell Douglas a $98 million increment to an advanced acquisition contract for thirty-two F/A-18C and eight F/A-18D aircraft for the Government of Kuwait. Expected completion: June 1994.

The Air Force awarded Northrop a $15 million face-value increase to a cost plus incentive fee contract for integration of Mk. 84 ordnance capability into the B-2. Expected completion: July 1994. ■



General Electric's Research and Development Center and GE Aircraft Engines' Advanced Engineering Technologies are using ENGINEOUS, a computerized design tool that runs other computerized design tools, to develop jet aircraft engine blades for optimal performance. The system can run "what if?" scenarios until the best design emerges.

Index to Advertisers

Crises on the periphery become the main mission as the Alliance regroups and reorganizes.

NATO's New Strategy

By Larry Grossman

THE North Atlantic Treaty Organization, after a year of extreme turbulence, has moved out smartly to reshape its military. Now on tap is a smaller and lighter but fast-moving, hard-punching, and free-wheeling fighting force.

Tactics, forces, deployments, and command structures are being revamped to create a combat arm able to respond rapidly to local flare-ups and serve as a basis for a more robust defense.

Helping to accelerate the NATO makeover is a new strategy statement, signed by the sixteen Allies in November in Rome. The sixty-paragraph document, first of its type since 1967, dropped NATO's focus on thwarting attack from the East. The main mission now is to manage small crises on NATO's periphery.

The shift foreshadows major changes for NATO's 1.3-million-strong defense structure. When the transformation is over, NATO's armed forces will bear little resemblance to the large, static force of past years. It will be smaller—perhaps fifty percent smaller—with far fewer nuclear weapons, divisions, wings, and American GIs. Readiness rates will be lower. No forward defense line will exist.

Moreover, says President Bush, the new NATO will be "lean, agile, and unmatched in human and technological quality." It is a claim that military analysts view with reservations, given the range of uncertainties facing the Alliance.

The Rome document, titled "The Alliance's New Strategic Concept," marks a fundamental break with "Flexible Response," the strategy NATO formulated in the early 1960s and formally adopted in 1967. That strategy hinged on NATO's threat to deliberately escalate conventional combat to nuclear war, if that was needed to repel a Warsaw Pact attack. NATO deployed its defenses far forward, and the Allies conceded no territory, even for tactical reasons.

Dealing with Dustups

The Allies had been working on the new strategy since they declared a set of new defense principles at the London summit in 1990, but Flexible Response suffered mortal shocks in 1991—the transformation

The new NATO strategy will continue to require advanced ground-attack planes like this Tornado IDS (interdictor-strike) of the Italian Air Force, shown in the camouflage paint scheme it sported in the Persian Gulf War. Even NATO's Rapid Reaction Force will have a major air component.

of former Warsaw Pact adversaries into friends, the outburst of ethnic warfare in Yugoslavia, and the decomposition of the USSR.

The new strategy document, say analysts, envisions employment of Allied forces for limited purposes. The blueprint anticipates sharp force reductions by the United States and its Western Allies in any event and scales down accordingly. It conforms to a plan, approved by the US and its Allies before the Rome summit, to remove eighty percent of the nuclear weapons in NATO's armory.

"We have shifted from a strategy of immediate defense against a very large threat to a strategy of crisis management," explained the Army's Gen. John R. Galvin, who serves as Supreme Allied Commander Europe (SACEUR).

General Galvin said that the point of the strategy is for the West to use its power "to bring down the level of confrontation in a crisis and to maintain the peace." He implied that NATO forces will be geared primarily to deal with dustups on NATO's borders, if they threaten to get out of hand.

Radically different concepts of operations are inherent in the Rome strategy document. The most conspicuous of these, say NATO affairs experts, is that Alliance leaders will no longer assign to specific nations the responsibilities for defending specific sectors of a front. As a result, Western forces will no longer maintain a fixed, in-place, linear defensive stance along cold war boundaries, where for years US ground and air forces and those of other NATO nations stood guard. Those boundaries have disappeared.

The new strategy calls for NATO nations to organize highly mobile, combined-arms, rapid-reaction units "able to respond to a wide range of eventualities, many of which are unforeseeable."

Backing up this relatively small collection of ready military forces would be a larger group of in-place forces, which could be raised to higher readiness, and an enhanced Alliance ability to mobilize its reinforcements, reservists, and replacement equipment in Europe and North America.

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Armed irregular forces take positions in Tbilisi, Georgia, during clashes among warring factions in the republic. The breakup of the old Soviet empire, the outburst of ethnic war in Yugoslavia, and national rivalries prompted NATO to abandon "immediate defense" in favor of "crisis management."

Three "Pools" of Power

That's the basic defense strategy. To support it, NATO is working hard to reorganize forces into three main categories, or "pools," of military power:

- *Reaction Forces,* fast-moving units that would break down into two groups—the Immediate Reaction Force and the Rapid Reaction Force—and account for seven percent of NATO's projected troop strength. The Reaction Forces would maintain high levels of readiness. Both would have ground and air units.

Plans call for the IRF, small but as yet of undetermined size, to be prepared within seventy-two hours to deploy a combat-ready force of 5,000 troops anywhere within NATO territory.

The RRF would have roughly 50,000 to 70,000 troops at its disposal and would be configured to support the IRF or deploy independently within a week anywhere in the NATO area. The RRF will be multinational, containing German, Dutch, Belgian, British, Italian, Spanish, Greek, US, and possibly Turkish forces. The RRF will be commanded by a British three-star general and would be headquartered in Germany. NATO will begin forming the RRF in April.

- *Main Defense Forces,* located primarily in the central region, which would comprise sixty-five percent of NATO force structure and center on seven corps-sized ground forces and supporting airpower. Each corps would have 50,000 to 70,000 troops.

Plans call for six of these corps to be based within borders of the old West Germany. All will be multinational. German officers will command two of the corps, while US, Belgian, and Dutch officers each will command one. The sixth corps based in western Germany will operate under a combined Danish-German staff.

A seventh corps would be based in what had been East Germany. The 1990 reunification accord among East and West Germany, the US, Britain, France, and the former USSR forbids NATO operations in that part of Germany. For that reason, the seventh corps will be exclusively German.

NATO believes that a major attack would be preceded by considerable warning. The main defense forces, therefore, would be held in a fairly low state of readiness.

- *Augmentation Forces,* or reinforcements, which would come principally from North America but also from some of the larger European allies.

Under present plans, the Augmentation Forces will account for about twenty-eight percent of NATO's future force structure. These forces would be composed of both active and reserve units, would require even more time than the main forces to achieve a reasonable level of combat readiness, and would rely heavily on US air- and sealift to reach the European theater.

Strengthening these three categories, explains General Galvin, will be the focus of NATO force planning.

Photo by Paul Kennedy

Multinationalism—as seen in the joint German-British-Italian-Spanish development of the European Fighter Aircraft—will be the watchword for the new NATO. Six multinational corps of 50,000 to 70,000 troops, the bulk of the Main Defense Forces, will be based within the borders of the former West German state.

"A Certain Glamour"

Though more than ninety percent of NATO personnel will be assigned to the Main Defense Force and Augmentation Forces, establishment of the multinational Reaction Forces has generated the greatest excitement among military leaders and the troops. Said General Galvin, "Everybody wants to be in the Reaction Forces."

This group of forces, which one USAF planner concedes has "a certain glamour," will be much larger and much more capable than the current NATO quick-reaction unit, the Allied Command Europe (ACE) Mobile Force.

"The ACE Mobile Force was kind of a show of force without a lot of fighting capability," observes one Air Force planner at the Pentagon. "The Immediate Reaction Force will have some teeth, so that, if it is committed, there would be no doubt in an aggressor's mind that we mean to fight."

The IRF will be defensive. Its air component, report USAF officers, would likely comprise one or two squadrons of F-15 air-superiority fighters.

"The Immediate Reaction Force is not a strike force," explained General Galvin. "It's not an expeditionary force. This is a reinforcing force, to be used within NATO."

The same is true of the larger, more heavily equipped RRF. It is conceivable that it could be used in operations outside Europe if NATO members agree to employ it in that fashion. Such a step, however, would mark a radical change in Europe's negative attitude toward NATO involvement in "out-of-area" operations.

The Rapid Reaction Force will have a major air component. NATO and Air Force officials say that a Luftwaffe officer would command the RRF's air component and that this force would have, in the words of one Air Force planner, "the offensive punch necessary to fight and win."

He says that, in addition to a large complement of modern air-superiority fighters, the air component would have a multinational force of hard-hitting ground-attack planes: F-16 multirole fighters, F-15E dual-mission fighters, Tornado GR Mk. 1 attack aircraft, and GR Mk. 5/7 Harrier jump jets, among other air-to-ground systems.

Following FOFA

Exactly how such an offensive air component would be employed remains unclear. In 1984, the Alliance formally adopted the concept of "Follow-On Forces Attack," or FOFA. General Galvin says FOFA was designed to break the mass and tempo of a numerically superior and technologically inferior enemy before engagement in a close-in ground battle.

Following the rapid demise of the Warsaw Pact, the pullback of the Soviet tank threat, and the evaporation of clear lines of defense in Europe, Alliance officers recrafted FOFA into a more flexible concept called "Joint Precision Interdiction." NATO officers continue to study interdiction and ways to carry it out in Europe.

General Galvin's comments suggest that he believes NATO's units must be flexible and able to operate with a minimum of specific preparation for set-piece battles. Current NATO plans, say USAF officers in Washington, call for RRF aircraft to "chop" to various NATO subordinate commands in event of a crisis.

Gen. Robert Oaks, the commander in chief of US Air Forces in Europe (USAFE), reports that the Air Force will continue to deploy a large force of F-15 air-superiority fighters at Bitburg AB, Germany, and at Soesterberg AB, the Netherlands, to help provide an integrated air defense. In addition, he says, the Air Force will continue to base some F-16s in Europe and, probably, some F-4G Wild Weasels at Spangdahlem AB, Germany.

General Oaks added that the remaining aircraft deploying in Europe will be "geographically balanced" and "mission-balanced."

General Galvin has formed a new Reaction Forces planning staff, commanded by a German three-star general. The position will rotate to officers from other Alliance nations. Though this staff is based at Supreme Headquarters Allied Powers Europe (SHAPE) in Mons, Belgium, it is separate from the regular SHAPE staff. The commander of the planning staff answers to the SACEUR, rather than to the SHAPE Chief of Staff.

The SACEUR also formed a new

air planning staff for the NATO Reaction Forces. It is commanded by a three-star Luftwaffe general and is located at Rheindahlem, Germany. The commander is responsible for ensuring readiness of the RRF's air components. He has no operational control of the aircraft.

Attending to Resupply

One topic that needs immediate attention is the new demand that the Rapid Reaction Force will create for NATO resupply, lift capabilities, and air-to-air refueling.

"The whole issue of resupply has to be rethought," says one Air Force officer who spent four years with USAFE. "In the past, we prepositioned logistics. Well, it's pretty hard to have prepositioned logistics and weapons if you don't know where you are going to fight."

NATO planners think aircraft might be forced to operate from bare bases more frequently. Availability of fuel, ammunition, and spares will affect NATO planning. The Persian Gulf War, which General Galvin views as a trove of lessons for NATO planners, established that it took thirty-two C-141 flights to move the 515 tons of munitions, fuel, and cargo and the 527 personnel needed to support one squadron of eighteen F-16s for three weeks at Al Kharj, a "bare" base in the eastern province of Saudi Arabia.

By almost all estimates, the prospect of nuclear war in Europe has declined almost to the vanishing point. The Alliance has stopped short of declaring a policy of "no first use" of nuclear arms, but not by much. NATO's official position now is that nuclear weapons are regarded as "weapons of last resort."

Accordingly, NATO's nuclear stockpile is being reduced. The US will keep in Europe only a "modest, tactical nuclear air-delivered capability," said General Oaks. This will be done by continuing to base USAFE dual-capable aircraft in Great Britain and in Germany.

For the time being, the US tactical nuclear arsenal will consist solely of gravity bombs dropped from dual-capable aircraft. The Air Force, at the order of President Bush, canceled development of its short-range attack missile–tactical (SRAM-T).

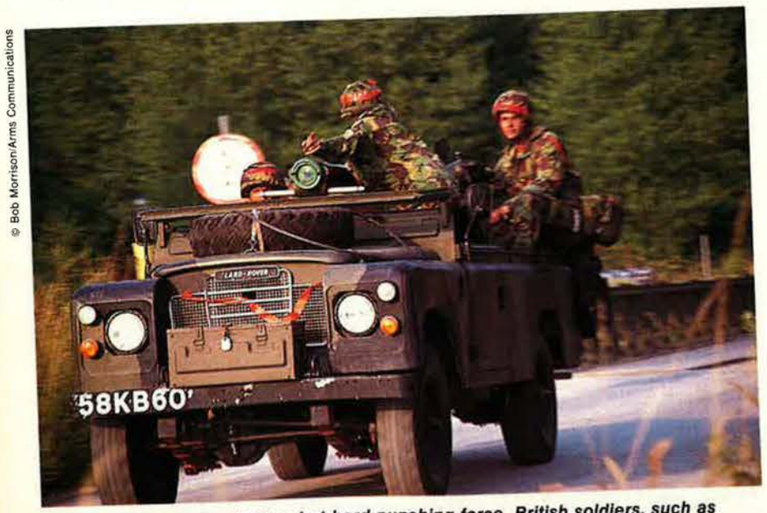
Without question, the new NATO strategy document implies a substantial reduction in the number of Alliance troops under arms and on alert.

Existing plans call for the number of Allied troops in central Europe to drop during the next five years—from 1.35 million in 1990 to 1.05 million. Half of that cut will come from withdrawals of US forces.

The Allies have also reacted to the disintegration of the Soviet threat by trimming forces. France, for example, plans to reduce its presence inside Germany by fifty percent. Belgium is in the midst of moving home eighty-five percent of all Belgian troops in Germany. In September, Canada announced it would close its two German bases—Lahr and Baden-Sollingen—by 1995 and cut the number of its soldiers and flyers in Europe from 6,600 to 1,100.

General Galvin says that the twenty-two NATO ground force divisions garrisoned in the central region in 1991 will be reduced to about fifteen by 1995. Tactical aircraft squadrons will drop from ninety to fifty-three.

"We can afford under the new strategy to do that because we are going to have a lot more warning time," the SACEUR said.



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NATO seeks a smaller, lighter, but hard-punching force. British soldiers, such as these on patrol in Germany, will play a key role in the RRF, which is to be commanded by a British three-star general. Gen. John Galvin, NATO Supreme Commander, says that "everybody wants to be in the Reaction Forces."

How Low Should It Go?

The slimmed-down Alliance force structure coincides with the intentions of the Bush Administration, which plans to reduce by more than one-half the 320,000 troops it stationed in Europe at the height of the cold war.

The troop number is now down to about 260,000. Plans call for cutting US conventional forces to 150,000 by the start of Fiscal 1995. Those plans predated the most recent defense budget reductions imposed by the White House. Some in Congress, moreover, continue to press for an American contingent of no more than 75,000. Under currently approved plans, USAFE will see combat strength reduced from a cold war high of nearly nine wings to a low of about three to four wings by 1995.

General Oaks believes that the planned force is about as low as the US should go. "Our interests have been well served, and now we are cutting the ante significantly," he said, "but you still have to ante up to stay in the game."

By the time the reductions are completed, USAFE, which includes 17th Air Force in Germany, 3d Air Force in Britain, and 16th Air Force in southern Europe, will have lost sixty percent of its aircraft and forty percent of its personnel.

Elsewhere, the Army's 3d Armored Division is on its way home. On January 17, the so-called "Spearhead Division," which since 1955 had waited for a Soviet attack at the Fulda Gap, began the trip back to the US. On the same day, the Army's 8th Infantry Division (Mechanized) also began to disperse. The 1st Armored Division and 3d Infantry Division (Mechanized) will remain in Germany as the two US divisions under V Corps command.

The Army is shooting for a reduction in its Europe-based troop strength from 213,000 to 92,000 by October 1995.

The Sixth Fleet, with a carrier battle group and amphibious ready group in the Mediterranean, will remain virtually intact.

What's left of NATO forces on the Continent is likely to be better equipped, overall, than before. That could well be the result of the Conventional Forces in Europe (CFE) Treaty. Under its provisions, the US, Germany, and the Netherlands are permitted to hand over tanks, artillery, and other types of equipment to NATO Allies, who will then destroy older equipment and bring the West's totals under the CFE ceilings.

Under this system of weapon "cascading," Norway, Denmark, Portugal, Spain, Greece, and Turkey will receive about 2,000 US M60 main battle tanks, 180 artillery tubes, and some 600 armored combat vehicles.

Trimming NATO's Command Structure

Senior military leaders have begun to slim down the Western alliance's top-heavy command structure. For starters, NATO is eliminating one of its three basic combat commands.

The Alliance will keep Allied Command Europe, with Gen. John Galvin as Supreme Allied Commander Europe, and Allied Command Atlantic, with Adm. Leon Edney as Supreme Allied Commander Atlantic. However, NATO agreed last December to disband Allied Command Channel, headquartered in Britain and commanded by the Royal Navy's Adm. Sir Jock Slater.

Staff photo by Guy Aceto

The Gulf War caused massive, eastward redeployment of Europe-based NATO fighters such as this RAF GR Mk. 1 Tornado, shown with its mission markings. With US Air Forces in Europe and other NATO nations' air forces awaiting major reductions, fewer aircraft will be available for such missions.

That move, in turn, prompted NATO leaders to reassign and reorganize British and Norwegian air, land, and naval forces in a new grouping, Allied Forces Northwest. It will be one of General Galvin's major subordinate commands. It will control operations in Britain, Norway, the North Sea, the Channel, and the Baltic approaches.

The SACEUR will also hold on to his other major subordinate commands: Allied Forces Central Europe, based in the Netherlands and commanded by a German four-star general, and Allied Forces Southern Europe, based in Italy and headed by a US admiral.

Within AFCENT, however, five primary subcommands have been reorganized into two entities: Air Forces Central Europe and Land Forces Central Europe.

The AIRCENT structure, to be based at Ramstein AB, Germany, will combine the old 2d Allied Tactical Air Force and 4th Allied Tactical Air Force. The expectation in early 1992 was that General Oaks would be named AIRCENT commander.

With their adoption of the new strategy, NATO leaders formally acknowledged the death of the Warsaw Pact and of the threat posed for four decades by the Red Army. "The monolithic, massive, and potentially immediate threat the Alliance faced in the past has now disappeared," a senior NATO official said at the Rome summit.

No one knows for certain what will emerge from the rubble of the former Soviet empire. Even after full implementation of the CFE Treaty, the Russian Federation will maintain the largest armed force in Europe, unless Moscow unilaterally reduces its military forces even further.

In addition, Alliance members see great risks in eastern Europe's smoldering nationalistic and ethnic conflicts. "We are still living in a very rapidly changing security environment," says one NATO official. "There is a greater chance of lesser crises arising unexpectedly."

Although they agreed in Rome to the new strategic framework, NATO leaders left many major issues unresolved. Many of these problems and questions are to be addressed during the coming year in the so-called Defense Planning Questionnaire (DPQ) process. The 1992 DPQ, prepared in consultation with the forces of all NATO nations, is expected to resolve many specific problems. "DPQ 1992 may be NATO's most important document in the Alliance's four decades," says one NATO expert in the US Army. ■

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Outfitted with their LASTE upgrade, the A-10s show their stuff at the TAC weapons meet.

The Warthog Round at Gunsmoke

By Frank Oliveri, Associate Editor

AFTER descending out of an azure sky, an A-10 approached the "enemy" tank at low level, released a single BDU-33 practice bomb, and pulled away hard. Spectators watching the action on video saw the bomb plummet toward the target and vanish. Suddenly, smoke burst upward from the barrel of the tank.

The vehicle was not returning fire. It only seemed that way because the bomb actually slid down the barrel—its opening was the aimpoint—and detonated, spewing smoke.

It was neither the first nor the last time that an A-10 crew participating in Gunsmoke '91 performed this feat of bombing virtuosity. It happened several times, hinting at the proficiency that aircrews displayed throughout the contest late last year at Nellis AFB, Nev. One A-10 unit won the overall competition. Two others finished in the top seven. Four of the five pilots with highest individual scores flew A-10s.

The biennial air-to-ground gunnery meet is no turkey shoot. Tactical Air Command uses it as a two-year lab to evaluate technologies, testing, training, and analysis. Said Maj. Gen. Billy McCoy, commander of the Fighter Weapons Center at Nellis, "Gunsmoke is an affirmation of what you train toward and what you expect to get out of the investment in training and systems."

Gunsmoke '91 showcased fourteen of the Air Force's active-duty, Guard, and Reserve fighter units, including the first F-15E and F-111 units ever to participate.

Top honors went to an A-10 crew of the 175th Tactical Fighter Group, Maryland ANG. Other A-10 crews finished fifth and seventh. Units flying F-16s finished second, third, fourth, sixth, ninth, and tenth. The F-15E unit placed eighth. Two A-7 teams came in eleventh and twelfth. Units from F-111 wings finished thirteenth and fourteenth.

Gulf War veteran and winner of the level bombing segment of the competition Capt. Jeffery Gingras gets 30-mm rounds for his gun during Gunsmoke '91. The Low-Altitude Safety and Targeting Enhancement system made the A-10 a formidable foe this year after several years of having difficulty cracking the top ten.

Participating Units, Gunsmoke 1991

Unit	Base	Aircraft
363d Fighter Wing	Shaw AFB, S. C.	F-16
188th Tactical Fighter Group	Fort Smith MAP, Ark.	F-16
944th Tactical Fighter Group	Luke AFB, Ariz.	F-16
432d Fighter Wing	Misawa AB, Japan	F-16
86th Fighter Wing	Ramstein AB, Germany	F-16
388th Fighter Wing	Hill AFB, Utah	F-16
175th Tactical Fighter Group	Baltimore, Md.	A-10
442d Tactical Fighter Wing	Richards-Gebaur AFB, Mo.	A-10
354th Fighter Wing	Myrtle Beach AFB, S. C.	A-10
150th Tactical Fighter Group	Kirtland AFB, N. M.	A-7
121st Tactical Fighter Wing	Rickenbacker ANGB, Ohio	A-7
27th Fighter Wing	Cannon AFB, N. M.	F-111
20th Fighter Wing	RAF Upper Heyford, UK	F-111
4th Wing	Seymour Johnson AFB, N. C.	F-15E

The "Top Gun" award for best individual pilot performance went to Lt. Col. Roger Disrud, an AFRES A-10 pilot with the 442d Tactical Fighter Wing, based at Richards-Gebaur AFB, Mo. Colonel Disrud edged out—by one point—Lt. Col. Ronald Ball, an A-10 pilot with the 175th TFG. The winner racked up a perfect score on his final run.

The 121st Tactical Fighter Wing, an ANG A-7D unit based at Rickenbacker ANGB, Ohio, won honors as the overall top maintenance team.

A Lift from Technology

High-technology upgrades in older aircraft brought major changes to the 1991 competition, which spanned thirteen days last October. The A-10s were the clear beneficiaries. The strong showing by the "Warthogs" stemmed from the addition of the Low-Altitude Safety and Targeting Enhancement (LASTE) system. In Gunsmoke 1989, before A-10s had received LASTE equipment, A-10 units had a hard time cracking the top ten.

The LASTE system, an integrated computer and software package developed by General Electric, gives the A-10 enhanced accuracy for gunnery and bombing. LASTE shows a continuously computed impact point on the pilot's head-up display. The system also senses when the aircraft gets too close to the ground and warns the pilot.

"When we started testing that airplane here about a year ago," recalled General McCoy, "we knew then that the A-10 would be a formidable foe in Gunsmoke."

The A-10 also benefited from its lack of speed, compared to newer Air Force fighters. Faster airplanes —most notably the F-16 and F-15E —have less time to stabilize the pipper and study approach problems before releasing bombs. In addition, the speed of the faster aircraft magnifies each small targeting miscue.

The Gunsmoke competition features three bombing profiles. Profile I tests the pilot's ability to drop six BDU-33 bombs from three dive bomb angles, twice at each angle. Each participating fighter must also complete low-angle strafe passes, expending 100 rounds per sortie. The F-111 and the F-15E do not mount a machine gun and therefore do not participate. The low-angle strafe does not contribute to a team's overall score.

In Profile II, the crew makes two passes each in "low-angle, low drag," "low-angle, high drag," and "low-level bomb." The crew expends six bombs per sortie and flies in a tactical pop-up pattern. Low-angle strafe passes are flown.

Profile III challenges crews to fly a low-level navigation route in two-ship formations. The route ends in the delivery of two BDU-50 practice bombs. The navigation portion of the contest consists of five gates. At least one aircraft in the two-plane formation must pass through each gate. Maximum altitude is 500 feet on these missions.

Contrary to expectations, combat experience gained by pilots in Operation Desert Storm did not pay dividends in Gunsmoke. General McCoy said that a Desert Storm pilot, fresh from an intense cycle of dropping bombs, would have an advantage. However, he noted, "training is perishable."

He went on, "The kid who flew twice a day every day over the war for six weeks, at the end . . . should be pretty darn good. If he doesn't fly again for the next month, . . . that precision will disappear."

Pilots undergo intense training once they know they are to take part in Gunsmoke. After the fine-tuning is done, most pilots agree that combat experience will have little impact on the outcome. In fact, some pilots saw few similarities between Desert Storm and the competition.

One who took that view was Capt. Jeffery Gingras, an A-10 pilot from the 354th FW, Myrtle Beach AFB, S. C., and a Desert Storm veteran.

"There's nothing really tactical about this at all," he claimed. Gunsmoke is an exercise in "refining your weapons delivery skills. As far as Desert Storm goes, it's your job to shoot [the enemy] and kill him or drop your ordnance on said target before they shoot at you. So what you would do is optimize your standoff capability, minimize your risk, while at the same time ensuring accuracy."

Captain Gingras said that the A-10 would not normally be able to carry out some of the missions practiced in Gunsmoke. For example, some of the low-level bombing runs would be too low for the A-10 to drop its regular bomb load.

"This does give you the capability of dropping bombs better," he said. "Right now I think I'm at the peak of my bomb dropping [ability]."

Gunsmoke's mission evaluators closely examine how the crews perform in the navigation portion of the meet; they think it is important to analyze how well single-seat aircraft perform in comparison to two-seat aircraft.

Conventional wisdom holds that two-seat planes like the F-111 and the F-15E would fare better in Gunsmoke because there is a second pair of eyes to help spot waypoints and landmarks. However, while dual-seaters performed well, pilots of single-seat F-16s took the top four individual spots in navigation/attack. This result, said USAF officials, can be attributed in large part to the connection of the F-16 to the Navstar Global Positioning System, which helps pinpoint a fighter's location. The GPS network got rave reviews in Desert Storm.

F-16 units grabbed six of the top ten overall spots this year and dominated in the navigation segment. The Global Positioning System, a stellar performer in the Gulf War, received much of the credit. The absent "T" in the unit designation of this aircraft is indicative of USAF's sweeping reorganization.

At a Disadvantage

The F-15E and the F-111 specialize in dropping heavy laser-guided munitions. Some pilots indicated that, while they were pleased to be included in the Gunsmoke competition, dropping small dumb bombs really isn't their forte.

Staff photo by Guy Aceto

The judges (note background) are omnipresent at Nellis AFB, Nev., during Gunsmoke. Because these competitions are so stringent, USAF knew the capabilities of its weapons, so it was not surprised by their performance in the Gulf War. Knowledge gleaned in Desert Storm will help Gunsmoke become more realistic.

"We're at a little bit of a disadvantage because the competition doesn't reflect our wartime mission," said Capt. Jim Gunn, an F-111D Weapon System Officer with the 27th FW, Cannon AFB, N. M.

Gunsmoke "reflects the wartime mission of some of the planes, but this is the kind of stuff that really we wouldn't practice for a war. We'd fly at night. We'd love to have a competition with some night events, with some radar events dropping on blind targets."

On the surface, it would seem that the F-15E, probably the most advanced fighter at the meet, would enjoy a huge advantage over other aircraft. Capt. Tim Bennett, an F-15E pilot and Desert Storm veteran, said things aren't always what they seem.

"We don't really have an advantage," he said. "The aircraft is . . . not designed to [drop] these type of BDU-33 practice bombs. It drops heavies pretty well, but its bread and butter is dropping laser-guided bombs. It can carry a lot of them a long way."

Captain Bennett noted that other aircraft perform dive and delivery better than the F-15E. This, he said, is because the aircraft has not been around long enough for technicians to make the kinds of software changes that will bring the Eagle up to parity with the older models.

In actual combat in the Persian Gulf War, however, software problems didn't prevent Captain Bennett and his weapons specialist, Capt. Dan Bakke, from obliterating a Soviet-built Iraqi Hind helicopter in midair with a 2,000-pound, laser-guided bomb.

The Hind was one of four that was harassing US special operations troops on the ground in Iraq. Captain Bennett and his wingman were vectored to the area by an AWACS unit. After they finally got under the weather at 1,500 feet, AAA fire began to pick up. Captain Bennett observed the helicopters landing intermittently, dropping off troops, and then moving on again. Captains Bennett and Bakke decided to drop a 2,000-pound bomb to kill a helicopter on the ground and its troops. Then Captain Bennett would lock an AIM-9 missile on a helicopter if it took off.

"We let the bomb go, and the bomb was sailing through the air," Captain Bennett said. "Right at that time, I'm sitting there waiting for the helicopter to come up, and if it comes up I'm going to hit it with my AIM-9. Well, as he comes up and starts moving—at that time I'm thinking there is no way . . . the bomb is going to make it—I uncage the AIM-9. I'm getting ready to shoot it, and a little bit later—I'm just waiting to get in range—the bomb comes right into the field of

view, right into the top of the chopper, and blows it all to hell."

The Importance of Maintenance

In Gunsmoke, the maintenance competition is based on points for aircraft appearance, maintenance practices, aircraft performance, and military appearance. Each maintenance team must service five aircraft, with four taking part and one on standby should there be some mechanical failure that removes an aircraft from service.

Maintenance plays a huge role in the success or failure of a unit in the competition. Competing ground crews sweat their way through numerous loading and checking procedures, and judges scrutinize their every move.

"As far as the competition goes, we're looking at accuracy and speed, [avoiding] mistakes and [doing] it as quickly and proficiently as possible," said SMSgt. Kevin Jozwiak of the 4th Wing, based at Seymour Johnson AFB, N. C.

Ground crews were required to perform the so-called integrated combat turn, which requires servicing the aircraft plus providing fuel, liquid oxygen, oil, and other fluids. In addition, Gunsmoke has a bomb loading competition. Sergeant Jozwiak said that Desert Storm helped his crew in proficiency and technique. He added, however, that he and his crewmates had been working twelve to fourteen hours a day to prepare their F-15E for the competition.

A maintainer works on a 432d FW F-16 after its long trip from Misawa AB, Japan. Such meticulous attention to detail helped the 121st TFW (ANG) from Rickenbacker ANGB, Ohio, win this year's maintenance round. ANG and AFRES units frequently stand out at competitions like Gunsmoke because of experience and unit cohesion.

TSgt. Mark Proffitt of the 4th Wing said the competition requires that "the book" be followed closely.

"It's a lot different when you're working in a combat situation," he said. "This [competition] is designed so that you use a book on every step. Go by the rules exactly. Not to say we didn't go by the rules [in Desert Storm], but there's a lot of things that we did over there that you can't do here."

Older aircraft obviously need greater care. Crews handling the A-7 and F-111 fighters faced an uphill battle to keep the aircraft combat ready. Said SSgt. Mike Corsaro of the 27th Fighter Wing, "If we can't win the competition, we at least want to beat the other F-111 unit."

No Surprise

The Air Force expressed little surprise following its overwhelming success in Desert Storm, noting that all its tactics and many of the systems used by ground-attack fighters in the Gulf War had been thoroughly tested over the years, frequently in competitions like Gunsmoke.

"We already knew high-tech systems worked," General McCoy said. "The fact that we went over there and were able to apply all that should have been no surprise."

The General further noted that many pilots had directly or indirectly learned from Gunsmoke, which he described as an exercise in "harnessing the technology of [an] airplane to give . . . a release solution and firing solution so that the dumbest of weapons comes off that platform and precisely goes down and hits the target."

As a result of Desert Storm, officers have begun changing Gunsmoke. Some say that the Air Force will add the dropping of laser-guided bombs to the competition. Today, only "dumb" bombs are used. This change would add considerable cost.

During Desert Storm, USAF had great success in suppressing radar-guided surface-to-air missiles, but it relearned how dangerous anti-aircraft artillery fire can be. The AAA threat was felt most keenly by the Royal Air Force, which lost several Tornado fighters on low-level missions. The US Air Force switched to attacking from medium altitude.

"We'd gone along a pretty long time without a war, and with the advances in technology, everybody really considered the heaviest threat was going to be SAMs," said Captain Bennett. Therefore, staying low was going to be the order of the day.

Category Best Team

(The aircrew team in each category that receives the highest number of total points on Profiles I, II, and III)

Aircraft	Unit
A-10	175th TFG (ANG), Baltimore, Md.
F-16	944th TFG (AFRES), Luke AFB, Ariz.
F-15E	4th Wing, Seymour Johnson AFB, N. C.
A-7	150th TFG (ANG), Kirtland AFB, N. M.
F-111	20th FW, RAF Upper Heyford, U. K.

Category Best Aircrew

(The individual aircrew that receives the hightest total number of points on Profiles I, II, and III)

Winner	Unit	Aircraft
Maj. David Walker	150th TFG (ANG) Kirtland AFB, N. M.	A-7
Lt. Col. Roger Disrud	442d TFW (AFRES) Richards-Gebaur AFB, Mo.	A-10
Capt. Steven Kwast Capt. Reno Pelletier	4th Wing Seymour Johnson AFB, N. C.	F-15E
Lt. James Wilkey	944th TFG (AFRES) Luke AFB, Ariz.	F-16
Maj. John Gibbons Capt. James Shane	27th FW Cannon AFB, N. M.	F-111

Arrival Competition

(The team that arrives closest to its scheduled time)

27th FW, Cannon AFB, N. M.

Gunsmoke 1991 Winners

Award	Winner	Score (possible points)
Top Team (meet winner)	175th TFG (ANG) Baltimore, Md.	8,524 (10,000)
Top Gun	Lt. Col. Roger Disrud 442d TFW (AFRES) Richards-Gebaur AFB, Mo.	2,203 (2,500)
Top Crew Chief	SSgt. Jerry Rose 944th TFG (AFRES) Luke AFB, Ariz.	
Top Maintenance Team	121st TFW (ANG) Rickenbacker ANGB, Ohio	3,592 (4,000)
Top Weapons Load Team	442d TFW (AFRES) Richards-Gebaur AFB, Mo.	2,990 (3,000)

Individual Top Gun Winners

Event	Winner	Score (possible points)
Strafe	Maj. Robert Tarter 442d TFW (AFRES) Richards-Gebaur AFB, Mo.	99.50 (100)
Navigation Attack	Capt. Christian Peloza 363d FW Shaw AFB, S. C.	1,784 (1,800)
High-Altitude Dive Bomb	Maj. Mike Clemovitz 944th TFG (AFRES) Luke AFB, Ariz.	—
Dive Bomb	Maj. Robert Tarter 442d TFW (AFRES) Richards-Gebaur AFB, Mo.	—
Low-Angle, Low-Drag Bomb	Capt: Jeffery Gingras 354th FW Myrtle Beach AFB, S. C.	—
Low-Angle, High-Drag Bomb	Lt. Col. Ronald Ball 175th TFG (ANG) Baltimore, Md.	—
Level Bomb	Capt. Jeffery Gingras 354th FW Myrtle Beach AFB, S. C.	—

Staff photo by Guy Aceto

F-15Es competed for the first time in 1991, as did F-111s. Pilots of these aircraft indicated that while dropping small, dumb bombs is not their forte, they were pleased to be included. One F-111 Weapon Systems Officer expressed a desire to fly in future competitions at night or against blind targets with laser-guided weapons.

"If it's at night and you can use electronic countermeasures and other things like that, you can defeat SAMs. The bad news is the AAA. No countermeasures are going to stop a guy from shooting in the air, and if they shoot enough, the 'Golden BB' is going to get you at some point."

As a result, the Air Force gave to Gunsmoke '91 a new, medium-altitude-profile mission, whereas all previous competitions had concentrated on the low-level mission.

The idea, said General McCoy, is to show the pilots that "you're not always going to have to go in right on the treetops, release at low altitude or for a quick pop and delivery. We've changed a little of the profile to indicate that there is a medium-altitude structure that we need to be proficient in." That will better prepare pilots for future conficts. ■

The F-117 pilot who dropped the first bomb recounts the opening hours of the Persian Gulf War.

A Strike by Stealth

By James P. Coyne

THE moon had set. Layers of clouds blanketed much of Saudi Arabia and swirled northward into Iraq. The "execute" order for Operation Desert Storm had gone out to the coalition air forces. H-hour was 3:00 a.m., Baghdad time, January 17, 1991.

Deep in Saudi Arabia, at an air base called Khamis Mushayt, US Air Force Maj. Gregory A. Feest scanned the cockpit displays of his F-117 Stealth fighter. Khamis Mushayt, tucked high in the Saudi mountains between Yemen and the Red Sea, was the operating location for USAF's 37th Tactical Fighter Wing, which had deployed to the Persian Gulf from its secret base at Tonopah, Nev. It was the only Air Force wing that had the F-117 black jet. Major Feest was in the 415th Tactical Fighter Squadron.

Satisfied all systems were "in the green," he pushed the throttles on his left console forward to their stops, released the brakes, and felt the airplane lunge forward. As runway lights flashed by on either side of the cockpit, Major Feest pulled back on the control stick and lifted his craft into the air.

He was alone in the night, with only the lights of villages in the mountains and desert visible below him. His radios were switched on but remained soundless.

Major Feest would drop the first bomb on Iraq in Operation Desert Storm. In December 1989, he had dropped the first bomb during the Panama operation, and in August 1990, he flew the lead fighter as the F-117s deployed to Khamis Mushayt.

Behind Major Feest, nine other pilots lifted their F-117s into the air at precisely timed intervals. His wingman would join up and fly with him to their tanker on the F-117 refueling track, which ran most of the length of Saudi Arabia.

After refueling, each would drop off the tanker at the north end of the track, not far from the Iraqi border, and fly to its assigned target. With luck, all the planes would get through unscathed and rejoin as they crossed the border on the way home.

The F-117s were not alone. Also bearing down on Iraq were seven heavy B-52G bombers, which covered the greatest distance of any

The first strike by USAF F-117s during the Persian Gulf War was part of a large, complex attack. In the time leading up to H-hour (3:00 a.m., January 17), Army Apache helicopters, Navy Tomahawk missiles, USAF B-52s, and a host of other aircraft were heading for targets in Iraq. The F-117s' journey would have been vastly more complicated without the precision of the KC-10 and KC-135 tanker crews who gave them the necessary fuel.

USAF photo by SrA. Chris Putman

A gleaming new facility at Khamis Mushayt served as the temporary home for F-117s deployed from Tonopah, Nev., to Saudi Arabia. Ten F-117s, flying far ahead of the main strike force deep into Iraq, caught Saddam's forces completely off guard, knocking out key command-and-control centers and air defense points.

combat aircraft that night and were the first to launch for the war. They had taken off from Barksdale AFB, La., at 6:35 a.m., Central Standard Time, January 16, nearly twelve hours before H-hour. The planes, part of Strategic Air Command's 2d Bomb Wing, carried conventionally armed AGM-86C air-launched cruise missiles to be fired at critical communications centers and power facilities deep inside Iraq. The round-trip flight of the B-52s would last more than thirty-five hours, the longest air combat mission in history.

US Navy warships had fired off a salvo of Tomahawk land-attack missiles (TLAMs). The cruiser USS *San Jacinto,* in the Red Sea, had launched the first of these at 1:30 a.m. Its target was in Baghdad, 700 miles away. Rather than giving the first TLAM an exact time on target, planners assigned it a five-minute "window" in which it was to make impact. The window extended from 3:06 a.m. to 3:11 a.m., Baghdad time.

Once the *San Jacinto*'s TLAM was on its way, USS *Bunker Hill* in the Persian Gulf and then the battleships USS *Wisconsin* and USS *Missouri* opened fire. In all, the initial attack saw the Navy ships fire fifty-two Tomahawks, all of which were clipping through the sky over the desert as Major Feest headed for Iraq.

Part of the Force

These air weapons were part of a huge strike force. In the runup to H-hour, 668 aircraft from the US Air Force, Army, Navy, and Marine Corps, the Royal Air Force, France, Kuwait, and Saudi Arabia had taken off for targets in Iraq. The attack had been choreographed by Lt. Gen. Charles A. Horner, commander of US Central Command Air Forces and "air boss" for the coalition; his director of Operations, Maj. Gen. John A. Corder; and Brig. Gen. Buster C. Glosson, director of Campaign Plans.

Major Feest and the other aircrews of the strike force rendezvoused with 160 KC-135 Stratotankers and KC-10 Extenders. The tankers flew stacked down, each tanker 500 feet below the one ahead of it, along carefully defined refueling tracks over Saudi Arabia. Plowing through cloud banks, the strike aircraft alternated on the tanker refueling booms. They topped off their tanks and swung to attack headings.

General Horner's strike force was controlled by three flying command posts, E-3 Airborne Warning and Control System (AWACS) aircraft. Orbiting near the Iraqi border, the AWACS sent radar beams hundreds of miles into Iraqi airspace. Two Navy E-2C Hawkeyes, one over the Persian Gulf and the other above western Saudi Arabia, provided additional radar coverage. An RC-135 Rivet Joint aircraft eavesdropped electronically, pinpointing any Iraqi communicators or radar operators who were transmitting. Some 60,000 feet up, U-2/TR-1 reconnaissance aircraft employed a variety of sensors to track the battle.

The opening attack took place not in Baghdad but far to the southwest of the city. There, Army and Air Force helicopters and F-117s combined to slash open a gap in western Iraqi air defenses *[see "Apache Attack," October 1991, p. 54]*. At H minus twenty-one minutes—2:39 a.m.—helicopter Task Force Normandy, comprising Army AH-64 Apaches and USAF MH-53 Pave Lows, knocked out two Iraqi radar sites just inside the border. The Apaches employed Hellfire missiles.

Minutes later, Major Feest would drop the first bomb, destroying an Iraqi Air Force interceptor operations center (IOC), about 150 miles inside Iraq. That IOC was a key link between border radar sites and the air defense headquarters in Baghdad.

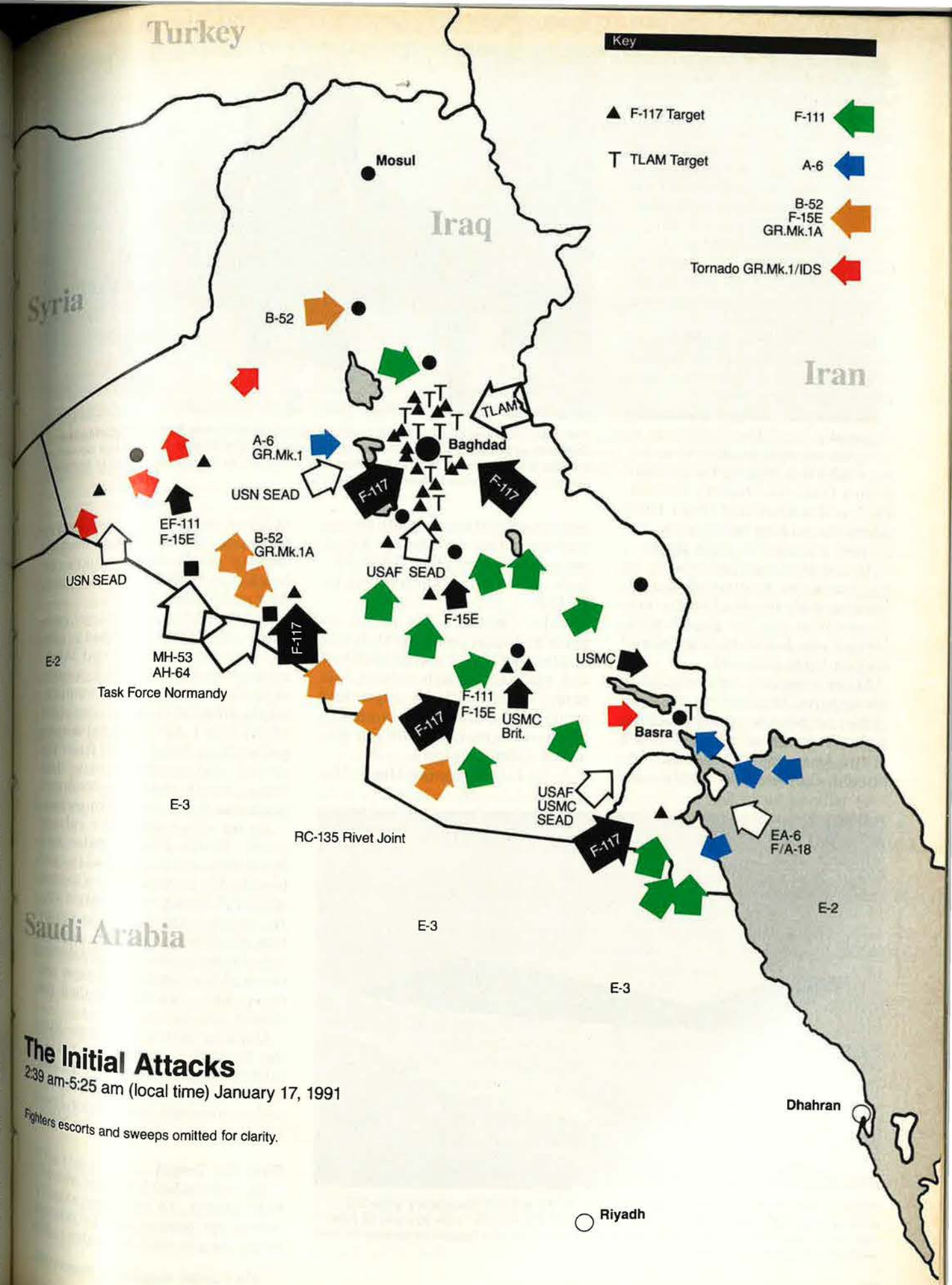
"We had practiced a lot, and we had become very good at finding a target and hitting it exactly on time, within one second," Major Feest said. "This was a little different than practice, though, because I knew they were going to be shooting back at me. So, as I came to my first IP [initial point], I was kind of apprehensive.

"It was a very difficult target, well hidden and camouflaged. The most difficult part of the mission was finding the IOC, which was housed in a hardened bunker at a town named Nukhayb."

Before takeoff, Major Feest had entered the exact latitude and longitude of each checkpoint along his route, as well as the position of the target, in the F-117's inertial navigational system (INS).

The "Fence Check"

Flying across the border, Major Feest performed a "fence check"—a last detailed check of the aircraft. From then on, things would happen rapidly. He made sure all external lights were switched off. Sometimes, under the stress of combat, the most obvious things are left undone. A single wingtip light, visible to enemy gunners, could mean disaster.



The Initial Attacks

2:39 am-5:25 am (local time) January 17, 1991

Fighters escorts and sweeps omitted for clarity.

Inside the cockpit, the only light came from the dimly glowing multifunction displays (MFDs) arrayed before him. Using switches on the throttles and pushing actuator buttons near the video displays, he could call up target information on one MFD while keeping aircraft status information, such as airspeed, attitude, and altitude, on another.

Another display gave Major Feest the data his sensors were gathering on the enemy's radar system. He could call up almost any combination of data he wanted.

He selected the next checkpoint on the INS and checked the latitude and longitude readout. The autopilot turned the aircraft.

Major Feest changed his heading frequently, as all F-117 pilots do, to complicate target tracking by an enemy radar that might get some slight return from the stealthy aircraft. On-board sensors told Major Feest where the probing radars were, and he flew a course to avoid them.

To complete the fence check, he compared the amount of fuel remaining with the level that a precomputation said he should have. He again made sure his warning and caution lights were out.

Major Feest now concentrated on his displays, hearing only the hum of the cockpit as he sped through the night. He prepared to drop the first of two laser-guided, hardened, improved, 2,000-pound bombs, designed to penetrate deep into enemy bunkers before detonating. These special bombs, called GBU-27s, were carried in the Gulf War only by F-117s.

The GBU-27, a penetrating 2,000-pound weapon carried only by F-117s during the Gulf War, provided a deadly complement to the Stealth fighter. F-117 pilots sought to put the bombs "in the basket," using laser guidance to hit not just specific buildings but specific sections of those buildings.

Major Feest punched up the armament display on an MFD. It told him that both bombs were operative and that the release system was ready. He armed his weapons and switched the armament system to "weapons armed, off safe" to prevent accidental release.

As his F-117 neared Nukhayb, Major Feest switched his computer system from "nav" mode to "weapons delivery" mode. He turned to a new heading over the pre–initial point, then passed over the IP.

He then called up the target position on the INS and watched as aiming cross hairs positioned themselves over the computed position of the target. He was now scrutinizing the infrared picture on one of the MFDs. The F-117's infrared sensors gather heat emanations from the ground, and an MFD displays their image, which closely resembles a black-and-white television picture.

As he approached the release point, Major Feest's pulse rate quickened, and he breathed fast and heavily. He set the autopilot to keep the F-117 steady on the target run. He checked the MFDs to ensure that his altitude, heading, and airspeed were correct for this delivery, checked his armament system one more time, and then flipped the master arm switch to "arm."

Outside, only a few lights from the town were visible. The F-117's infrared sensors, however, picked out buildings, dry watercourses, and an unpaved road. Major Feest could see these clearly on his MFD.

Some of the F-117's malevolent appearance on the ground disappears once the craft is airborne. This sleek side view (along with the F-117's "now you see it, now you don't" qualities) helps explain the Arabic nickname the Saudis bestowed on the aircraft: "Shabah," or "Ghost."

Over the Target

He had studied his target intently beforehand, so he knew exactly where the bunker was in relation to the sparse terrain features. He compared what he saw on the MFD with an aerial photo strapped to his legboard. As he flew closer, he could see the outline of the bunker and some of its support structures for positive target identification.

Major Feest moved the fingertip target designator (TD) button on one of the throttles, slewing the cross hairs until they were precisely over the aimpoint, which is called the "designated mean point of impact" (DMPI). Depending on size, hardness, and other considerations, a target may have more than one DMPI. In this case, the single aimpoint was the center of the top of the bunker.

By depressing and then releasing the TD button, Major Feest told the computer exactly where he wanted to aim. Immediately the F-117's laser designator began to shoot a continuous, invisible, pinpoint laser beam at the DMPI. The laser energy, reflecting from the target to the aircraft, provided guidance for the bomb.

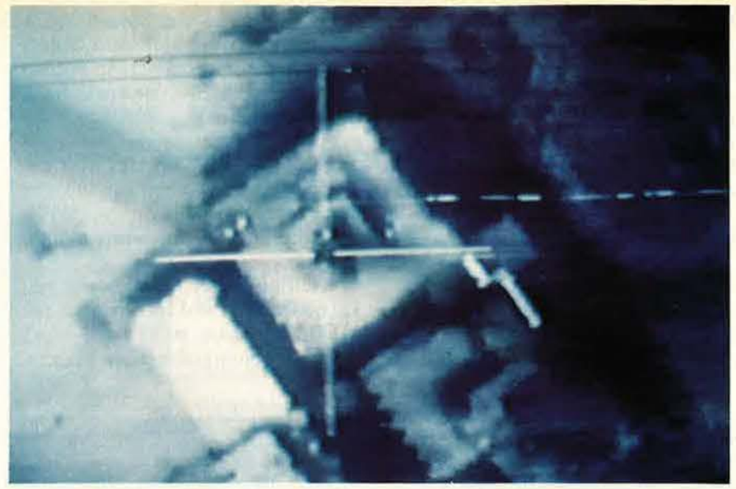
Symbology on the MFD and on the head-up display in the windscreen cued Major Feest to fly left or right to correct for crosswinds. More symbology told him when he was in range of the target. Once he had passed the "max range" point, the bomb would have enough energy, imparted by the forward motion of the F-117, to arc into the target. F-117 pilots refer to such a shot as "putting it into the basket."

Major Feest saw the "in range" symbology, checked his position in relation to the target, decided he agreed with the computer, and depressed the red button on the top of his control stick. The weapons bay doors snapped open. He heard a "clunk" as the huge bomb was released from its shackles in the weapons bay. The doors snapped closed.

As the weapon dropped away, its nose sensor homed on the reflected laser beam and sent signals to the guidance system, which moved vanes on the side of the bomb to control the arc of flight. Major Feest watched the IR display intently. The plunging bomb appeared at the bottom of the display just before it hit.

"The Doors Blew Off"

"I saw the bomb go in," he said. "I saw it penetrate. Then the explosion came out the hole the bomb had made, and then the doors blew off the bunker. I knew I had knocked out the target."



This famous video footage from an F-117 flying over Baghdad, showing the imminent destruction of what Lt. Gen. Charles A. Horner, the Central Command Air Forces boss, termed "my counterpart's headquarters," clearly illustrates what F-117 pilots mean by "putting it in the basket."

Then, Major Feest said, the reality of war hit home.

"I turned toward my next target," he said. "I looked back, and that was the first time I had ever seen anyone shooting at me. They had started shooting as soon as my bomb went off. I thought, 'Boy, I'm glad I am through there and don't have to fly through that.'"

For Major Feest, the mission wasn't over. The airspace over western Iraq was swarming with flak. "I looked out in front of me and I was heading out to western Iraq now, and I saw what everybody at home saw on television," he said. "It was the same as downtown Baghdad. Tracers, flashes, flak all over the place, and that was scary. I knew I had to go into that to drop my second bomb.

"It was, apparently, all barrage fire. It was probably twenty minutes later that I was going to hit my next target, a couple of hundred miles away. Looking out and seeing what was in the target area was scary. I had to go into that stuff."

Major Feest wondered about his chances of surviving the mission. "I didn't think I was going to make it through there because the barrage fire was so intense," he said. "I saw SAMs in front of me and behind me. They flew right through my altitude. Luckily, they didn't track me.

"I just concentrated on finding my target. I found it and tracked it, just like the first time. I hit it, came off, and turned back south toward Saudi Arabia. Stuff was going off above me and below me.

"Flying that first night, after seeing what we had to fly through, we all thought we would probably never make it home. Even though it was barrage fire, there was so much of it, I just knew I'd get the 'Golden BB,' the one with my name on it. My wingman, flying about a minute behind me, had to hit another target. I knew he had to fly through the same sort of stuff. I didn't think he could make it. For both of us to make it would require too much luck, I was sure, but we made it home okay."

The opening attack by the helicopters and F-117s blew a gap in the Iraqi defenses. Nonstealthy F-15E fighters, equipped with Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) pods, streaked through the breach into western Iraq at near-supersonic speed to hit Scud missile sites.

On the leading edge, flying far ahead of the main strike force, the ten F-117s from Khamis Mushayt knocked out Saddam's command-and-control centers and key air defense points. Most of these targets were in and around Baghdad. Flying single-ship missions, the F-117s caught the Iraqis by surprise. Min-

utes earlier, when Major Feest and the helicopters knocked out air defenses to the southwest, the batteries in Baghdad had filled the night sky with hot metal. Soon, however, they fell quiet again, evidence that the incoming F-117s had not been tracked.

The Blind Barrage

At H-hour, 3:00 a.m., another stealth pilot positioned his cross hairs on a telecommunications center in downtown Baghdad. This was the building that General Horner's chief planner, General Glosson, had dubbed the "AT&T Building." As soon as the first bomb fell in Baghdad, the Iraqi air defenses opened up, full bore. Millions of viewers around the world later saw the awesome display on television. Streams of deadly red tracers and hundreds of SAMs rose up in a blind barrage.

F-117 pilots still refuse to give specifics on targets they bombed in Baghdad. However, one F-117 pilot (who did not fly over Baghdad on the first night but who later attacked targets in the city) described a typical attack.

"Your weapons are armed and ready to go," said Maj. Robert D. Eskridge. "You make sure your system is in the weapons delivery mode. You check it, and, thirty seconds later, you check it again.

"When you're still several miles out, the city is an indistinct collection of infrared splotches. With a fingertip you slew your cross hairs over the general location of your target, which might be the northeast quadrant of the city. As you approach the IP, you can see the city much more distinctly on your MFD, just like a black-and-white photograph.

"Getting closer, you can see major boulevards and the river on the MFD. You know your target—let's say it's a command bunker—is east of the river and north of a main boulevard. You refine the cross hairs' positioning."

The aiming process becomes very precise, Major Eskridge said. "You are fixated on the MFD. You know stuff is coming up indiscriminately, bursting around you, but you have to ignore it and concentrate on that target. Your flight path takes you closer and closer.

"The image is now larger and very distinct. Now you can see cross streets. You check the photo strapped on your legboard. You know the bunker is, say, four streets to the north of the last major boulevard. You also know it's three blocks east of the river. You refine the cross hairs' position some more.

"Closer. Now you can see separate buildings. You know the bunker is in the backyard of the third building from the corner, on the north side of the street. You can see the building. You can see the backyard. You can see the bunker. You can see the bunker air shaft.

"You make one final adjustment to the cross hairs, and you depress the TD button. The laser designator starts to do its thing, which is pinpoint the exact spot you want the bomb to hit.

"You fly the aircraft and follow the symbology to correct for drift. You wait for the indicators to tell you that you're inside 'max range.'

"Then, when you're sure you're within the parameters to drop the bomb in the basket, you depress the pickle button on the stick. The bomb releases. As it plunges toward the target, you make sure those cross hairs stay centered on the aimpoint, the DMIP.

"After what seems like a long time, but is really just seconds, you see the bomb flash into view, homing on that laser reflection. It penetrates exactly where you aimed it. You see smoke billow out of the hole. Probably the doors fly off the bunker.

"Then you roll into your preplanned turn and get out of there as fast as you can. One thing is certain. Nobody has ever been able to egress a target fast enough. Nobody. Ever."

On that first night, as the F-117s banked steeply away from their targets, Air Force F-15 Eagles and Navy F-14 Tomcats sped toward their combat air patrol positions over Iraq. There they orbited, ready to destroy Iraqi interceptors. Unseen and undetected, the lead F-117s flew swiftly beneath them, headed back to their mountaintop base in Saudi Arabia. ■

Not a single F-117 was lost during Desert Storm, despite the Iraqis' "awesome display" of firepower. Hundreds of SAMs flew up from Baghdad against them, but the F-117s made it back unscathed, testimony to the Iraqis' inability to track them.

James P. Coyne is a veteran fighter pilot who, after his retirement from the Air Force in 1984 as a colonel, served Air Force *Magazine as Senior Editor and* Signal *Magazine as Editor in Chief. This article is adapted from his forthcoming Air Force Association book,* Airpower in the Gulf, *which will be published by the Aerospace Education Foundation. His most recent article for Air Force Magazine was "Bombology" in the June 1990 issue.*

Military Almanac of the Commonwealth

of Former Soviet Republics

Information for this Almanac was compiled from a variety of official and unofficial sources. Because of the extraordinary turmoil in the Commonwealth of Independent States (what was the Soviet Union), some data are estimated. Information contained herein is quantitative. Command and control of the joint forces is highly uncertain, as is unity and morale. Change continues at a rapid pace.

In addition to reviewing this material and serving as general advisors, William F. Scott and Harriet Fast Scott prepared several items.

Lineup of Military Power, 1991

Strategic Nuclear Missiles

1,393* intercontinental ballistic missiles (ICBM). SS-11: 296. SS-13: 40. SS-17: 44. SS-18: 308. SS-19: 300. SS-24: 90. SS-25: 315.
**The total ICBM figure does not include ICBMs held in reserve for flight testing.*

912 submarine-launched ballistic missiles (SLBM). SS-N-6: 176. SS-N-8: 280. SS-N-18: 224. SS-N-20: 120. SS-N-23: 112.

Air Defense

2,010+ interceptors. MiG-21 Fishbed: 45. MiG-23 Flogger: 890. MiG-25 Foxbat: 300+. Su-15 Flagon: 225. Su-27 Flanker: 200+. MiG-31 Foxhound: 350.

6,850 strategic surface-to-air missile (SAM) launchers. SA-2: 2,400. SA-3: 1,000. SA-5: 1,950. SA-10: 1,500.

4,735 tactical SAM launchers. SA-4: 1,300. SA-6: 725. SA-8: 880. SA-9: 425. SA-11: 375. SA-12A: 100. SA-13: 930.

25 airborne warning and control aircraft. Il-76 Mainstay: 25.

100 antiballistic missile launchers. ABM-1B, SH-11, SH-08.

Air Forces

141 long-range strategic bombers. Tu-95 Bear: 125. Tu-160 Blackjack: 16.

300+ medium-range bombers. Tu-22M Backfire: 200+ (excludes Backfires with Soviet Naval Aviation). Tu-16 Badger: 40. Tu-22 Blinder: 60.

1,370+ tactical counterair interceptors. MiG-23 Flogger: 590. MiG-29 Fulcrum: 600+. Su-27 Flanker: 180.

2,080+ ground-attack aircraft. MiG-27 Flogger: 450+. Su-17 Fitter: 330. Su-24 Fencer: 840. Su-25 Frogfoot: 460.

80 tanker aircraft. M-4 Bison: 25. Tu-16 Badger: 20. Il-78 Midas: 35.

515+ tactical reconnaissance and electronic countermeasures aircraft. MiG-21 Fishbed: 60. MiG-25 Foxbat: 50+. Su-17 Fitter: 165. Su-24 Fencer: 180. Yak-28 Brewer: 60.

170 strategic reconnaissance and ECM aircraft. Tu-16 Badger: 105. Tu-22 Blinder: 55. Il-20 Coot: 10.

2,600 training aircraft.

668 military air transports assigned to Military Transport Aviation (VTA). An-22 Cock: 45. An-12 Cub: 100. Il-76 Candid: 500. An-124 Condor: 23.

1,655 civil aviation aircraft (Aeroflot). An-12 Cub: 160. Il-76 Candid: 125. Other medium- and long-range transports: 1,370.

Ground Forces

41,450* main battle tanks. T-54/-55: 11,000. T-62: 8,500. T-64: 5,250. T-72: 12,500. T-80: 4,200.
**The total does not include tanks in storage.*

1,400 surface-to-surface missiles. FROG-3/-5/-7: 550. SS-21 Scarab: 300. SS-1 Scud B: 550.

59,080 artillery pieces, mortars, and multiple rocket launchers. Towed artillery pieces: 31,380. Self-propelled artillery pieces: 9,600. Mortars: 11,000. MRLs: 7,100.

28,000 infantry fighting vehicles.

32,500 armored personnel carriers.

4,700 combat and support helicopters. Mi-2 Hoplite: 740. Mi-4 Hound: 20. Mi-6 Hook: 450. Mi-8 Hip: 1,675. Mi-17 Hip-H: 250. Mi-24 Hind: 1,250. Mi-26 Halo: 300. Mi-10 Harke: 15.

Naval Forces

59 ballistic missile submarines. Delta: 43. Yankee: 10. Typhoon: 6.

109 nuclear-powered general-purpose submarines. Cruise missile: 44. Attack: 65.

112 diesel-electric-powered general-purpose submarines. Cruise missile: 15. Attack: 97.

16 other submarines. Includes both nuclear-powered and nonnuclear-powered boats.

1 C/TOL aircraft carrier (*Kuznetsov* class).

4 V/STOL aircraft carriers (*Gorshkov* and *Kiev* classes).

38 cruisers. *Moskva*-class aviation cruisers: 2. *Kirov*-class nuclear-powered guided missile cruisers: 3. Guided missile cruisers: 33.

39 destroyers. Includes 28 guided missile destroyers.

146 frigates.

130 amphibious warfare ships and craft.

30 major underway replenishment ships.

Naval Aviation

266 strike and bomber aircraft. Tu-22M Backfire: 160. Tu-16 Badger: 100. Tu-22 Blinder: 6.

405 fighter-attack aircraft. Su-17 Fitter: 125. Su-24 Fencer: 100. Su-25 Frogfoot: 75. MiG-27 Flogger: 30. Yak-38 Forger-A: 75.

155 interceptors. MiG-23 Flogger: 85. MiG-29 Fulcrum: 70.

20 tankers (Tu-16 Badger).

100 reconnaissance and electronic warfare aircraft. Tu-16 Badger: 40. Tu-95 Bear-D: 15. Tu-22 Blinder: 5. Su-24 Fencer-E: 10. An-12 Cub: 30.

492 + antisubmarine aircraft. Tu-142 Bear-F: 55. Mi-14 Haze-A: 79. Ka-27 Helix: 130+. Ka-25 Hormone-A: 100. M-12 Mail: 75. Il-38 May: 53.

445 transport, miscellaneous, and training aircraft.

Joint Forces Leaders

(As of February 12, 1992)

Marshal of Aviation Yevgeni Ivanovich Shaposhnikov. Born 1942. Russian. Interim Commander in Chief of Joint Armed Forces of the Commonwealth of Independent States (December 24, 1991–March 1, 1992). USSR Minister of Defense August 23, 1991–December 25, 1991. Opposed coup. Pilot, senior pilot, flight commander, deputy commander, then commander of a fighter squadron. Deputy commander, then commander of a fighter regiment (1971–75) and a fighter division (1975–79). In 1979, deputy commander of aviation of the Carpathian Military District. From 1984, deputy commander, then commander of aviation of the Odessa Military District. Commander of aviation of Soviet Forces Germany (Western Group of Forces), 1987–88. In 1988, commander of an air army, then First Deputy Commander in Chief of Soviet Air Forces (to 1990). Commander in Chief of the Air Forces and Deputy Minister of Defense from July 1990 to August 1991. Member of the Central Committee CPSU 1990–91. Entered service in 1959. Kharkov Higher Military Aviation Schools for Pilots (1963). Gagarin Military Air Academy (1969). Military Academy of the General Staff (1984). Military Pilot First Class. Promoted August 26, 1991.

Gen. Col. Victor Nikolaievich Samsonov. Born 1941. Russian. Chief of the General Staff since December 1991. Began officer career with the naval infantry in the Pacific Fleet, after graduating from the Far Eastern Higher Combined Arms Command School. Chief of staff, then commander of a motorized rifle regiment, chief of staff of a tank division, commander of a motorized rifle division. Has served in Northern Group of Forces and in Central Asian and North Caucasus Military Districts. Chief of staff, then commander of a combined arms army. Commandant of Yerevan after Armenian earthquake in 1988. First Deputy Commander and Chief of Staff of the Transcaucasus Military District (1988–90). Commander of Leningrad Military District (1990). On August 19, 1991, appointed commandant of Leningrad (now St. Petersburg). Refused to deploy troops in Leningrad during coup. Frunze Military Academy (1972). Military Academy of the General Staff. Promoted 1990.

Gen. Col. Pavel Sergeievich Grachev. Born 1948. Russian. Chairman of the State Committee for Defense of the Russian Federation since August 23, 1991. Opposed coup. Deputy commander, commander of an airborne regiment, chief of staff, commander of an airborne division, First Deputy Commander of Airborne Troops. Commander of Airborne Troops (December 1990). Ryazan Higher Airborne Command School (1969). Frunze Military Academy (1981). Military Academy of the General Staff. "Hero of the Soviet Union," 1988, Afghanistan. Promoted August 23, 1991.

Gen. of the Army Yuri Pavlovich Maximov. Born 1924. Russian. Commander in Chief of the new Strategic Deterrent Forces since November 19, 1991. Joined Red Army in 1942. Division commander (1965), then first deputy commander of an army (1969). First Deputy Commander of the Turkestan Military District (1973–76). On special assignment (1976–78). Commander of the Turkestan Military District (1979–84). Commander in Chief of Southern TVD (1984–85). CINC of Strategic Rocket Forces, June 1985–November 1991. Candidate (1981), then Member of the Central Committee CPSU (1986–90). People's Deputy USSR (1989). Frunze Military Academy (1950). Academy of the General Staff, with gold medal (1965). "Hero of the Soviet Union" (1982). Promoted 1982.

Gen. Col. Vladimir Magomedovich Semenov. Born 1940. Karachayevets. Commander in Chief of the Ground Forces since August 31, 1991. In armed forces since 1958. Commander of a platoon, company, battalion, regiment. Chief of staff and deputy commander (from 1975), then commander (from 1979) of a division. Commander of a corps (1982), and commander of an army (1984) First Deputy Commander of Transbaykal Military District (1986–88), then commander (1988–91). People's Deputy USSR (1989–91). Member of the Central Committee CPSU (1990–91). Baku Higher Combined Arms Command School (1962). Frunze Military Academy (1970). Military Academy of the General Staff (1979). Promoted 1989.

Gen. Col. of Aviation Victor Alexeievich Prudnikov. Born 1939. Russian. Commander in Chief of Troops of Air Defense since August 31, 1991. Instructor pilot (1959). Deputy commander of aviation squadron, squadron navigator (1967), then squadron commander (1968). Commander of a fighter aviation regiment (1971). Deputy commander (1973) and commander (1975) of an Air Defense division, first deputy commander of a detached air defense army (1978–79). After finishing the Academy of the General Staff, first deputy commander (1981), and commander (1983) of an air defense army. Commander of the Moscow Air Defense District (1989–91). Member of the Central Committee CPSU (1990–91). Armavir School for Pilots (1959). Gagarin Military Air Academy (1967). Military Academy of the General Staff (1981). Military Pilot First Class. Promoted 1989.

Gen. Col. of Aviation Peter Stepanovich Deynekin. Born 1937. Russian. Commander in Chief of the Air Forces since August 31, 1991. Bomber pilot. Commander of an aviation regiment (1969), then a division. Deputy commander (1982), then commander of an air army (1985). Commander of Air Forces' Long-Range Aviation (1988). Military Academy of the General Staff, with gold medal (1982). Distinguished Military Pilot (1984). Promoted 1991.

Adm. of the Fleet Vladimir Nikolaievich Chernavin. Born 1928. Russian. Commander in Chief of the Navy since December 1985. Joined the Navy in 1947. Commanded one of the first Soviet nuclear submarines (1959). Chief of Staff and First Deputy Commander of the Northern Fleet (1974–77). Commander of the Northern Fleet (1977–81). Chief of the Main Naval Staff and First Deputy Commander in Chief of the Navy (1981–85). Candidate (1981), then Member of the Central Committee CPSU (1986–90). Deputy of the Supreme Soviet 10th and 11th sessions. People's Deputy USSR (1989–91). Naval Academy (1965). Academy of the General Staff (1969). "Hero of the Soviet Union" (1981). Promoted 1983.

Defense Leaders of Key Republics

Republic of Ukraine

Gen. Col. of Aviation Konstantin Petrovich Morozov. Born 1944, of Russian father and Ukrainian mother. Minister of Defense of Ukraine since September 1991. Held Soviet air defenses posts in the USSR, Hungary, Poland, Czechoslovakia. Commander of a fighter division. Chief of staff (1988) and then commander (1990–91) of an air army in Ukraine. People's Deputy of Ukraine. Kharkov Higher Military Aviation School for Pilots (1967). Promoted January 1992.

Republic of Kazakhstan

Gen. Lt. Sagadat Kozhakhmetovich Nurmagambetov. Born 1924. Kazakh. Chairman of Kazakhstan State Committee of Defense since October 25, 1991. Joined Soviet Red Army in 1942. At end of World War II, was Soviet Army rifle battalion commander in Berlin. Deputy Commander of Central Asian Military District (1969–1981 and 1985–1989). First Deputy Commander of the Southern Group of Forces (1981). People's Deputy of Kazakhstan. Hero of the Soviet Union (February 1945). Frunze Military Academy (1949). Higher Courses of Academy of the General Staff.

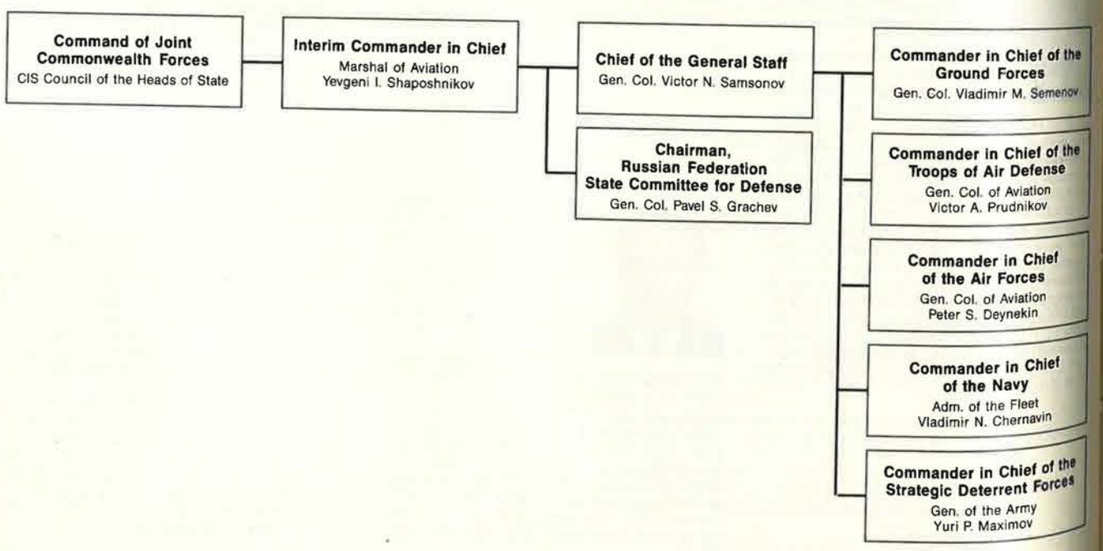
Republic of Belarus

Gen. Col. Peter Grigorievich Chaus. Born 1939. Belarussian. Minister of Defense Affairs, Republic of Belarus (formerly Byelorussia) since December 11, 1991. Fought in Soviet forces in Afghanistan. Chief of Staff Baltic Military District (1990–August 1991). First Deputy Chief of Civil Defense, USSR, 1991. Educated at Minsk Suvorov Military School.

Russian Federation

Gen. of the Army Konstantin Ivanovich Kobets. Born 1939 in Kiev. Russian. State Defense Advisor of Russian Federation and member of President's State Council since September, 1991 (appointed by Russian President Boris Yeltsin). Head of commission to analyze the activities of Soviet Armed Forces leadership during coup. Chairman of the Committee for Preparation and Conduct of Military Reform, part of State Council USSR (1991). Acting Russian Minister of Defense during August coup attempt. Deputy Chief of the General Staff and Chief of Signal Troops (1987–July 1991). People's Deputy of RSFSR (1990). Chairman of RSFSR State Committee on Defense and Security (February 1991). Doctor of Military Sciences. Kiev Military Signals School (1959). Budenniy Military Academy of Signals (1967). Military Academy of the General Staff (1978). "Hero of the Soviet Union" (1982). Promoted August 24, 1991.

The Main Command
of the Armed Forces of the Commonwealth of Independent States



Location of Strategic Nuclear Weapons
(as of September 1991)

Republic	Long-Range Missiles (ICBM)	Long-Range Bombers	Strategic Submarines
Armenia	0	0	0
Azerbaijan	0	0	0
Belarus	72	0	0
Georgia[a]	0	0	0
Kazakhstan	104	40	0
Kirghizia	0	0	0
Moldova	0	0	0
Russia	1,041	71	59
Tajikistan	0	0	0
Turkmenistan	0	0	0
Ukraine	176	30	0
Uzbekistan	0	0	0
Estonia[b]	0	0	0
Latvia[b]	0	0	0
Lithuania[b]	0	0	0

[a]Georgia did not affiliate itself immediately with the Commonwealth of Independent States (CIS).

[b]The three newly independent Baltic states have no formal relationship to the CIS comprising republics of the former USSR.

Location of Conventional Forces
(as of September 1991)

Republic	Selected Maneuver Divisions	Selected Interceptor Aircraft	Selected Tactical Aircraft
Armenia	3	0	0
Azerbaijan	4	30	100
Belarus	10	110	360
Georgia[a]	4	50	190
Kazakhstan	4	100	240
Kirghizia	1	0	0
Moldova	1	0	0
Russia	71	1,400	980
Tajikistan	1	0	0
Turkmenistan	4	70	90
Ukraine	20	230	620
Uzbekistan	1	30	260
Other	16[b]	—[c]	—[c]
Estonia[d]	1	110	0
Latvia[d]	1	30	150
Lithuania[d]	4	0	70

[a]Georgia did not affiliate itself immediately with the Commonwealth of Independent States (CIS).

[b]Sixteen active divisions remained in eastern Europe and Mongolia.

[c]Indeterminate number of aircraft were in transit, storage, or inactive status.

[d]The three newly independent Baltic states have no formal relationship to the CIS.

Relative Power of the Republics
(as percentage of former USSR power)

Region/Republic	Territory	Population	Domestic Output	Industrial Output	Agricultural Output	Oil and Gas Output
Europe-Slavic						
Russia	76.0	51.0	61.1	61.9	47.0	90.9
Ukraine	3.0	18.0	16.2	16.7	22.6	0.9
Belarus	1.0	4.0	4.2	4.0	5.8	0.3
Moldova	[a]	2.0	1.2	1.0	2.3	—
Central Asian						
Kazakhstan	12.0	6.0	4.3	2.5	6.5	4.2
Uzbekistan	2.0	7.0	3.3	2.3	4.7	0.4
Turkmenistan	2.0	1.0	0.7	0.4	1.2	1.0
Kirghizia	1.0	2.0	0.8	0.6	1.3	3.1
Tajikistan	1.0	2.0	0.8	0.5	1.0	—
Transcaucasian						
Georgia	[a]	2.0	1.6	1.4	1.2	—
Azerbaijan	[a]	2.0	1.7	1.7	1.6	2.2
Armenia	[a]	0.9	1.2	0.5	[a]	—
Baltic[b]						
Latvia	[a]	1.0	1.1	1.1	1.4	—
Lithuania	[a]	1.0	1.4	1.1	2.2	—
Estonia	[a]	1.0	0.6	0.6	0.8	—

Based on 1989 data, most current officially available. Percentages may not sum to 100 due to rounding.

[a]Less than one percent.

[b]The three Baltic states are independent, unaffiliated with the CIS.

Active Military Population, 1991

Ground Forces	1,400,000
Air Forces	320,000
Navy and Naval Air Forces	430,000
Strategic Defense Forces	475,000
Strategic Attack Forces (includes Strategic Deterrent Forces and strategic elements of the Air Forces and Navy)	280,000
Command/General support	650,000
Total	**3,555,000**

Figures are mid-1991 estimates. Further reductions have occurred and are occurring.

Significant External Military Deployments

(as of mid-1991)

Europe (Germany and Poland)	312,000
Mongolia	3,000
Cuba	6,000
Vietnam	2,800
India	500

Aircraft Production[a]

Equipment Type	1988 USSR	1988 US	1989 USSR	1989 US	1990 USSR	1990 US
Bombers	45	22	40	0	40	0
Fighters/fighter-bombers	700	534	625	473	575	456
Antisubmarine warfare fixed-wing aircraft	5	6	3	9	1	5
Military helicopters	300	337	225	273	175	307
AWACS	5	8	5	7	2	11

[a]Total military production, including exports.

Missile Production[a]

Equipment Type	1988 USSR	1988 US	1989 USSR	1989 US	1990 USSR	1990 US
ICBMs	150	12	140	9	125	14
SLBMs	75	0	75	16	65	82
SRBMs	600	0	600	0	600	86
Long-range SLCMs[b]	175	199	175	394	175	391
Short-range SLCMs[b]	1,100	497	1,100	228	1,000	311

[a]Total military production, including exports.
[b]SLCMs' range divided at 600 kilometers.

Ground System Production[a]

Equipment Type	1988 USSR	1988 US	1989 USSR	1989 US	1990 USSR	1990 US
Main battle tanks	3,500	784	1,700	720	1,300	718
Armored fighting vehicles	5,250	1,109	5,700	659	4,400	627
Towed field artillery	1,100	47	800	62	700	155
Self-propelled field artillery	900	170	750	41	400	0
Multiple rocket launchers	500	48	300	47	250	49
Self-propelled AA artillery	100	0	100	0	100	0

[a]Total military production, including exports.

Naval Ship Production[a]

Equipment Type	1988 USSR	1988 US	1989 USSR	1989 US	1990 USSR	1990 US
Ballistic missile submarines	1	1	2	1	1	1
Attack submarines	7	2	7	3	10	5
Other submarines	1	0	0	0	1	0
Aircraft carriers	0	0	1	0	0	1
Cruisers	1	3	1	4	0	1
Destroyers	3	0	3	0	1	0
Frigates and corvettes[b]	5	0	7	1	7	1

[a]Total military production, including exports.
[b]Includes paramilitary ships.

AEF launches a new tuition assistance program for enlisted personnel.

THE EAGLE PLAN

By Arthur C. Hyland

AFA's Aerospace Education Foundation has begun a new, $60,000-per-year tuition-assistance program for active-duty Air Force enlisted personnel. Under the "Eagle Plan," AEF awards unconditional grants to selected graduates of the Community College of the Air Force (CCAF). Each scholar receives a $250 grant and certificate of achievement.

Enlisted personnel in grades E-4 through E-7 are eligible. There are two requirements. The awardee must be the top CCAF graduate at his or her base and must be planning to continue studying toward a bachelor's degree from an accredited college. These grants are presented in April and October at biannual graduation ceremonies.

Winners are chosen by a committee of the base senior enlisted advisor, base education officer, and local AFA representative. Details are available from each base education officer. ■

Fall 1991 Recipients

MSgt. Stewart J. Allen, Griffiss AFB, N. Y.
SSgt. Troy F. Alley, Nellis AFB, Nev.
MSgt. Robert L. Barnes, Hickam AFB, Hawaii
SSgt. Glenn P. Boudreau, McGuire AFB, N. J.
SSgt. Robert S. Brickley, Randolph AFB, Tex.
Sgt. Muriel B. Brooks, Carswell AFB, Tex.
SMSgt. Ralph B. Burke, Offutt AFB, Neb.
SSgt. Gary Campbell, Robins AFB, Ga.
TSgt. Randy Childers, Maxwell AFB, Ala.
SSgt. Christopher Colby, K. I. Sawyer AFB, Mich.
TSgt. John M. Contorno, Jr., Homestead AFB, Fla.
SSgt. Russell L. Demers, Jr., Keesler AFB, Miss.
TSgt. Kevin M. Drummonds, Kelly AFB, Tex.
Sgt. John Y. Dusenberry, Pope AFB, N. C.
MSgt. LaMar A. Eikman, Lackland AFB, Tex.
MSgt. Rodney Ellison, Peterson AFB, Colo.
SSgt. Gary W. Erikson, Dyess AFB, Tex.
SSgt. Pamela Fenton, McChord AFB, Wash.
TSgt. Frederick J. Ferrer, Goodfellow AFB, Tex.
MSgt. Robert E. Fitzpatrick, Ellsworth AFB, S. D.
TSgt. Ronald S. Fox, Rhein-Main AB, Germany
Sgt. Anthony L. Gallo, Sr., RAF Chicksands, UK
MSgt. Richard Garneski, Whiteman AFB, Mo.
SSgt. James R. Garrett, Myrtle Beach AFB, S. C.
Sgt. David J. Geisenhoff, RAF Bentwaters/Woodbridge, UK
SSgt. Arlandio Green, Langley AFB, Va.
TSgt. Alfred B. Guinee III, Norton AFB, Calif.
SSgt. Edward C. Harris, Columbus AFB, Miss.
MSgt. Thomas Hayden, Luke AFB, Ariz.
TSgt. Timothy F. Hicks, Charleston AFB, S. C.
SSgt. Scott M. Hoffman, Edwards AFB, Calif.
TSgt. James E. Holcomb, RAF Mildenhall, UK
MSgt. George E. Hoots, Eaker AFB, Ark.
SSgt. Trent L. Johnson, RAF Upper Heyford, UK
SSgt. Troy C. Johnson, Castle AFB, Calif.
SSgt. Charles E. Jones, Los Angeles AFB, Calif.
SSgt. Leon M. Jones, McConnell AFB, Kan.
SSgt. James Kelcher, Lowry AFB, Colo.
SSgt. Michael L. Kimbrell, Mountain Home AFB, Idaho
SSgt. Steven J. King, Lajes Field, Azores
SSgt. Michael Kisker, Grissom AFB, Ind.
SSgt. Robert Lackie, Shaw AFB, S. C.
SSgt. Curtis A. Lamson, RAF Alconbury, UK
TSgt. Brenda F. Lopez, Tyndall AFB, Fla.
SSgt. Robert E. Lyons, Jr., RAF Lakenheath, UK
MSgt. Annie J. Mariner, Izmir AS, Turkey
SSgt. Terrence G. McConnell, Altus AFB, Okla.
MSgt. Robert F. McCoy, Jr., Tinker AFB, Okla.
SSgt. Patrick S. McInnis, Hanscom AFB, Mass.
SSgt. Karen F. Montague, Reese AFB, Tex.
SSgt. John P. Mook, Sheppard AFB, Tex.
TSgt. Deiadra J. Moore, Brooks AFB, Tex.
Sgt. Laurann M. Nelson, Andrews AFB, Md.
SSgt. Antonio S. Parra, Hill AFB, Utah
TSgt. Gilbert Pennington, Onizuka AFB, Calif.
SSgt. Theresa Pest, Gunter AFB, Ala.
A1C Albert G. Prendergaft, MacDill AFB, Fla.
SSgt. Anthony L. Puente, Cannon AFB, N. M.
MSgt. Danny A. Rodesillas, Beale AFB, Calif.
SSgt. Michael P. Rourke, Moody AFB, Ga.
SSgt. Steven B. Runyon, Wright-Patterson AFB, Ohio
SrA. William J. Rustad, San Vito Dei Normanni AB, Italy
TSgt. Dale G. Sesvold, Lindsey AB, Germany
Sgt. Aaron G. Smith, Jr., Warren AFB, Wyo.
TSgt. James R. Snyder, Barksdale AFB, La.
SSgt. Brent L. Stephens, Holloman AFB, N. M.
Sgt. Lawrence J. Stuhr, Jr., Fairchild AFB, Wash.
MSgt. Josef N. Swaney, Torrejon AB, Spain
Sgt. Gerald Tanner, Davis-Monthan AFB, Ariz.
SSgt. Michael P. Toothman, George AFB, Calif.
TSgt. William A. Totton, Vandenberg AFB, Calif.
MSgt. Alan P. Van Bevern, Chanute AFB, Ill.
MSgt. Sheldon D. Wheaton, Bergstrom AFB, Tex.
MSgt. Patrick White, Wurtsmith AFB, Mich.
MSgt. Brian M. Williams, Grand Forks AFB, N. D.
SSgt. Sharon C. Williams, Incirlik AB, Turkey
TSgt. Mark Wood, US Air Force Academy, Colo.

Gallery of Aircraft of the Commonwealth

of Former Soviet Republics

By John W. R. Taylor

Bombers and Maritime

Beriev A-40 Albatross (NATO "Mermaid")

In its 1991 report *Military Forces in Transition*, DoD states that acceptance trials of the A-40 by Naval Aviation have started and that it will eventually replace the Il-38 May and M-12 Mail, though not on a one-for-one basis. The two variants to which it refers:

Be-42. Search-and-rescue version of A-40, for coastal missions. 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

Beriev Be-42 Albatross (NATO "Mermaid")

can be carried, and there is room for up to 60 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.

Be-44. ASW/surveillance/minelaying version, able to carry weapons and other stores in the 20 ft bay in the bottom of the hull aft of the step.

Largest amphibian ever built, the A-40 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. The prototype made a first public appearance in the Aviation Day flypast at Tushino Airport, Moscow, on August 20, 1989. The commentator described it as an aircraft for search and rescue, designed under the leadership of Alexander K. Konstantinov. When an example was exhibited at the 1991 Paris Air Show, flush intakes at the front of the underwing pods were admitted to provide cooling air for the extensive avionics required for such missions as ASW. 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 (probably ESM) above the wingtip floats, and an inflight refueling probe on the nose. Traditional cockpit instrumentation on the early aircraft will be replaced by color CRTs on production aircraft.

Further versions of the A-40 are projected to carry up to 105 passengers, as transports for mixed cargo/passenger payloads, and for fire-fighting/water bomber missions. The OKB is said to be designing a derivative of the A-40 capable of operating anywhere in the Pacific on SAR missions. Two prototypes of a smaller version, designated Be-200, with a span of 107 ft 3½ in and takeoff weight of 79,365 lb, are to be built in partnership with ILTA Bank of Geneva, Switzerland. First flight is scheduled for 1994. *(Data for basic A-40 as shown in Paris.)*

Power Plant: two MKB (Perm)/Soloviev D-30KPV turbofans, each 33,070 lb st, on pylons above rear of hull. Two Novikov/Rybinsk R-36-35 booster turbojets, each 5,530 lb st.
Dimensions: span 137 ft 9½ in, length 137 ft 9½ in, height 36 ft 1 in.
Weights: max payload 22,045 lb, gross 189,595 lb.
Performance: nominal cruising speed 435 mph, patrol speed (SAR) 200–250 mph, required runway length 5,905 ft, max wave height for safe operation 6 ft 6½ in, max patrol endurance without flight refueling 9 hours.

Beriev M-12 Tchaika (NATO "Mail")

Tupolev Tu-16 (NATO "Badger-G") (Swedish Air Force)

Beriev M-12 Tchaika (NATO "Mail")

About 75 of an estimated 100 M-12 twin-turboprop amphibians, built from 1964, are in service for overwater surveillance and antisubmarine duties within a 230-mile radius of Naval Aviation shore bases.

Power Plant: two Ivchenko AI-20M turboprops; each 4,190 ehp. Internal fuel capacity approx. 2,905 gallons.
Dimensions: span 97 ft 5¾ in, length 99 ft 0 in, height 22 ft 11½ in, wing area 1,130 sq ft.
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) tail-sting.

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 in the CIS and on detachments overseas. The Indian Navy has five. Standard equipment includes a large radome under the front fuselage and an MAD tail-sting, 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. Fuel capacity 7,925 gallons.
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 448 mph at 21,000 ft, patrol speed 248 mph at 2,000 ft, takeoff 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")

The Tu-16 reaches its 40th birthday this year; the prototype flew on April 27, 1952. On paper, most of the 650 Badgers of many types listed in last year's "Gallery of Soviet Aerospace Weapons" are probably deployed or in store, but the force is likely to be reduced rapidly in the current political and economic climate. Tu-22M-3s now constitute the majority of the Smolensk Air Army theater attack force. Others replaced Tu-16s at a Far East base of the Irkutsk Air Army last year. 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 continue to require for some time a proportion of the 150 tankers, reconnaissance, and ECM Tu-16s that they had a year ago; but Tu-22Ms replaced Tu-16s at Olenegorsk Naval Air base on the Kola Peninsula, and other bases have probably re-equipped subsequently. Some of the versions listed below are, therefore, of diminishing significance:

Tu-16A (Badger-A). Basic strategic jet bomber, able to carry nuclear or conventional free-fall weapons. 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 Badgers or a probe-and-drogue system to refuel Blinders. Manufacture in China as Xian H-6 continues.

Tu-16K-10 (Badger-C). Antishipping version, first shown in 1961 Aviation Day flypast. AS-2 (Kipper) winged missile carried 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 Badger-A. No provision for free-fall bombs.

Tu-16R (Badger-D). Maritime/electronic reconnaissance version. Nose like Badger-C. Larger undernose radome. Three elint radomes in tandem under weapons bay. Cameras in weapons bay.

Tu-16 (Badger-E). Photographic and electronic reconnaissance version. Similar to Badger-A, 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 Badger-A, but with underwing pylons for two AS-5 (Kelt) rocket-powered air-to-surface missiles that can be carried to a range greater than 2,000 miles. Free-fall bombing capability retained. Majority serve with anti-shipping squadrons of the Naval Air Force.

Tu-16K (Badger-G modified). Specially equipped to carry AS-6 (Kingfish) air-to-surface missile 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). Specialized 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 Badger-A. Some aircraft have large flat-plate antennas at wingtips.

Tu-16R (Badger-K). Electronic reconnaissance variant with nose like Badger-A. 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 or rear fuselage, and "solid" extended tailcone housing special equipment instead of tailgun position. Sometimes has a pylon-mounted pod under each wing. *(Data for Badger-G follow.)*

Power Plant: two Mikulin RD-3M-500 turbojets; each 20,920 lb st. Internal fuel capacity 11,570 gallons.
Dimensions: span 108 ft 3 in, length 114 ft 2 in, height 34 ft 0 in, wing area 1,772.3 sq ft.
Weights: empty 82,000 lb, normal gross 165,350 lb.
Performance: max speed 652 mph at 19,700 ft, service 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")

First operational bombers of the Air Armies and Naval Aviation with supersonic dash capability, Tu-22s are being 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. The Libyan and Iraqi air forces each have a few.

Blinder-B. Similar to Blinder-A, but equipped to carry an AS-4 (NATO Kitchen) air-to-surface missile 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. 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-7 turbojets in pods above rear fuselage, on each side of tailfin; each 30,900 lb st 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 Mach 1.4 at 40,000 ft, service ceiling 60,000 ft, max unrefueled combat radius 1,490 miles.
Accommodation: crew of three, in tandem.
Armament: single 23-mm gun in radar-directed tail mounting. Other weapons as described for individual versions.

Tupolev Tu-22M (NATO "Backfire")

This supersonic swingwing medium bomber has been in continuous production since 1977, at the rate of about 30 a year. Well over 200 have been delivered to the Smolensk and Irkutsk Air Armies, to attack deep theater targets; Naval Aviation units have more than 160, replacing obsolescent Tu-16s. A high proportion of these forces are equipped with the latest Tu-22M-3 version, which can carry up to ten AS-16s, the newest CIS short-range attack missiles, 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:

Tu-22M-2 (Backfire-B). Initial series production version. Wing sweep variable from 20° to 65°. Slightly inclined lateral engine air intakes, with large splitter plates. Two twin-barrel guns in tail mounting. Above-nose fairing usually replaces optional in-flight refueling probe.

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

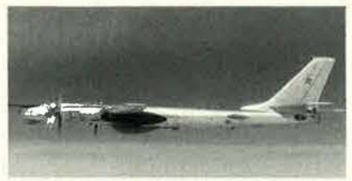
Backfire is capable of performing nuclear strike, conventional attack, and antiship missions, its low-level penetration features making it more survivable than earlier Tupolev bombers. Recent deployment of AS-16 SRAMs with Backfire-C has improved deliverable warhead potential and increased flexibility for air force strategists. *(Data for Backfire-B follow.)*

Power Plant: two unidentified engines, each with probable rating of more than 45,000 lb st with afterburning.
Dimensions: span 112 ft 6½ in spread, 76 ft 9¼ in swept; length 129 ft 11 in; height 35 ft 5¼ in.
Weight: gross 286,600 lb.
Performance: max speed Mach 2.0 at high altitude, Mach 0.9 at low altitude, service ceiling 59,000 ft, max unrefueled combat radius 2,485 miles.
Accommodation: crew of four, in pairs.
Armament: primary armament of two AS-4 (Kitchen) air-to-surface missiles, carried under the fixed center-section panel of each wing, or a single Kitchen semi-recessed in the underside of the center-fuselage. Multiple racks for 12 to 18 1,100 lb bombs sometimes fitted under the air intake trunks. Alternative weapon loads include up to 26,450 lb of conventional bombs, or mines. Development of decoy missiles has been reported, to supplement very advanced ECM and ECCM. Two GSh-23 twin-barrel 23-mm guns, with barrels side by side horizontally, in radar-directed tail mounting.

Tupolev Tu-22M-3 (NATO "Backfire-C") (Novosti)

Tupolev Tu-22M-2 (NATO "Backfire-B") (Swedish Air Force)

Tupolev Tu-22 (NATO "Blinder")



Tupolev Tu-95 (NATO "Bear-D")

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

After 38 years of continuous production, these remarkable propeller-driven aircraft remain a formidable spearhead of Russian strategic nuclear attack and maritime airpower. *Military Forces in Transition* reports that "New construction of Bear-Hs has brought the total operational inventory to over 80 at three main operating bases." At the same time, additional Tu-142 Bear-F Mod 4s have been delivered to Naval Aviation, bringing the total of the Navy's maritime reconnaissance/ASW/"TACAMO equivalent" Bears to around the same total of 80. Major current versions of the Tu-95 and Tu-142:

Bear-D. Identified in 1967, this maritime reconnaissance version of the Tu-95 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 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. A similar tail is fitted to Bear-G.

Tupolev Tu-142M (Nato "Bear-J") (G. Jacobs/Jane's Intelligence Review)

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

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 are bulged prominently, suggesting the use of larger or low-pressure tires. Bear-F has two stores bays for sonobuoys, torpedoes, and 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 fin tip. 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.

Most of approximately 55 Bear-Fs in service are now to Mod 3 or Mod 4 standard.

Bear-G. Bomber and elint conversion of early Tu-95 Bear-B/C bombers, able to carry two AS-4 (Kitchen) air-to-surface missiles, 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.

Bear-H. New-production version based on Tu-142 airframe, but fuselage shortened to length of Tu-95. Carries six AS-15 (Kent) long-range cruise missiles on an internal rotary launcher, with provision for two more under each wingroot and a cluster of three between each pair of engines. 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 fin-tip fairing. There are no elint blister fairings on the sides of the rear fuselage, and the ventral gun turret is deleted. Some aircraft have only a single twin-barrel gun, instead of the usual pair, in the tail turret.

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. Fin-tip 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.

Tupolev Tu-160 (NATO "Blackjack") (Soviet Wings/Alexander Dzhus)

Duties of the Bears have included deployments to Cam Ranh in Vietnam and to staging bases in Cuba and Angola. Bears have been encountered off the US east coast during transits between Murmansk and Cuba and during elint missions from Cuba. Bear-Hs have flown simulated attack and training missions against the US and Canada. Other Bears, including missile-armed Gs, have a theater role and conduct regular combat training exercises against naval and land targets in the northern Pacific region. The Indian Navy has ten Tu-142M Bear-Fs for maritime reconnaissance. *(Data for Bear-H follow.)*

Power Plant: four Kuznetsov NK-12MV turboprops; each 14,795 ehp. Internal fuel capacity 25,100 gallons. 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 506 mph at 25,000 ft, service 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")

In its 1991 report *Military Forces in Transition*, DoD comments that "construction of the Tu-160 Blackjack, a high-altitude supersonic bomber, . . .[has continued], with a total operational fleet of about 16 based at the sole operating base at Priluki, Ukraine. Production and deployment of this aircraft . . . have proceeded at a slower pace than had been anticipated." Since then, Col. Gen. Peter Deynekin, a one-time Blackjack pilot who was appointed CINC of the former Soviet Air Forces last year, has expressed his dissatisfaction with both the Tu-22M and Tu-160. Claiming that it has been common practice for aircraft to be rushed into service prematurely, in the hope that they can be brought up to standard by operational units, he said that this process has taken more than three years for the Tu-160, and that "even after many years of operational flying with the Tu-22M, we still discover design shortcomings in the airframe and engine." Meanwhile, following a US lead, Tu-95 and Tu-160 long-range bombers have been taken off alert status and a start made on placing their nuclear weapons in storage at their bases. Development of a modified nuclear SRAM for the bombers has been ended.

It was expected that at least 100 Tu-160s would be built in a complex added to the huge Kazan airframe plant. Instead, according to Col. Gen. Igor Kalugin, CINC of the strategic bomber force, manufacture of the bomber will end soon. Comparison of the Tu-160 with USAF's equally threatened B-2 is interesting. The two aircraft 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 Blackjack 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 only as a high-altitude standoff cruise missile launcher. However, the rotary launcher inside each of its two huge weapon 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 Backfire. Common features include low-mounted variable-geometry (20° to 65°, manually selected) wings and a massive dorsal fin; but Blackjack'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 Backfire.

Power Plant: four Kuznetsov/KKBM NK-32 turbofans; each 55,115 lb st with afterburning. Provision for in-flight refueling presumed.

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 Mach 1.88 at high altitude, service 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 AS-16 (Kickback) SRAMs or six ALCMs, currently AS-15s (Kents).

Fighters

MiG-21 (NATO "Fishbed")

More than 75 percent of the Frontal Aviation fighter force was equipped with MiG-29 and Su-27 fourth-generation aircraft by 1991. Remaining MiG-21s are assigned primarily to reconnaissance missions (see Reconnaissance, ECM, and Early Warning Aircraft section).

MiG-23 (NATO "Flogger")

Air Forces reequipment and resubordination have resulted in a major reduction in the number of operational MiG-23s. Older models have been retired and replaced by MiG-29s and Su-27s in the Military Districts and Groups of Forces, and in the Aviation of Air Defense (APVO). Others were passed to Naval Aviation units, together with Su-24s, Su-17s, Su-25s. MiG-27s, and MiG-29s, in 1989–90, to expand its permanently land-based tactical air element in the ATTU zone opposite NATO. Production ended in the mid-1980s, and all MiG-23s are expected to be withdrawn from first-line service by the mid-1990s. Current variants in CIS service are as follows:

MiG-23MF (Flogger-B). Single-seat air combat fighter with 27,500 lb st Tumansky R-29-300 turbojet. Wing sweep variable manually in flight or on the ground at 16°, 45°, or 72°. Equipment includes Saphir-23D-Ch 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. Described as the first Soviet aircraft with a demonstrated ability to track and engage targets flying below its own altitude. Standard version from about 1975.

MiG-23UB (Flogger-C). Tandem two-seater for operational training and combat use, with 22,045 lb st 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-23MF, but with R-35F engine, rear fuselage fuel tank deleted, much smaller dorsal fin, Saphir-23ML lighter-weight radar, and TP-23M IRST.

MiG-23MLD (Flogger-K). Development of Flogger-G, identified by dogtooth notch at junction of wing glove leading-edge and intake trunk on each side, to generate vortices to improve stability in yaw at high angles of attack. This compensates for smaller ventral folding fin and small dorsal fin. New IFF antenna forward of windscreen. AA-11 (Archer) close-range air-to-air missiles on fuselage pylons. Pivoting weapon pylons under outer wings. *(Data for Flogger-G follow.)*

Power Plant: one Tumansky R-35F-300 turbojet, rated at 28,660 lb st with max afterburning. Variable-geometry air intakes and variable nozzle. Internal fuel capacity 1,519 gallons. Provision for 211 gallon external fuel tank on centerline pylon, and two more under fixed wing panels. Two additional 211 gallon tanks may be carried on nonswiveling pylons under outer wings for ferry flights, with wings at 16° sweep. Attachment for assisted takeoff rocket on each side of rear fuselage.

Dimensions: span 45 ft 10 in spread, 25 ft 6¼ in swept; length excl probe 52 ft 1¼ in; height 15 ft 9¾ in; wing area 401.5 sq ft spread, 368.1 sq ft swept.

Weights: empty 22,485 lb, max external weapons 6,615 lb, gross 32,625–39,250 lb.

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

Accommodation: pilot only.

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

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. It was always assumed that this high "straight and level" performance was demanded to match the threat of USAF's B-70 Valkyrie supersonic bomber. In fact, as Mikoyan General Designer Rostislav Belyakov reveals in his *MiG 1939–1989* history of the OKB, written with Jacques Marmain of France, it was intended to intercept the A-11 (SR-71A). It never proved capable of doing so, but more than 300 improved models are in service 30 years after the design was finalized and are expected to serve with the APVO through the end of this century.

The airframes are manufactured of 80 percent welded nickel steel, with eight percent titanium in areas subject to extreme heating, such as the wing leading-edges, and 11 percent D19 special heat-resistant aluminium alloy. Versions that can now be identified precisely are:

MiG-25P (Foxbat-A). Basic single-seat interceptor, first flown as Ye-155P-1 prototype on September 9, 1964. Two R-15B-300 turbojets, each rated at 22,500 lb st with afterburning. Smertch look-down/shoot-down radar with tracking range of 31 miles, Sirena-3 radar warning receivers in wingtip antiflutter bodies and starboard fin tip, and SRO-2M IFF. Armed with one infrared and one radar homing AA-6 (Acrid) air-to-air missile under each wing. All converted later 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 with individual canopy, forward of standard cockpit and at lower level. No radar or reconnaissance sensors in nose. Limited to Mach 2.65.

MiG-25PD (Foxbat-E). Development of Foxbat-A, produced from 1978 until 1982. Uprated R-15BD-300 engines, with life of 1,000 hours instead of 150 hours. Saphir-25 radar and IRST, giving look-down/shoot-down capability comparable with that of MiG-23MF. Basic armament of two AA-6 (Acrid) and four AA-8 (Aphid) missiles. 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. Additional 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 AS-11 (Kilter) antiradiation missiles to attack surface-to-air missile sites over long standoff ranges. *(Data for Foxbat-E follow.)*

Power Plant: two Tumansky R-15BD-300 turbojets, each 24,700 lb st with afterburning. Internal fuel capacity 4,670 gallons. Electronically controlled variable ramps in intakes.

Dimensions: span 45 ft 11¾ in, length excl probe 64 ft 9½ in, height 20 ft 0¼ in, wing area 661 sq ft.

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

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

Armament: see individual model descriptions.

MiG-29 (NATO "Fulcrum")

More than 600 MiG-29s are in service with Frontal Aviation units assigned to Air Forces of the Military Districts and Groups of Forces. Others have been delivered to the air forces of Cuba, Czechoslovakia, the former East Germany (now equipping the 5th Luftwaffe division), India, Iran, Iraq, North Korea, Poland, Romania, Syria, and Yugoslavia. Production of the basic versions for CIS air forces is ending, but new derivatives are being developed, including a carrier-based fighter and a greatly redesigned version known at present as the MiG-29M. Some MiG-29s have been transferred from Frontal Aviation to Naval Aviation land-based units in the ATTU zone.

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 NO-193 coherent pulse-Doppler look-down/shoot-down radar owes less to unlicensed Hughes APG-65 technology than was once thought, and 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 and has been photographed in Polish Air Force service with an underwing armament of four 57-mm rocket pods and two AA-11 missiles. Versions identified to date are as follows:

MiG-29 (Fulcrum-A). Land-based 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.

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-29 (Fulcrum-C). As Fulcrum-A, but with more deeply curved top to fuselage aft of the cockpit, containing equipment. This may have been transferred from inside fuselage to make room for extra fuel.

MiG-29K (Fulcrum-D). Maritime version, used in late 1989 for ski-jump takeoff and deck landing trials on carrier *Admiral Kuznetsov*. Two converted from Fulcrum-As. More powerful 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, 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 or flare dispenser "fences" forward of dorsal fins. Different IRST. Expected to form close-range air defense/attack force on *Admiral Kuznetsov* and its sister ships.

MiG-29M. Greatly redesigned Fulcrum with quadruplex digital fly-by-wire controls and a "glass" cockpit with CRTs. Experimental prototype flown for the first time by Mikoyan chief test pilot Valery Menitsky in late 1989. Radome of more tapered profile. Nose lengthened by approx 7½ in. Longer canopy. Wider and longer dorsal spine, terminating in a spade-like structure that extends beyond the jet nozzles. Dogtooth tailplane leading-edge. More rounded wingtip trailing-edge. Center-section without engine air louvers, eight underwing hardpoints, and RD-33K engines, like MiG-29K. Slightly changed wing position and modifications to change the center of gravity are claimed to make the MiG-29M more comfortable to fly, with increased permissible angle of attack, better maneuverability, and improved cruise efficiency. A foreign partner is being sought for continued development, with export deliveries from 1994.

In addition, a "fifth-generation" version with multiaxis thrust-vectoring engine nozzles has been test flown at the Zhukowsky flight research center. *(Data for Fulcrum-A follow.)*

Power Plant: two Sarkisov (St. Petersburg/Klimov) RD-33 turbofans, each 18,300 lb st with afterburning. Internal fuel capacity 1,153 gallons. Provision for two external tanks under wings and one under fuselage.

Dimensions: span 37 ft 3¼ in, length 56 ft 10 in, height 15 ft 6¼ in, wing area 409 sq ft.

Weights: empty 24,030 lb, gross 33,600–40,785 lb.

Performance: max speed at height Mach 2.35, at S/L Mach 1.06, service ceiling 60,700 ft, takeoff run 790 ft, landing run 1,970 ft, range 932 miles on internal fuel, 1,550 miles with external tanks.

Accommodation: pilot only (two seats in tandem in Fulcrum-B).

Armament: six medium-range radar/IR homing AA-10 (Alamo-A/B) and/or close-range AA-11 (Archer) air-to-air missiles on three pylons under each wing. Provision for carrying AA-9 (Amos) and AA-8 (Aphid) missiles. Able to carry bombs, 57-mm, 80-mm, and 240-mm rockets, and other stores (including nuclear weapons) in attack role. One 30-mm GSh-30 gun in port wingroot leading-edge extension, with 150 rds.

MiG-25PDS (NATO "Foxbat-E")

MiG-29 (NATO "Fulcrum-C") (Ivo Sturzenegger)

MiG-31 (NATO "Foxhound-A")

MiG-31 (NATO "Foxhound-A")

One-quarter of the APVO air defense force is now equipped with fourth-generation MiG-31s and Su-27s, replacing MiG-23s and Su-15s. Production and development of both types are continuing, and Mikoyan's General Designer, Rostislav Belyakov, hopes to exhibit a developed MiG-31M at next year's Paris Air Show. However, its future may depend on export orders and foreign industrial partnership.

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. Belyakov decided to reduce the airframe's steel content to 50 percent, with 16 percent titanium, 33 percent dural, 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, including targets below and behind its own location. Other equipment includes a rectractable 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.

The basic MiG-31 Foxhound-A is able to be guided automatically, and to 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 with flush dielectric areas at front and rear, larger curved fin root extensions, modified and extended wingroot leading-edge extensions, and four new-type underwing pylons for active radar-guided missiles. *(Data for MiG-31 Foxhound-A.)*

Power Plant: two MKB (Perm)/Soloviev D-30F6 turbofans; each 34,170 lb st with afterburning. Internal fuel capacity approx 5,350 gallons. Provision for two underwing tanks, each 660 gallons, and flight refueling.

Dimensions: span 44 ft 2 in, length 74 ft 5¼ in, height 20 ft 2¼ in, wing area 663 sq ft.

Weights: empty 48,115 lb, gross 90,390–101,850 lb.

Performance: max speed Mach 2.35 at height, Mach 1.23 at S/L, service ceiling 67,600 ft, takeoff run 3,940

ft, landing run 2,625 ft, combat radius 450 miles at Mach 2.35, 870 miles at Mach 0.85 with external tanks.
Accommodation: crew of two, in tandem.
Armament: basic armament of four AA-9 (Amos) radar-homing, long-range, air-to-air missiles in pairs under fuselage; two AA-6 (Acrid) medium-range, infrared-homing, air-to-air missiles on inner underwing pylons; and four AA-8 (Aphid) close-range, infrared-homing, air-to-air missiles on two outer underwing pylons. One 23-mm GSh-6-23 six-barrel Gatling-type gun in fairing on starboard lower fuselage, with 260 rds.

Sukhoi Su-15 (NATO "Flagon")
The number of Su-15s in home defense units is believed to be fewer than 225, in three versions, as follows:
Flagon-E. Single-seat interceptor. R-13F-300 turbojets, each rated at 14,550 lb st. Major production version, operational since second half of 1973.
Flagon-F. Last known production version, identified by ogival nose radome instead of conical type on earlier variants. Generally similar to Flagon-E but with uprated engines.
Flagon-G. Two-seat training version of Flagon-F with probable combat capability. Individual rearward hinged canopy over each seat. Periscope above rear canopy for enhanced forward view. Overall length unchanged. *(Data for Flagon-F follow.)*
Power Plant: two Tumansky R-13F2-300 turbojets; each 14,550 lb st with afterburning.
Dimensions: span 30 ft 0 in, length 70 ft 0 in, height 16 ft 8½ in.
Weights: empty 24,250 lb, gross 39,680 lb.
Performance: max speed Mach 2.1 above 36,000 ft, service ceiling 65,600 ft, combat radius 620 miles.
Accommodation: pilot only.
Armament: one radar homing and one infrared homing AA-3 air-to-air missile (Anab) on outboard underwing pylons; AA-8 infrared homing close-range missile (Aphid) on each inboard pylon. GSh-23L 23-mm gun pods or fuel tanks on two underbelly pylons.

Sukhoi Su-27 (NATO "Flanker")
Last October Vladimir F. Laptev, then deputy minister of the aviation industry for military aircraft in the former USSR, said that the Su-27 would be the major, and perhaps the only, combat aircraft in production for domestic use in two years' time. To justify this reliance on a design started under the leadership of Pavel Sukhoi in 1969, the OKB named for him is developing important new versions. First exports of basic Su-27s, to China, were made in 1991. More than 200 equip air defense units in states of the CIS; others form primary equipment of the fighter units intended to escort Su-24s of the Legnica and Vinnitsa Air Armies on deep penetration missions. Variants identified to date are as follows:

Sukhoi Su-27 (NATO "Flanker-A") (Paul Jackson)

Side-by-side two-seat Su-27 (TASS)

Yakovlev Yak-38 (NATO "Forger-A") (Ivo Sturzenegger)

Yakovlev Yak-141 (NATO "Freestyle")

Su-27 (Flanker-A). Prototypes and preseries aircraft, the first of which flew on May 20, 1977, as the T-10-1. All with curved wingtips, and tailfins mounted centrally above the engine housings.
Su-27 (Flanker-B). Single-seat production version, with square wingtips carrying launchers for air-to-air missiles, tailfins located outboard of engine housings, extended tailcone, and other changes. First Soviet fighter with fly-by-wire flight controls. No ailerons; one-piece differential tailerons operate in conjunction with flaperons and rudders for pitch and roll control. Wing leading- and trailing-edge flaps 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. In ground attack configuration, carries cylindrical ECM jammer pod on each wingtip. Able to carry reconnaissance pack on centerline pylon. First flown April 20, 1981.
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 first tested on experimental T-10-24. Folding outer wing panels, strengthened landing gear with twin-wheel nose unit, and added arrester hook. Long tailcone of land-based version deleted, to prevent tail scrapes during takeoff and landing. Able to refuel in flight and to carry centerline buddy pack. Expected to become standard equipment of Russian carrier air wings.
Also seen conducting trials with the *Admiral Kuznetsov* is 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. Although described as a deck landing trainer, this derivative is more likely an interdictor and reconnaissance aircraft to replace the Su-24, for use in both land-based and carrier-borne forms.
The Su-27 has fine-grille hinged screens in the engine air intake ducts to guard against FOD during takeoff and landing. A range of more than 2,500 miles on internal fuel removed the need for external tanks. *(Data for standard Flanker-B follow.)*
Power Plant: two Saturn/Lyulka AL-31F afterburning turbofans; each 27,557 lb st.
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 Mach 2.35 at height, Mach 1.1 at S/L, service 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 air-to-air missiles, including pairs of AA-10A/B/C/D (Alamo-A/B/C/D), or AA-9 (Amos), and four AA-11 (Archer) or AA-8 (Aphid). Able to carry a wide range of air-to-surface weapons, including five-round packs of 130-mm rockets.

Yakovlev Yak-38 (NATO "Forger")
The Yak-38 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 DoD's *Military Forces in Transition* suggests that "the Yak-38 Forger, which has operated from *Kiev*-class carriers since 1976, appears to be in the process of retirement from combat service well in advance of the projected delivery date of a successor aircraft." When first observed on board *Kiev*, the Yak-38 made only vertical takeoffs. STOL takeoff became routine after perfection of 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, known by the following NATO reporting names:
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 Soviet carrier/cruisers, in addition to Forger-Bs and about 19 Kamov Ka-25 or Ka-27 helicopters. Forger-A has also been operated from the carrier *Admiral Kuznetsov*. Primary roles are assumed to be reconnaissance, strikes against small ships, and fleet defense against shadowing maritime reconnaissance aircraft. Production was believed to total about 75 by late 1986, with limited subsequent manufacture.
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 follow.)*
Power Plant: one 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 st. Two RKBM RD-36-35FVR liftjets in tandem aft of cockpit, inclined forward at 13° from vertical; each 6,725 lb st.
Dimensions: span 24 ft 0 in, width with wings folded 16 ft 0 in, length 50 ft 10¼ in, height 14 ft 4 in, wing area 199 sq ft.
Weights: basic operating (including pilot) 16,500 lb, gross 25,795 lb.
Performance: max speed Mach 0.95 at height, Mach 0.8 at S/L, service ceiling 39,375 ft, combat radius 115–230 miles.
Accommodation: pilot only.
Armament: four pylons under inner wings for 5,730–7,935 lb of stores, including AS-7 (Kerry) short-range air-to-surface missiles, armor-piercing antiship missiles, AA-8 (Aphid) air-to-air missiles, gun pods each containing a 23-mm twin-barrel GSh-23 cannon, 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* (formerly *Baku*) in November. Official funding for the program has been withdrawn, but the Yakovlev OKB is continuing development. 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. Control is digital fly-by-wire, with agility comparable with that of the MiG-29. Manual or automatic flight control is said to be practicable from takeoff to landing, day and night, in all weathers. The multimode flint-control radar is similar to that of the MiG-29, with a slightly smaller antenna.
Power Plant: one Soyuz/Koptchyenko R-79 turbofan; 34,170 lb st with afterburning. Vectoring nozzle turns 95° downward for short takeoff, 95° downward and 80° forward for vertical landing. R-79 lift thrust is approx. 80 percent of cruise rating. Two RKBM/Rybinsk RD-41 liftjets; each approx. 9,170 lb st, able to vector through +12° 30'. Puffer-jet stability controls at wingtips and tail.
Dimensions: span 33 ft 1¾ in (19 ft 4¼ in folded), length 60 ft 0 in, height 18 ft 0½ in.
Weight: gross 42,990 lb.
Performance: max speed Mach 1.7 at height, service ceiling above 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. At least four underwing hardpoints for AA-10 (Alamo) and/or AA-11 (Archer) air-to-air missiles, bombs, or rocket pods.

Attack Aircraft

MiG-27 (NATO "Flogger D and J")
Mikoyan counterpart to the West's F-5A and Jaguar, 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-23MF, 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. At least 450 constitute the spearhead of the Frontal Aviation ground attack force, with others resubordinated to Naval Aviation units land-based within the ATTU zone. There are two main variants:
MiG-27K (Flogger-D). Forward portion of fuselage completely redesigned by comparison with interceptor versions of MiG-23. Instead of having an ogival radome, Flogger-D's nose is sharply tapered in side elevation, with a radar ranging antenna and a small sloping window covering a laser rangefinder. Doppler navigation radar in nose. Additional armor on flat sides of cockpit. Seat and canopy raised to improve view from cockpit. 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 downwards (with 260 rds), AA-2 (Atoll) air-to-air missiles, AS-7 (Kerry) and AS-14 (Kedge) air-to-surface missiles, 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. Bullet-shaped antenna above each glove pylon, associated with missile guidance. Radar warning receiver fairing on each side of front fuselage, ahead of nosewheel bay. Other equipment includes a PrNK-23K nav/attack system, SUV fire-control system, a flight control system with automatic modes, and an ECM jammer.
MiG-27D (Flogger-J). Identified in 1981 and since delivered in successively upgraded versions. Improved PrNK-23M nav/attack system. Latest model has wider and deeper nose, with lip at top over much larger and less sloping window for the more advanced Klen laser rangefinder. Blister fairing under nose, with rectangular window at front, probably provides rearward laser designation capability for laser-guided bomb delivery. Bullet-shaped antennas above wingroot glove pylons and external armor on sides of cockpit deleted. Wingroot leading-edge extensions on some aircraft. As well as SPPU-22 pods, this version can carry a photoreconnaissance pod containing three cameras. A version built by HAL in India is designated **MiG-27M Bahadur.** *(Data for Flogger-D follow.)*
Power Plant: one Tumansky R-29B-300 turbojet; 25,350 lb st with afterburning. Internal fuel capacity 1,426 gallons. Provision for two or three 208-gallon external tanks.
Dimensions: as for MiG-23MF, except length 50 ft 10 in (excl probe).
Weights: gross from unprepared runway 39,900 lb, gross with eight 1,100 lb bombs 45,570 lb.
Performance: max speed Mach 1.77 at height, Mach 1.1 at S/L, service ceiling 45,900 ft, takeoff run 3,120 ft, landing run with brake-chute 2,950 ft; combat radius (lo-lo-lo) with two AS-14 missiles 140 miles, with two AS-14s and three external tanks 335 miles.
Armament: described above.

Sukhoi Su-17 (NATO "Fitter-C, D, E, G, H, and K")
Military Forces in Transition suggests that production of the swingwing Fitter had ended by last year. Many of the 1,000+ 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, as well as replacing older Fitters deployed at land bases of the Baltic Fleet and in the Pacific for antishipping strikes and amphibious support roles. Export variants are designated Su-20 and Su-22, the latter with Tumansky R-29B engines; but all CIS aircraft are Su-17s, with Lyulka engine, as follows:
Su-17M (Fitter-C). Basic single-seat attack aircraft with Lyulka AL-21F-3 turbojet. Manual wing sweep control, to 30°, 45°, and 63°. Curved dorsal fin between tailfin and dorsal spine fairing. Gun in each wingroot. Equipment said to include SRD-5M (NATO High Fix) I-band centerbody ranging radar, ASP-5ND fire-control system, Sirena-3 omnidirectional radar warning system, and SRO-2M IFF. Operational since 1971 in relatively small numbers with Frontal Aviation and Naval Aviation.

MiG-27D (NATO "Flogger-J") (Ivo Sturzenegger)

Sukhoi Su-17M-4 (NATO "Fitter-K") (Ivo Sturzenegger)

Su-17M-2 (Fitter-D). Generally similar to Fitter-C, but forward fuselage lengthened by 15 in and drooped 3° to improve pilot's view. Added undernose pod for Doppler navigation radar. Laser rangefinder in intake centerbody.
Su-17U (Fitter-E). Tandem two-seat trainer. Generally similar to Fitter-D but without Doppler pod. Deepened dorsal spine fairing, providing additional fuel tankage. Port wingroot gun deleted.
Su-17UM (Fitter-G). Two-seat trainer variant of Fitter-H, with combat capability. Deepened dorsal spine fairing and drooped front fuselage like Fitter-E. Taller vertical tail surfaces. Shallow ventral fin (removable). Starboard gun only. Laser rangefinder fitted.
Su-17M-3 (Fitter-H). Improved single-seater with same deepened spine and tail modifications as Su-17UM. Doppler navigation radar fitted internally in deepened undersurface of nose. Retains both wingroot guns. Launcher for air-to-air missile between each pair of underwing pylons. About 165 Fitter-H/Ks are equipped for tactical reconnaissance duties, 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. 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 Fitter-K follow.)*
Power Plant: one Saturn/Lyulka AL-21F-3 turbojet, rated at 24,700 lb st with afterburning. Internal fuel capacity 1,200 gallons. Up to four 211-gallon drop-tanks under fuselage and wings.
Dimensions: span 45 ft 3 in spread, 32 ft 10 in swept; length 61 ft 6¼ in; height 16 ft 5 in; wing area 430 sq ft spread, 398 sq ft swept.
Weight: gross 42,990 lb.
Performance: max speed Mach 2.09 at height, Mach 1.14 at sea level, ceiling 49,865 ft, max range 1,430 miles at height, 870 miles at sea level.
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 AA-2 (Atoll), AA-8 (Aphid), or AA-11 (Archer) air-to-air missiles, AS-7 (Kerry), AS-9 (Kyle), or AS-10 (Karen) air-to-surface missiles, 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 Legnica and Vinnitsa Air Armies. Reassignment of other former Air Army Fencers, including over 75 percent of the Legnica units, has increased considerably 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°, 68°) variable-geometry wings, the Su-24 entered first-line service in December 1974 as a replacement for the Yak-28 (NATO Brewer). Its ability to deliver a wide range of air-to-surface missiles provides defense suppression and some hard-target kill potential. A specially developed long-range navigation system and electro-optical weapon systems enable the Su-24 to penetrate hostile airspace at night or in poor weather with great precision and then deliver ordnance within 180 ft of its target. 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 tanks—a development which necessitated development of a similar probe for the Su-27s that escort Fencers on combat missions. 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). Introduced in 1983 and now primary Air Army version. Believed to have terrain-following radar instead of former terrain-avoidance system. Slightly 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; blister for laser ranger/designator added aft of nosewheel bay; single long noseprobe. Overwing fences integral with extended-wingroot glove pylons fitted when carrying AS-14 (Kedge) missiles. Export version is **Su-24MK.**
Su-24MR (Fencer-E). Reconnaissance/EW variant of Fencer-D used by tactical and Naval air forces. Equipment carried in underbelly pod. Flight refueling and air-to-surface missile capabilities retained. "Hockey stick" antenna below fuselage under each engine air intake nose section.

Su-24MP (Fencer-F). Electronic jamming/sigint/reconnaissance version to replace Brewer-E model of Yak-28. *(Data for Fencer-D follow.)*

Power Plant: two Saturn/Lyulka Al-21F-3A afterburning turbojets; each 24,700 lb st. Internal fuel capacity estimated at 3,435 gallons. Provision for two or four 330-gallon external tanks on wing and glove pylons.

Dimensions: span 57 ft 10 in spread, 34 ft 0 in swept; length 80 ft 5¾ in; height 16 ft 3¾ in.

Weights: empty, equipped 41,885 lb, gross 87,520 lb.

Performance: max speed Mach 2.18 at height, Mach 1.15 at S/L, service ceiling 57,400 ft, combat radius (lo-lo-lo) over 200 miles, (hi-lo-hi, with 6,615 lb 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 × 220 lb FAB-100), 57-mm to 370-mm rockets, 23-mm gun pods, and such missiles as AS-7 (Kerry), AS-10 (Karen), AS-11 (Kilter), AS-12 (Kegler), AS-13 (Kingpost), AS-14 (Kedge), and Kh-31. Two AA-8 (Aphid) air-to-air missiles can be carried for self-defense.

Sukhoi Su-25 and Su-28 (NATO "Frogfoot")

Production of the Su-25 to meet Soviet (now CIS) requirements was scheduled for completion in 1991. It remains available for export, and the Sukhoi OKB is continuing development of an extensively upgraded version known at present as the Su-25T. Described separately, this is expected to be redesignated Su-34 if ordered into production.

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 is 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 chemical weapons and self-protection air-to-air missiles. The accuracy of the laser guidance system is claimed to place bombs within 16 ft of a target over a standoff range of 12.5 miles. The engines will run on any fuel likely to be found in a combat area, including MT gasoline and diesel oil; and 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.

Some of the Su-25s delivered 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 current 700-strong fighter-bomber force. Others are flown by the air forces of Afghanistan, Bulgaria, Czechoslovakia, Hungary, and Iraq. Versions identified to date are as follows:

Su-25 (Frogfoot-A). Basic single-seat close-support version. Export model is **Su-25K** (K for *kommercheskiy*, "commercial").

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

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.* One only.

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.

Su-28. Export model of Frogfoot-B. *(Data for Frogfoot-A follow.)*

Power Plant: two nonafterburning Soyuz/Tumansky R-195 turbojets, each 9,921 lb st. Provision for two underwing fuel tanks.

Dimensions: span 47 ft 1½ in, length 50 ft 11½ in, height 15 ft 9 in, wing area 362.75 sq ft.

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, service ceiling 22,965 ft, range with combat load at S/L 466 miles, at height 776 miles.

Accommodation: pilot only.

Armament: one twin-barrel 30-mm gun (3,000 rds/min) in port side of nose, with 250 rds. Eight underwing pylons for 9,700 lb of air-to-surface weapons, including pods for 23-mm guns with twin barrels that pivot downward, 57-mm to 370-mm rockets, laser-guided missiles, and 1,100 lb incendiary, antipersonnel, and chemical cluster bombs. Two small outboard pylons for AA-2D (Atoll) or AA-8 (Aphid) air-to-air missiles. Weapons load is to be increased to 14,100 lb.

Su-25T (Su-34?)

Exhibited at the 1991 Dubai Air Show, the Su-25T is a considerably upgraded Frogfoot derivative with improved navigation and attack systems, new missiles, and R-195 turbojets rated at the same 9,921 lb st as those installed in the latest operational Su-25s. The first of three 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. Max weapon load is increased to 11,025 lb, including Kh-25ML (AS-10 Karen) laser-guided and Kh-58 (AS-11 Kilter) antiradiation missiles. The additional fuel gives the Su-25T a combat radius of 400 miles at low altitude and 560 miles at height.

To reduce the aircraft's infrared signature, a small pipe in the tailcone of each turbojet expels air to lower the exhaust temperature. 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 TV night navigation system (or, eventually, a FLIR system known as Mercuri) enables a main battle tank to be identified at night over a distance of nearly two miles. The Vikhr primary attack missile is carried in two eight-round underwing clusters. The gun is transferred to an underbelly position, on the starboard side of a farther-offset nosewheel.

An initial batch of ten Su-25Ts has been built for Air Forces acceptance testing. If the new model enters full production this year, as was planned, its designation is expected to be changed to **Su-34.** The export version is provisionally designated **Su-25TK.**

Weight: gross 42,990 lb.

Performance: max speed 590 mph, service ceiling 32,800 ft, takeoff and landing run on unpaved runway 2,300 ft.

Sukhoi Su-37

Designed as a twenty-first century successor to the Su-25, the Su-37 has been optimized for low-level attack at transonic speed but is intended to be a true multirole combat aircraft, suitable also for air-superiority missions and as an Su-24 replacement for long-range interdiction. It is currently at the design stage and, for economic reasons, is being aimed initially at export markets. The airframe is compound delta, with close-coupled foreplanes and fly-by-wire control. Survivability clearly relies on high performance and 1,765 lb of armor and other protective features rather than low-observables, as the 17,630 lb max weapon load is hung externally on 18 hardpoints. To combine high speed with long range, Sukhoi has chosen a single new Soyuz/Tumansky turbofan with a mighty thrust rating of 40,500 lb, and high fuel efficiency, to power the aircraft. The wings fold to reduce stowage requirements. Provision is made for in-flight refueling.

Single-seat and tandem two-seat versions are projected. The radar is intended to offer low-altitude terrain following at transonic speed, weapon guidance against land and sea targets, and precision attacks on low-flying targets including hovering helicopters. A podded multichannel thermal imaging system would permit standoff attack over ranges of 62–93 miles. Reconnaissance pods would be available with a variety of photographic, TV, and infrared systems. The data that follow are provisional.

Dimensions: span 38 ft 8½ in, length 57 ft 5 in.

Weight: gross with 18,300 lb of fuel 55,115 lb.

Performance: max speed Mach 2 class at height, Mach 1.22 at low level, service ceiling 55,775 ft, combat radius 932 miles with 6,615 lb of weapons.

Armament: laser and TV guided air-to-surface missiles, antiradiation missiles, air-to-air missiles comparable with latest Sidewinders and AMRAAM, antitank missiles, rockets of 85-mm to 370-mm caliber, bombs of up to 3,300 lb, and podded 30-mm guns. One 30-mm gun in starboard fuselage.

Sukhoi Su-25 (NATO "Frogfoot-A") (P. R. Foster)

Model of two-seat Su-37

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. Four variants may be identified by NATO reporting names:

Cub-A. Electronic intelligence (elint) version. Generally similar to basic Cub 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")

A signals intelligence version of the standard An-26 transport is in first-line service. It can be identified by many short blade antennas above and below the fuselage.

Ilyushin Il-20 (NATO "Coot-A")

This elint/reconnaissance aircraft is a conversion of the standard 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 Il-22 is another of the numerous adaptations of the Il-18 airframe for major military applications. Operational in substantial numbers, it was first photographed openly from a sporting balloon drifting over Pushkin airfield in 1990. Equipped for airborne command post duties, the examples seen had a bullet-shaped pod on the fin tip. Electronics can be expected to vary considerably. Another 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.

Ilyushin A-50 (NATO "Mainstay")

Development of this AEW&C version of the Il-76 began in the 1970s. About 25 currently operate with MiG-29, MiG-31, and Su-27 counterair fighters of the APVO 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.

Mainstay substantially improves CIS capabilities for early warning and air combat command and control compared with the earlier Tu-126. It can detect and track aircraft and cruise missiles flying at low altitude over land and water and could be used to help direct fighter operations over battlefields as well as to enhance air surveillance and defense. A production slowdown from five A-50s a year to only two delivered in 1990 is said by DoD to have caused problems for the APVO.

MiG-21 (NATO "Fishbed-N")

The retirement of MiG-21s from first-line fighter duties in the CIS has enabled Frontal Aviation to replace its aging Fishbed-H specialized reconnaissance aircraft with 60 late-model MiG-21bis Fishbed-Ns. Like their predecessors, they carry a pod housing forward-facing or oblique cameras, or elint sensors, on the fuselage centerline pylon. The MiG-21bis has a more powerful turbojet than the R-11 and R-13 of earlier versions, and an improved Sapfir-21 radar. Navigation precision is enhanced by a short-range radio-navigation system comparable with Shoran, and ILS.

Power Plant: one Tumansky R-25-300 turbojet; with three-minute max rating of 21,825 lb st below 13,125 ft. Internal fuel capacity 687 gallons. Provision for three 130-gallon external tanks, and for two JATO rockets.

Dimensions: span 23 ft 5½ in, length excl noseprobe 48 ft 2¾ in, height 13 ft 5½ in, wing area 247 sq ft.

Weight: gross 19,235–21,605 lb.

Performance: max speed Mach 2.05 at height, Mach 1.06 at S/L, service ceiling 57,400 ft, takeoff run 2,725 ft, landing run with flap-blowing and brake-chute 1,805 ft, range on internal fuel 695 miles.

Accommodation: pilot only.

Armament: one GSh-23 twin-barrel 23-mm gun, with 200 rds. Provision for up to four underwing AA-2 (Atoll) and/or AA-8 (Aphid) air-to-air missiles.

Antonov An-26 (NATO "Curl-B") (World Air Power Journal)

Antonov An-12 (NATO "Cub-D") (Soviet Wings/Alexander Dzhus)

Ilyushin A-50 (NATO "Mainstay") (Swedish Air Force via FlygvapenNytt)

MiG-25RB (NATO "Foxbat-B") (Ivo Sturzenegger)

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 air-to-air missiles 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 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 SLAR 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-25RBCh** standard, with more sophisticated equipment, from 1981.

More than 50 Foxbat B/D reconnaissance/bombers remain in service with Frontal Aviation. 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: span 44 ft 0¼ in, length excl probe 70 ft 8½ in, height 21 ft 4 in, wing area 661 sq ft.

Weights: gross 81,570–90,830 lb.

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

Armament: provision for four 1,100 lb bombs under wings and two under fuselage.

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

In addition to the standard Mi-6 heavy transport helicopter, there are at least two special-duty versions:

Hook-B. Command support helicopter, with large, flat-bottom, U-shaped antenna under tailboom. Other antennas include two long spearlike types projecting rearward from a mid-cabin position, on each side.

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. Other antennas similar to those of Hook-B. Designation changed to Mi-22.

These aircraft are expected to be replaced by specially equipped versions of the Mi-26 during the first half of the 1990s.

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. 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")

It came to light recently that the hitherto-unknown designation Mi-9 applies to a special-duty helicopter, **Hip-G.** Airborne communications version. Rearward inclined "hockey stick" antennas projecting from rear of cabin and from undersurface of tailboom, aft of box for Doppler radar.

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 Czechoslovak Air Force service, at the Dobrany-Line air base, near Pizen, 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.

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-55 (NATO "Mystic")

Although this counterpart to USAF's Lockheed U-2C/TR-1 has been publicized in Russia only as a high-altitude research aircraft, there is little doubt that it was conceived as a military reconnaissance vehicle. One of the two **M-17** prototypes, with a single RKBM RD-36-51V turbojet, rated at 15,430 lb st, was observed at Ramenskoye flight test center in 1982 and was given the NATO reporting name **Mystic-A.** Two prototypes of the twin-engine **M-55 Mystic-B** followed and are assumed to represent the intended military version. Under the management of the Molniya Scientific and Industrial Enterprise, which is now responsible for the former Myasishchev OKB, both versions have been used for research missions and to set international records. These include a speed of 456 mph around a 500 km closed circuit, and sustained altitude of 71,785 ft, set by Mystic-A. The following details apply to the M-55 Mystic-B:

Power Plant: two MKB (Perm)/Soloviev turbojets; each 11,025 lb st.
Dimensions: span 123 ft 4 in, length 74 ft 5½ in, height 15 ft 9 in.
Weight: gross 44,000 lb (Mystic-A, record flights).
Accommodation: pilot only.
Armament: none.

Sukhoi Su-17 (NATO "Fitter-H and K")

Some of the Su-17 (Fitter-H/K) fighters serving with tactical air force units are equipped for reconnaissance duties. Equipment includes, typically, an underfuselage pod containing sensors, an active ECM pod under the port wing fixed center-section, plus two external fuel tanks.

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.

Mil Mi-8 (NATO "Hip-K") (P. R. Foster)

Myasishchev M-55 (NATO "Mystic-B") (TASS)

Tupolev Tu-95 (NATO "Bear")

See main Tu-95 entry in Bombers and Maritime section.

Yakovlev AEW&C aircraft

It is understood that Antonov's AEW&C derivative of the An-74, known to NATO as Madcap, has been abandoned. Instead, the Yakovlev OKB is developing a twin-turboprop AEW&C aircraft, presumably for operation from carriers of the *Admiral Kuznetsov* class.

Transports and Tankers

Antonov An-12BP (NATO "Cub")

Replacement of An-12BP medium-range transports with Il-76s over the past 17 years has left fewer than 100 of these veteran aircraft 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.

Power Plant: four Ivchenko AI-20K turboprops; each 3,945 ehp. Normal fuel capacity 3,672 gallons; max capacity 4,781 gallons.
Dimensions: span 124 ft 8 in, length 108 ft 7¼ in, height 34 ft 6½ in, wing area 1,310 sq ft.
Weights: empty 61,730 lb, gross 134,480 lb.
Performance: max speed 482 mph, service 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. The prototype flew for the first time on February 27, 1965. 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, wing area 3,713 sq ft.
Weights: empty 251,325 lb, gross 551,160 lb.
Performance: max speed 460 mph, range 6,800 miles with 99,200 lb payload.
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 on 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. In addition to military models assigned to air commands in regiments and squadrons, more than 200 Aeroflot An-26s are available to the Military Transport Aviation force. 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 st RU 19A-300 auxiliary turbojet in starboard nacelle for turboprop starting and to provide additional power for takeoff, climb, and cruising flight, as required.
Dimensions: span 95 ft 9½ in, length 78 ft 1 in, height 28 ft 1½ in, wing area 807.1 sq ft.
Weights: empty 33,113 lb, gross 52,911 lb.
Performance: cruising speed 273 mph at 19,675 ft, service ceiling 24,600 ft, range 683 miles with max payload.
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")

This specialized "hot and high" short/medium-range transport has been produced in Kiev at the rate of at least 40 a year, many for military service. The basic airframe 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. Powered by two 5,112 ehp Ivchenko AI-20D Series 5 turboprops, the An-32 is able to operate from airfields 13,000 to 14,750 ft above sea level in an ambient temperature of ISA + 25°C and can transport three metric tons of freight over a 683-mile stage length, with fuel reserves. Maximum payload is 14,770 lb.
Dimensions: span 95 ft 9½ in, length 78 ft 0¼ in, height 28 ft 8½ in.
Weights: empty, equipped 38,158 lb, gross 59,525 lb.
Performance: max cruising speed 329 mph, service ceiling 30,840 ft, range with max payload 534 miles, with 12,125 lb payload 1,243 miles.
Accommodation: crew of three or four; freight, or 42 paratroops and a jumpmaster, or 24 litters 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. These aircraft, and a preseries batch of eight, were built at Kiev. Manufacture of the production versions, with extended wingspan, lengthened fuselage, and other refinements, was then transferred to a plant in Kharkov. The following variants are being produced currently, at the rate of 20 aircraft a year:

An-72A (Coaler-C). Light STOL transport for military and civil operation. Crew of three on flight deck. Conventional landing gear, with twin-wheel nose unit and two wheels in tandem on each main unit. D-36 turbofans fitted initially have been superseded by more powerful D-436s.

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-74 (Coaler-B). Specialized version for operation in the Arctic and Antarctic, with flight crew of five. More advanced navigation aids including 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.

An-74A, An-74AT, and An-74S. These versions appear to be generally identical to the equivalent An-72 models, except for having the enhanced avionics and larger nose of the An-74.

Power Plant: two Zaporozhye/Lotarev D-436 turbofans; each 16,550 lb st.
Dimensions: span 104 ft 7½ in, length (An-72) 92 ft 1¼ in, height 28 ft 4½ in, wing area 1,062 sq ft.
Weights (original D-36 engines): max payload 22,045 lb, gross 76,060 lb.
Performance (at T-O weight of 72,750 lb, D-36 engines): max speed 438 mph, normal cruising speed at 32,800 ft 342–373 mph, ceiling 35,100 ft, takeoff run 3,050 ft, landing run 1,525 ft, range 497 miles with max payload or 2,980 miles with max fuel.
Accommodation: crew of three (normal) or five (An-74); main cabin designed primarily for freight, but (except for An-74) folding seats for 68 passengers along side walls and on removable central seats, and provision for 24 casualties on litters, 12 seated, and attendant. In combi role, An-74 carries eight mission staff, plus 3,307 lb of freight in rear compartment.
Armament: none.

Antonov An-124 (NATO "Condor")

The An-124 is Antonov's counterpart to the USAF/Lockheed C-5 Galaxy, with a slightly larger wingspan and higher gross weight. Except for having a low-mounted tailplane, its general configuration is similar to that of the C-5. It has an upward hinged visor-type nose and rear fuselage ramp/door for simultaneous front and rear loading/unloading. Advanced features include a quadruple redundant 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 and giving a weight saving of more than 4,410 lb. 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, exceeding by 53 percent the previous record set by a C-5A. In a further dramatic demonstration of its potential, on May 6–7, 1987, an An-124 set a closed-circuit distance record by flying 12,521.2 miles nonstop around the periphery of the former Soviet Union. Deliveries to VTA, the Military Transport Aviation force, to replace An-22s, began in the same year, and totaled 23 by mid-1991. Others have been made available for extensive civilian long-range charter flying, notably in the insignia of Air Foyle and HeavyLift of the UK. In September 1990, as a consequence of the Gulf crisis, an An-124 carried 451 Bangladeshi refugees from Amman to Dacca, as the start of an urgent relief program. It had been equipped rapidly with chemical toilets, a 150-gallon drinking-water tank, and large quantities of foam rubber to line the cargo hold in lieu of seats.

There is no current military application for the An-124's much larger six-engine derivative, the An-225 Mriya, and only one prototype has flown. Its NATO reporting name is Cossack.

Power Plant: four Zaporozhye/Lotarev D-18T turbofans; each 51,590 lb st. Fuel capacity quoted as 507,063 lb.
Dimensions: span 240 ft 5¾ in, length 226 ft 8½ in, height 68 ft 2¼ in, wing area 6,760 sq ft.
Weights: nominal max payload 330,693 lb, gross 892,872 lb.

Antonov An-32 (NATO "Cline") (Paul Duffy)

Antonov An-74 (NATO "Coaler-B") (J. M. G. Gradidge)

Ilyushin Il-76TD (NATO "Candid-A") (Paul Duffy)

Performance: max cruising speed 537 mph, takeoff balanced field length 9,850 ft, landing run 2,625 ft, range 2,795 miles with max payload, 10,250 miles with max fuel.
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 VTA, with deliveries continuing. The military can also draw on the 125 Il-76s of Aeroflot as necessary. The unarmed **Il-76/76T/76TD** versions are known to NATO as Candid-A. Deliveries of military **Il-76Ms** (Candid-B), with rear guns and small ECM fairings, has been under way since 1974. When operating into combat areas, they can be fitted with packs of 96 × 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, with 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 MKB (Perm)/Soloviev D-30KP turbofans; each 26,455 lb st. Fuel capacity 21,615 gallons.
Dimensions: span 165 ft 8 in, length 152 ft 10¼ in, height 48 ft 5 in, wing area 3,229.2 sq ft.
Weight: gross 374,785 lb.
Performance: cruising speed 466–497 mph at 29,500–39,350 ft, nominal range 3,100 miles with payload of 88,185 lb, max range 4,163 miles.
Accommodation: crew of seven, incl two freight handlers; up to 140 passengers.
Armament: two 23-mm twin-barrel GSh-23L guns in tail turret.

Ilyushin Il-78 (NATO "Midas")

Development of Midas began in the mid-1970s, to replace modified Myasishchev M-3 (Bison) in-flight refueling aircraft which supported the Bear/Bison strategic attack force for many years. According to *Soviet Military Power,* the first unit of Midas tankers entered operational service during 1987; more than 12 are now operational, in support of both strategic and tactical aircraft. Each Il-78 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.)*

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-bottomed 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 ships. These include SS-N-3B (Shaddock) missiles launched from *Kresta I* cruisers, SS-N-12 (Sandbox) missiles from *Kiev*-class carrier/cruisers and *Slava*-class cruisers, SS-N-19 (Shipwreck) missiles from the battle cruisers *Kirov* and *Frunze*, and SS-N-22 (Sunburn) missiles from *Sovremennyy*-class destroyers. *Kiev*- and *Kirov*-class ships can each carry three Hormone-Bs, the others one. 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 follow.)*

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.
Weights: empty 10,505 lb, gross 16,535 lb.
Performance: max speed 130 mph, service 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.

sive use of titanium and composite materials throughout the airframe, with special emphasis on resistance to corrosion at sea. An ability to operate independently of ground support equipment also received priority.

The basic ASW version of the Ka-27 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, and NATO assigned to them the reporting name Helix. In 1983, at least 16 Ka-27s were seen on board the *Kiev*-class carrier/cruiser *Novorossiysk*, since when the replacement of Hormones with Helix variants has continued. The design has proved so versatile that the variants listed below are capable of meeting the complete transportation, close support, and ECM needs of a carrier-based assault force:

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 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 on tailcone, 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 Helix-A but some operational equipment deleted. Winch beside cabin door on port side. External fuel tank above flotation gear on each side of cabin. First seen on carrier/cruiser *Novorossiysk*.

Ka-29TB (Helix-B). Combat transport version first shown at 1989 Aviation Day display. Heavy armor on wider flight deck and engine bay. Four-barrel Gatling-type 7.62-mm machine gun behind downward-articulated door in starboard side of nose. Four pylons on outriggers can carry four-round clusters of AT-6 (Spiral) air-to-surface missiles and 57-mm or 80-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. More than 30 in service.

Ka-29? First shown on board 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. Conical tailcone. No stores pylons. Unidentified structure at rear of fuselage pod. No apparent gun door or armor. Many more detail changes. Likely EW jamming helicopter to support seaborne assault force. *(Data for Ka-29TB follow.)*
Power Plant: two St Petersburg/Klimov (Isotov) TV3-117VK turboshafts; each 2,225 shp.
Dimensions: rotor diameter (each) 52 ft 2 in, length of fuselage 38 ft 0¾ in, height 17 ft 8½ in.
Weight: empty 12,170 lb, gross 27,775 lb.
Performance: max speed at S/L 155 mph, service ceiling 16,400 ft, range 500 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-? (NATO "Hokum")

Armament: two 18 in ASW torpedoes, nuclear 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, to build on the success of the Ka-25 and to overcome its inability 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 exten-

Electronic warfare Ka-29? (TASS)

Kamov Ka-? (NATO "Hokum")

Kamov's Hokum is the world's first single-seat close-support helicopter. Test flying has been under way since July 27, 1982, and, after competitive evaluation with the Mi-28, series production for the Russian army has begun.

Retention of Kamov's familiar coaxial rotor configuration ensures compact dimensions, with no tail rotor to cause problems during nap-of-the-earth operation. 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.

To reduce the pilot's work load and enhance low observability, Hokum is designed to operate in packs, supported by surveillance and target designation aircraft. Survivability features include cockpit armor able to withstand hits by 20-mm gunfire, and the small dimensions of transmission and control systems by comparison with those of a helicopter with a tail rotor. A new K-37 ejection seat enables the pilot to eject safely at any altitude. Hokum 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. Engine and rotor blade protection embody lessons learned from Desert Storm operations. A tandem two-seat training version has been developed.
Power Plant: two St Petersburg/Klimov (Isotov) TV3-117VK turboshafts; each 2,225 shp.
Dimensions: rotor diameter 47 ft 7 in; length, rotors turning, 52 ft 6 in.
Weight (estimated): gross 16,500 lb.
Performance: max speed in shallow dive 217 mph, vertical rate of climb 1,970 ft/min at 8,200 ft, hovering ceiling out of ground effect 13,125 ft, combat radius (estimated) 155 miles.
Armament: one 30-mm 2A42 gun, with 500 rounds, on starboard side of fuselage. Four wing pylons for 16 laser-guided missiles capable of penetrating 900-mm of reactive armor over a range of 5–6.2 miles; or eighty 80-mm rockets.

Mil (WSK-PZL Swidnik) Mi-2 (NATO "Hoplite")

Manufacture of this smallest helicopter in the current Mil range 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. Production may now end.
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 130 mph at 1,640 ft, service ceiling 13,125 ft, range 360 miles with max fuel, 105 miles with max payload.
Accommodation: pilot on flight deck; eight passengers, 1,543 lb of freight, or four litters and medical attendant in cabin.
Armament: provision for air-to-surface rocket pod, or two 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 12.7-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 in the former Soviet Army for some years.

Power Plant: two Soloviev D-25V turboshafts; each 5,500 shp.
Dimensions: rotor diameter 114 ft 10 in, length of fuselage 106 ft 10½ in, height 32 ft 4 in.
Weights: empty 60,055 lb, gross 93,700 lb.
Performance: max speed 186 mph, service ceiling 14,750 ft, range 385 miles with 17,637 lb payload.
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. How many will be retained after current force restructuring is anybody's guess. Primary combat task of the Mi-8, for which the crews are well trained, is to put down assault troops, equipment, and supplies behind enemy lines within 15–20 minutes of a nuclear or conventional bombardment/strike. Versions and derivatives currently deployed are 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 × 57-mm rockets in four packs, or other weapons. More than 1,500 formerly in service. Some uprated to Mi-17 standard, as Mi-8T and Mi-8TB.
Hip-D. For airborne communications role; see p. 60.
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 Swatter antitank missiles on rails above racks. About 250 in service with ground forces. Some uprated to Mi-17 standard, as Mi-8TBK.
Hip-G. See Mi-9 entry on p. 60.
Hip-H See Mi-17 entry below.
Hip-J and K. ECM versions; see p. 60.
Power Plant: two St Petersburg/Klimov (Isotov) TV2-117A turboshafts; each 1,700 shp. Standard fuel capacity 494 gallons, max ferry capacity 977 gallons.
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 161 mph at 3,280 ft, service ceiling 13,050 ft, range 311 miles as passenger transport.
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 litters 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 what appear to be 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.

Mil Mi-14PL (NATO "Haze-A") (Lutz Freundt)

Mil Mi-24R (NATO "Hind-G1") (Lutz Freundt)

Power Plant: two St Petersburg/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.
Weight: gross 30,865 lb.
Performance: max speed 143 mph, service 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 naceiles, 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. If an engine fails, the output of the other is increased automatically to 2,200 shp for sustained single-engine flight. Many are operational in the Soviet armed forces. They 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, and many of those in Soviet service have been converted with TV3 engines and port-side tail rotor (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 follow.)*
Power Plant: two St Petersburg/Klimov (Isotov) TV3-117MT turboshafts; each 1,920 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, service ceiling 11,800 ft, max range 590 miles with auxiliary fuel.
Accommodation and Armament: as for Mi-8 Hip-E.

Mil Mi-24 (NATO "Hind")

Production of Kamov and Mil military helicopters declined by some 40 percent in 1988–90, to an annual total of 175 aircraft. Output of almost every model was reduced, without any adverse effect on the size and mix of Army Aviation. On the contrary, it was much enhanced by the transfer of virtually all Mi-8 assault helicopters and Mi-24 gunships from Frontal Aviation to the newly formed Land Forces Army Aviation, and by replacement of older Mi-8s and -24s with the latest variants. Of well over 2,300 Mi-24s (and export Mi-25s and -35s) built at plants in Arsenyev and Rostov, approximately half are believed to be still at the disposal of the CIS military, in the following gunship 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, up to 3,300 lb of chemical or conventional bombs, PFM-1 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 AK-47 guns from cabin windows. Many small antennas and blisters, including IFF and radar warning antennas. Infrared 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-24W (Hind-E). As Hind-D, but with modified wingtip launchers and four underwing pylons for up to twelve AT-6 (Spiral) radio-guided, tube-launched antitank missiles in pairs, and enlarged undernose guidance pod on port side, with fixed searchlight to rear. AA-8 (Aphid) air-to-air missiles can be carried on the underwing pylons. HUD in place of former reflector sight.

Mi-24P (Hind-F) (*P* for *pushka*, "cannon"). First shown in service in 1982 photographs. Generally similar to Hind-E 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/chemical) warfare, on lengthened pylons. Other features include a lozenge-shaped housing with cylindrical insert under the port side of the cabin, 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 follow.)*
Power Plant: two St Petersburg/Klimov (Isotov) TV3-117 turboshafts; each 2,200 shp.

Dimensions: rotor diameter 56 ft 9 in, length excl rotors and gun 57 ft 5 in, height 21 ft 4 in.
Weights: empty, equipped 18,078 lb, gross 26,455 lb.
Performance: max speed 208 mph, service ceiling 14,750 ft, range, internal fuel 310 miles.
Accommodation: crew of two; flight mechanic, and provisions for eight troops or four litters in main cabin.
Armament: see individual model descriptions. Max external load 5,290 lb.

Mil Mi-26 (NATO "Halo")

Design of the Mi-26 heavy-lift helicopter began in the early 1970s to meet the requirement for an aircraft of greater capability than the Mi-6, for day and night operation in all weather. Except for the four-engine twin-rotor Mi-12, which did not progress beyond prototype testing, it 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 with the former Soviet Air Forces in early 1983, and was fully operational by 1985. More than 70 have since been built for military and civil use. 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.

The 1990 edition of *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 Zaporozhye/Lotarev D-136 turboshafts; each 11,240 shp. Max fuel capacity 3,170 gallons.
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, service ceiling 15,100 ft, range 497 miles.
Accommodation: crew of five; about 40 tip-up seats along side walls of hold; seats can be installed for about 85 combat-equipped troops, plus four more passengers in compartment aft of flight deck. Other loads include two airborne infantry combat vehicles or a standard 44,100 lb ISO container.
Armament: none.

Mil Mi-28 (NATO "Havoc")

After ten years of flight testing, full-scale production of the Mi-28 was scheduled to start this year. The certification program was complete by last fall, but a few modifications to the helicopter are still being made. The original straight tips of the main rotor blades are to be changed to embody forward sweep. The positions of some instruments in the cockpits are being improved. An Mi-28 exhibited at the 1991 Dubai Air Show was fitted with new wingtip countermeasures pods, housing chaff/flare dispensers and sensors, probably radar warning.

The general configuration of the Mi-28 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 fires only unguided weapons. 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. Radar warning, flare dispensing, and IR suppression systems will be standard on production Mi-28s.

Power Plant: two St Petersburg/Klimov (Isotov) TV3-117 turboshafts; each 2,200 shp. Internal fuel capacity approx 502 gallons. Provision for four underwing tanks.
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 22,925 lb.
Performance: max speed 186 mph, service 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 UV-20 pods of 20 57-mm or 80-mm rockets and total of 16 AT-6 (Spiral) antitank missiles. Missile guidance equipment in thimble radome on nose.

Airborne Tactical Missiles

AS-2 (Mikoyan K-10; NATO "Kipper")

First seen at the 1961 Aviation Day display, this airplane-configuration missile, with underslung turbojet, was described by the commentator at Tushino as an antishipping weapon. Radar is carried in the nose of the Tu-16 carrier aircraft, and guidance is believed to be inertial, with optional command override and active radar terminal homing. A 2,200 lb high-explosive warhead is believed to be normal, although a nuclear armed version has been reported.
Dimensions: span 16 ft 0 in, length 32 ft 10 in.
Weight: 9,260 lb.
Performance: max speed Mach 1.2, range 75 miles.

AS-10 (NATO "Karen") and AS-14 (NATO "Kedge") and laser head for Kh-29L (center) (Nick Cook/Jane's Defence Weekly)

AS-11 (NATO "Kilter") (Nick Cook/Jane's Defence Weekly)

AS-13 (NATO "Kingpost") (Nick Cook/Jane's Defence Weekly)

AS-5 (NATO "Kelt")

The transonic AS-5 has a similar airplane-type configuration to that of the turbojet-powered AS-1 (Kennel), which it superseded. The switch to liquid rocket propulsion eliminated the need for a ram air intake and permitted the use of a larger radar inside the hemispherical nose fairing. Guidance is said to be inertial, with radar terminal homing that can be switched from active to home-on-jam as required. A 2,200 lb high-explosive or one megaton nuclear warhead can be fitted.

Well over 1,000 AS-5s were delivered for carriage by Tu-16s. A few may be operational.
Dimensions: span 15 ft 9 in, length 28 ft 2 in.
Weight: 6,615 lb.
Performance: max speed Mach 0.9 at low altitude, Mach 1.2 at 30,000 ft, range 110 miles at low altitude, 200 miles at height.

AS-7 (Kh-23; NATO "Kerry")

In service since about 1972, this first-generation tactical air-to-surface missile is said to have a single-stage solid-propellant rocket motor, radio command guidance system by joystick control from the launch aircraft, and a 242 lb hollow-charge high-explosive warhead. It is carried by the MiG-27 Flogger, Su-17 Fitter, Su-24 Fencer, and Yak-38 Forger.
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 AS-4 (Kitchen). In service for defense suppression since the early 1970s, it has a passive radar homing system and 440 lb warhead with which to attack land-based and shipborne radars. Launch aircraft are reported to be the MiG-23, 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 6 ft 6½ in, length 19 ft 9½ in.
Weight: 1,650 lb.
Performance: max speed supersonic, range 56 miles.

AS-10 (Kh-25ML; NATO "Karen")

It is believed that Karen was developed initially as the Kh-25MR, using the same kind of radio command guidance system as the Kh-23 (Kerry), to which it is very similar. More important now is the semiactive laser-guided Kh-25ML, which has a solid-propellant rocket motor and 242 lb high-explosive warhead. Target designation is by the launch aircraft, which include the MiG-27, Su-17, Su-24, and Su-25. The AS-12 Kegler is basically similar, except for its warhead.
Dimensions: span 2 ft 8¼ in, length 12 ft 3½ in.
Weight: 672 lb.
Performance: max speed transonic, max range 6.2 miles.

AS-11 (Kh-58; NATO "Kilter")

Kilter was revealed officially in the form of an inert round, carried on a trolley beneath the fuselage of an Su-24, at the Moscow Air Show in August 1989. It is an antiradiation missile of conventional cruciform clipped-delta wing/tailfin configuration, with passive radar homing head and a solid-propellant rocket motor. A blast fragmentation warhead of about 285 lb has been estimated. Kilter forms primary armament of the Foxbat-F defense suppression version of the MiG-25, as well as being one of the wide range of weapons compatible with the MiG-27 and Su-24.
Dimensions: span 3 ft 11¼ in, length 14 ft 1¼ in.
Weight: estimated at 925 lb.
Performance: range approx 30 miles.

AS-12 (Kh-25MP; NATO "Kegler")

Kegler is a member of the AS-10/Kh-25 family of air-to-surface missiles, with a passive radar homing seeker. Having developed a successful airframe and motor, its engineers seem to have adapted the basic Kh-25 to produce a lightweight replacement for the AS-9. Able to be launched from low altitude, it offers better aircraft survivability than the AS-9 and can be carried by the Su-17, Su-24, Su-25, and Tu-22M.
Dimensions: span 2 ft 8¼ in, length 13 ft 9 in.
Weight: 728 lb.
Performance: range 21 miles.

AS-13 (Kh-59; NATO "Kingpost")

At the 1991 Dubai Air Show, Kingpost was described by its exhibitors as a medium-range TV command-guided air-to-surface cruise missile. Although its two-stage motor should ensure high performance, it is unlikely to offer the range of its nearest US counterpart, the AGM-84E SLAM. However, its standoff range should be adequate to provide much enhanced survivability for its Su-24 launch aircraft in attacks on point targets. No other details are yet available, but Kingpost is about 13 ft long.

AS-14 (Kh-29; NATO "Kedge")

Two basic versions of Kedge were revealed at Dubai: the TV-guided Kh-29T and the semiactive laser-guided Kh-29L. Except for the seeker head, the two air-to-surface tactical missiles are identical. In the class of USAF's Maverick, they are carried on the extended wingroot glove pylons of the Fencer-D version of the Su-24 and, probably, by the Su-25. The Kh-29L has been seen on a MiG-27, accompanied by an underfuselage laser designator pod. Iraqi Air Force Mirage F1s use this version with a French Thomson-CSF Atlis designator. Kedge's warhead is believed to be a 551 lb GP bomb.
Dimensions: span 3 ft 9¼ in, length 12 ft 7¼ in.
Weight: 1,455 lb.
Performance: range 7.5 miles.

AS-? (Kh-31)

Seen for the first time at Dubai '91, this impressive medium-range air-to-surface antiradiation missile does not yet have a NATO reporting name, although it has probably been in service for some years. It appears to be powered by an integral rocket/ramjet, with four air intakes for the ramjet disposed around the outside, each carrying a wing and control surface. No details are yet available.

AT-2 (NATO "Swatter")

This standard CIS antitank weapon forms the missile armament of the Mi-24 (Hind-A and D) helicopter gunship and is carried by the Hip-E version of the Mi-8. The solid-propellant Swatter-A/B employs semi-automatic command to line-of-sight (SACLOS) guidance via elevons on the trailing-edges of its rear-mounted cruciform wings and two small canard surfaces at the nose. Swatter-C is said to be similar but with semiactive laser guidance. *(Data for Swatter-A/B.)*
Dimensions: span 2 ft 2 in, length 3 ft 9¾ in.
Weight: 65 lb.
Performance: cruising speed 335 mph, range 1.85 miles.

AT-6 (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 Helix-B.
Dimensions: span 1 ft 0 in, length 6 ft 0 in.
Weight: 77 lb.
Performance: cruising speed 895 mph, range 3 miles.

AT-? (Vikhr)

A new tube-launched antitank missile known as Vikhr ("whirlwind" or "vortex") was seen for the first time, as armament of the new Su-25T attack aircraft, at Dubai '91. A total of 16 can be carried, in eight-round underwing clusters. No details are available, but guidance is believed to be laser beam riding, in conjunction with the aircraft's new Schkval ("squall") nose-mounted electro-optical targeting system.

AA-2 (R-3; NATO "Atoll")

Designated R-3A in the CIS, the basic AA-2 is the Soviet counterpart to the US Sidewinder 1A (AIM-9B), to which it is almost identical in size, configuration, and infrared guidance. At least four other versions have followed, including the AA-2D (R-3S), with improved seeker, which became standard armament on home and export versions of the MiG-21. On the multirole versions of this fighter, an AA-2C radar-homing version of Atoll can be carried on the outer stores pylon under each wing, in addition to IR homing Atolls on the inner pylons. Length of the AA-2C is increased to 11 ft 6 in and weight to 205 lb. All versions of Atoll have a solid-propellant rocket motor and 24 lb fragmentation warhead. Range of the AA-2C is 5 miles. Other aircraft that carry Atoll include the MiG-23, MiG-27, Su-15, and Su-17. *(Data for AA-2D follow.)*
Dimensions: length 9 ft 3½ in, body diameter 5 in, fin span 1 ft 8¾ in.
Weight: 165 lb.
Performance: cruising speed mach 2.5, range 1.85 miles.

AA-3 (K-8; NATO "Anab")

This solid-propellant air-to-air missile arms Su-15 interceptors. Each aircraft normally carries one Anab with an I/J-band semiactive radar seeker and one with an infrared homing head.
Dimensions: length 10 ft 10 in (IR) or 11 ft 9½ in (SAR), body diameter 8.66 in, wingspan 3 ft 5½ in.
Weight: 575 lb (IR), 595 lb (SAR).
Performance: range 1.85 miles (IR), 6.2 miles (SAR).

AA-6 (R-40; NATO "Acrid")

This air-to-air missile is one of the weapons carried by the Foxbat-A and E interceptor versions of the MiG-25. Its configuration is similar to that of Anab, but it is considerably larger, with a 110 lb warhead. The version of Acrid 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 Acrid include the Su-15 and MiG-31. *(Data common to both versions.)*
Dimensions: length 20 ft 4 in, body diameter 14¼ in, wingspan 5 ft 11 in.
Weight: 1,015 lb.
Performance: cruising speed Mach 2.2, range 18.5 miles.

Kh-31 (Nick Cook/Jane's Defence Weekly)

AT-? (Vikhr) antitank missile (Nick Cook/Jane's Defence Weekly)

AA-7 (NATO "Apex") and AA-8 (NATO "Aphid") (Ivo Sturzenegger)

AA-8 (NATO "Aphid") (Brian M. Service)

AA-9 (NATO "Amos") (Piotr Butowski)

More CIS Missiles

An expanded Gallery of Commonwealth Missiles will appear in the June 1992 issue. It will cover ICBMs, SLBMs, Airborne Nuclear Attack and Cruise Missiles, SAMs, and Naval SAMs.—THE EDITORS

AA-7 (R-23; NATO "Apex")

This air-to-air missile 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 follow.)*
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 Atoll as standard close-range air-to-air missile of CIS air forces, Aphid is carried by late model MiG-21s, MiG-23s, MiG-25s, MiG-29s, MiG-31s, Su-15s, 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-24 Hind-D and E helicopters. It is a highly maneuverable solid-propellant weapon with infrared homing guidance in its basic R-60T form. The semiactive radar version (R-60R) 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 radar homing long-range missile is reported to have achieved successes against simulated cruise missiles after look-down/shoot-down launch from a MiG-25 test-bed. It is standard armament on the MiG-31, is an alternative weapon for the Su-27, and is believed to be in a similar class to the USN AIM-54 Phoenix, which it resembles. Amos has a solid-propellant rocket motor, and combines inertial midcourse guidance, probably with command updates, and semiactive radar terminal homing. Reports suggest that passive radar homing and active radar versions are being developed for use against AWACS aircraft.
Dimensions: length 14 ft 1¼ in, body diameter 15¾ in, wingspan 3 ft 3½ in.
Weight: 990 lb.
Performance: range 45 to 93 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 and in line with its small foreplanes. Four versions have been identified:

Alamo-A. Short-burn semiactive radar homing version, for use over medium ranges. Standard armament of MiG-29 and Su-27.

Alamo-B. Short-burn infrared homing version. Carried by Su-27 and MiG-29.

Alamo-C. Long-burn semiactive radar homing version, for use over longer ranges. Carried by Su-27 and MiG-31.

Alamo-D. Long-burn infrared homing counterpart of Alamo-C. Carried by Su-27.

Dimensions: length 12 ft 11½ in (A), 11 ft 10½ in (B), 15 ft 1 in (C), body diameter 7¼ in; wingspan 2 ft 3½ in.
Weight: 440 lb (A), 385 lb (B), 529 lb (C).
Performance: range 15.5 miles (A and B), 22 miles (C).

AA-11 (R-73A; NATO "Archer")

This close-range missile was one of the weapons displayed for the first time at the 1989 Soviet Air Show at Khodinka. Control appears complex, with movable sets of vanes and fins fore and aft of fixed cruciform surfaces at the front of the missile, control surfaces at the trailing-edge of each of the cruciform tailfins, and four thrust-vectoring control vanes in the rocket exhaust. They are expected to confer great maneuverability, particularly when the missile is launched at large off-boresight target angles. Other features of Archer include infrared guidance, active radar fuze (probably to be superseded by active laser type), and a fragmentation warhead of about 33 lb. It is carried by the MiG-29 and Su-27.
Dimensions: length 10 ft 0 in, body diameter 7 in, span of tailfins 1 ft 8½ in.
Weight: 275 lb.
Performance: range 5 miles. ■

The Wright brothers let the landing take care of itself—a luxury that pilots no longer have.

Getting Down

By Susan Katz Keating

THE FIRST time Orville Wright landed the twelve-horsepower Wright Flyer at Kitty Hawk, N. C., he didn't bother to gauge his airspeed, aim for a spot on the runway, or take account of crosswinds. Nor did he make any of the other adjustments that, in the years since, have become second nature to pilots as they put aircraft on the ground. There was no need. That first powered flight, on December 17, 1903, lasted a mere twelve seconds and covered only 120 feet.

The Wrights focused their energies on getting their 605-pound craft airborne, a task that entailed applying the proper amount of forward power. Landing was a matter of easing back on thrust, something the Wright Flyer initially accomplished on its own. The longest of the Wrights' four flights on December 17 lasted only fifty-nine seconds, covering 852 feet at ten miles per hour. When it was over, the Flyer did not so much land as merely settle to earth.

Nowadays, such a landing would be rare. Most modern planes fly heavy and touch down fast. For example, the front-line F-15C air-superiority fighter, even if carrying no ordnance and almost no fuel, would still weigh about 29,000 pounds and would approach the landing strip at a speed of about 130 knots. Under these conditions, any fighter pilot who attempted simply to let his powered craft seek its own path down probably would not live to explain why things went wrong.

Today, high-performance airplanes land only after the execution of a precise series of steps, undertaken according to specifications. Each craft, be it a light airplane or a space shuttle, carries its own landing "blueprint." Follow the wrong blueprint, and you won't get down according to plan.

The key phrase is "according to plan." The early days of aviation saw plenty of unplanned descents and descents of an unexpected kind, the result of minute differences between top speed and stall speed in the first airplanes.

An aircraft that took off at thirty miles per hour might stall out in a steep turn at thirty-nine miles per hour and might have a maximum speed of only fifty miles per hour. Danger lurked everywhere because the speed at which these aircraft turned in flight hovered right at the stall speed. When landing, a pilot would carry power right to the point where he pulled up the nose of the plane and touched down. Timing was critical, and pilots favored long, low approaches.

Need to Land on Less

Today, however, the standard for landing is nearly the opposite. Military planners expect runway denial to be a fact of life in future conflicts. Working according to this projected limitation, aircraft designers are focusing on new types of fighter and attack aircraft that can land quickly on short runways. This can be accomplished either by reducing an aircraft's speed just prior to touchdown or by stopping soon after landing.

Dealing with limitations has always been crucial in the art of landing. Until recently, the limitations have been dictated less by tactical considerations—such as runway damage—than by the aircraft themselves.

In World War I, when planes puttered along at about 100 miles per hour, pilots would try to position themselves so that, if their engines failed on approach, the flight path could also serve as a glide path. In an emergency, a pilot could manipulate the rudders to fishtail his plane, nearly killing airspeed, in order to make a sharp descent. With skill and luck, he could get down in one piece—or at least survive the crash.

In World War II, pilots who had to land the P-51 Mustang learned to hold on tight and work with the airplane. Landing this touchy fighter was a matter of slowing to 130 miles per hour while applying enough forward power to keep the nose up. If too much power was injected at the wrong time, the craft would flip on its back.

More recently, pilots new to flying the U-2 reconnaissance aircraft (and later the TR-1) were notorious for floating their planes down the runway while attempting to land. The glider-like U-2 came into the inventory at a time when pilots were accustomed to the relatively level landings of tricycle-gear planes. Neophyte U-2 pilots instinctively approached the runway in a horizontal attitude until they got used to the notion of holding the nose up in order to land the aircraft, essentially in a stall condition.

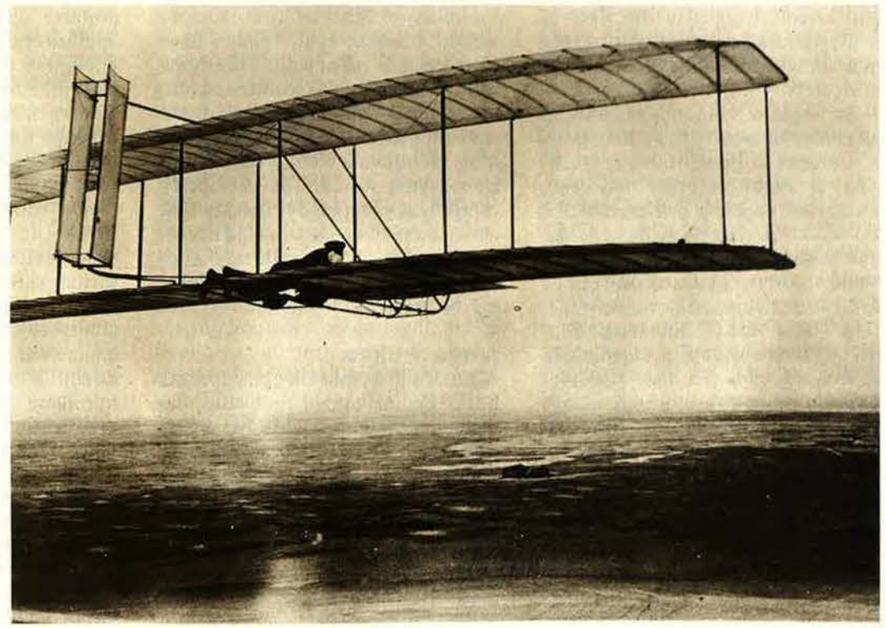
Fortunately for Air Force aircrews through the years, designers have kept a sharp focus on the hazards of landing and have used technology to ease pilots' tasks. In 1935, for instance, the Army Air Corps fleet of Boeing P-26 fighters posed a sticky problem. The "Peashooter" was a great leap for its time, marking the Air Corps's change from biplane to monoplane, but, with a landing speed of eighty-two mph, it was at first considered too hot to handle. Boeing later fitted the P-26 with flaps, then a fairly new device, and these successfully reduced touchdown speed to a manageable seventy-three mph.

In today's front-line fighters, onboard computers provide the technological help. Fighter jets must land within strictly defined limits. Thanks to new computerized avionics systems that control engine speed by increments of one knot, pilots can easily meet the requirements.

Solutions Beget Problems

In anticipation of the reduced runway requirements of the future, engineers have mapped out various ways to "land short." The first step is to reduce landing speed, a problem with many possible solutions. None of them, however, is ideal.

One way to reduce approach speed is to first reduce the aircraft's stall speed, which would permit a plane to drop safely to ever-lower speeds without fear of losing power



Flying their glider-kite in 1902, the Wright brothers concentrated on lift rather than landing. Early pilots worried more about getting airborne; for landing, they relied on long, low, powered approaches, which often led to unplanned descents and descents of an unexpected kind.

Pilots of modern jets rely on computerized avionics to calculate such interrelated variables as airspeed, weight, and center of gravity and make precise adjustments in landing. Engineers are developing technologies to allow planes to land on short or damaged runways.

completely. The obvious way to reduce stall speed is to increase the lift of the wings, either by varying the sweep or by increasing the camber with flaps and leading-edge devices.

Though this sounds simple, it brings with it a raft of problems centering on added weight to the airplane. As any aeronautical engineer will attest, weight is the first of many landing-related factors that interact with and affect one another intricately.

An airplane's landing weight and its center of gravity have long been of concern to pilots. On approach, amid a wealth of other concerns, weight and center of gravity must be calculated precisely. A miscalculation would have a domino effect that could cause the plane to stall out or overrun the remaining runway.

In World War II, pilots kept control with the use of a slipstick, a device resembling a slide rule that factored in such variables as takeoff weight, fuel consumption, and position of fuel tanks. In the B-47 bomber, for example, the slipstick calculation could facilitate a landing at speeds ranging from about 130 to 185 mph. Modern aircraft have a computerized slipstick that identifies problems and, in many cases, makes adjustments without disturbing the crew. The B-1B bomber, for example, has a computerized fuel redistribution system to maintain constant trim.

In general, aeronautical engineers figure landing weight to range from takeoff value to about eighty-five percent of takeoff weight. For the purposes of stall reduction, it would be easier to use the end-of-mission weight as the landing weight, because lighter planes have a greater margin of stall. This, however, would be dangerous indeed; pilots cannot count on returning to base only after they have consumed most of the available fuel or released all external stores. The possibility of in-flight emergency dictates that a plane must be ready to land immediately after takeoff without dumping huge amounts of fuel or releasing ordnance.

A Ripple Effect

Landing weight directly affects both landing speed and stopping distance. It is also closely related to the aircraft's center of gravity, which shifts with every sweep of a movable wing. Wing loading—the weight of the aircraft divided by the area of the lifting surface—has a major effect on approach speed. In general, approach speed should be set at about 1.2 times the airplane's stall speed, which in turn helps determine its touchdown speed, further defining the required landing distance.

These realities translate into a set of factors so closely interrelated that to tinker with one means adjusting the others. For instance, increasing the wing lift will reduce the stall speed, but lift relies on wind coming across the wing surface. The aircraft must still travel fast enough to create enough lift to stay aloft until touchdown. The resulting landing distance is not short enough to make the procedure worthwhile. In short, solely increasing wing lift is not a viable solution to the problem of runway reduction.

Another method of reducing speed before landing is by using jet thrust, rather than aerodynamics, to supply lift. "Vectored" thrust, the ability to vary the direction of an engine's thrust with respect to the direction of the aircraft, is one way to reduce speed. Efficient, reliable, and cost-effective vectored thrust would be a fighter pilot's dream come true. For the most part, it would eliminate worries about cratered runways because aircraft equipped with short or vertical takeoff and landing equipment would require a landing surface only slightly larger than the aircraft itself. In addition, such an aircraft could land on many surfaces that are otherwise dangerous, including those that are soft or icy. Vectored thrust would also eliminate the hazards of high-velocity approaches and landings because it would enable a plane to land vertically, with an approach speed of zero knots forward velocity.

Vectored-thrust landing would therefore be a complete departure from the standard method of getting down, which includes approach, flare, and ground roll elements.

The standard approach is mapped out to begin with clearance over an imaginary fifty-foot object. The angle of approach varies according to aircraft type. Transports, for example, can usually descend safely at a maximum angle of three degrees. The flare occurs when the plane stops its downward glide at a predetermined height and levels out to landing attitude. The plane decelerates from approach speed (1.2 times stall speed) to touchdown speed (on average, 1.15 times stall speed). Actual touchdown speed is factored at 1.1 times stall rate. The ground roll varies according to weight, speed, and the force used to halt the aircraft.

Eliminating or modifying any of these considerations increases mission flexibility, and vectored thrust would certainly allow a pilot to alter landing requirements. But vectored thrust has its drawbacks, which show up in design. Currently, vectored-thrust designs are limited to smaller aircraft, such as the Marine Corps AV-8B Harrier II. Engines must receive adequate air to sustain a hover at low speeds, and this requires large intakes, which in turn produce drag and constrain airspeed. The intakes also produce a large radar signature.

Brakes, Chutes, and Hooks

Runway requirements can also be reduced by halting a conventionally powered aircraft swiftly on the ground. The amount of force needed to stop an aircraft within a given distance after touchdown increases according to the weight of the plane and the square of the landing speed.

In many airplanes, brakes alone won't do the job. So far, developments in wheel brakes on fighter and attack aircraft have not had great success in shortening stopping distances. Designers have been unable to counter poor, wet weather that will always reduce the friction within a brake assembly and thus reduce the plane's stopping ability.

One old standby is the drag chute, which keeps a plane from barreling along full tilt until it hits something strong enough to stop it. The problem with parachutes is that they are dangerous in high crosswinds. Moreover, they don't help much when a plane has a relatively low landing speed.

Another way to slow aircraft would be to take a page from the Navy's book and employ ground-based arresting gear similar to that used on aircraft carriers. This method assumes that a predetermined, nonemergency landing site will be available, and it is an unwieldy solution because it involves resetting the arresting gear each time it is used. That, in turn, creates lag time for other planes waiting to land. If a landing craft does not engage, or if the gear does not work, problems can mount very quickly.

Today, the most practical slowing device is the thrust reverser, which has its roots in the old reversible-pitch propeller. The idea is to create aerodynamic drag by reversing engine thrust. Although turboprops can be operated in reverse for the duration of the landing roll, jet engine thrust reversers must be cut off at slow speeds (roughly seventy miles per hour), lest the engine ingest its own exhaust. Thrust reversers may draw in ground material, especially on a cratered runway. The devices also add considerable weight to the aircraft. Sometimes the airplane has to work much harder in normal flight situations to compensate for their presence.

Daunting as all these drawbacks may seem, various methods of reducing runway requirements have begun to emerge. Some have been successfully integrated in the joint Air Force–McDonnell Douglas F-15 STOL/Maneuvering Technology Demonstrator (S/MTD) program.

Evaluations conducted at Edwards AFB, Calif., have shown that the demonstrator can land (and take off) on a 1,500-foot section of runway, considerably shorter than the 7,500 feet required by the F-15E.

The key to the S/MTD's achievement is a combination of airframe modification and use of integrated flight- and propulsion-control systems. Modifications include canards, rough-field landing gear, and two-dimensional thrust-vectoring and thrust-reversing engine nozzles. The airplane was specially equipped with technology permitting a short land, or SLAND, mode, designed to ensure an exact flight path and accurate speed control on approach to a short landing.

The SLAND mode involves closing down the two-dimensional nozzles, thereby controlling thrust with upper and lower rotating vanes. Another innovation is the separation of the pitch and airspeed responses. Normally, the throttle controls the approach and landing speeds, affecting pitch. In S/MTD landings, airspeed and pitch are decoupled, enabling the pilot to set down his plane with greater precision.

The S/MTD's canards improve pitch authority and reduce approach speeds by roughly five knots, to about 132 knots. This reduces the landing energy of the S/MTD, which weighs about 4,000 pounds more than a typical F-15. Once the S/MTD has touched down, the canards help keep the aircraft hugging the ground.

Impressive as the S/MTD is, it too has limitations. Some of its technologies are difficult to integrate with the other systems on the airplane. Despite the advances of S/MTD technology, STOL capability is still limited by the basic abilities of the aircraft.

With that in mind, engineers are working on upgrades of current systems, with an emphasis on increasing the ability to land at night or in bad weather. Even so, no one should expect any time soon to see a single, elegant solution to the problem of getting down. ■

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The outlook is for recovery in five or ten years, but that is then. This is now.

More Stormy Weather for the Airlines

By Richard Mackenzie

THE commercial airline industry lost a total of nearly $6 billion in 1990 and 1991, the worst two-year period in international aviation history. The slump accelerated during the past year: Two-thirds of the global industry's two-year loss—$3.7 billion to $4 billion—came in 1991.

US airlines absorbed much of this staggering amount, raising concern about the health of the industry. Of the 1991 loss, some $2 billion was registered by US-flag carriers. A high percentage of the loss came late in 1991, reports William Jackman of the Air Transport Association of America (ATA).

The economic downturn in the West lay at the root of industry woes, but it was not the only cause. The Iraqi invasion of Kuwait in 1990 and the US-led military response in 1991 also cut into revenues, say industry experts. The Mideast tension not only heightened the public's fear of flying but also raised the cost of fuel. Oil prices soared when Iraq invaded Kuwait. Prices came down after the allied victory, but not to prewar levels.

Gunter O. Eser, director general of the International Air Transport Association (IATA), warns that, if losses continue at the 1990–91 rate, it will become increasingly difficult for the airlines to finance the purchase of new aircraft in the future.

The picture is darkened by the collapse in recent years of several big US carriers, including Pan Am, Eastern Airlines, and Braniff—all former great names in the aviation industry. Many airports and air routes are stretched to capacity, say industry experts.

Not everyone is downcast about the airlines' future. Don Fuqua, president of the Aerospace Industries Association (AIA) and a keen observer of the industry, is optimistic. "Look beyond 1991," he admonishes listeners. "If you look ten years down the road, this decade will be a very strong one for commercial transport."

"The Worst is Over"

Mr. Fuqua argues that one must examine and analyze the airline industry in five- or ten-year segments. In this light, he says, the gloomy present looks like "a speed bump in the road" to greater prosperity. "We are projecting that, by the year 2005 —fifteen years from now—we will have a strong market," says Mr. Fuqua. "We'll be making more airplanes than we've ever done before. They'll be larger and more fuel-efficient."

"The worst is over," agrees Helene Becker, who analyzes the airline industry for the Wall Street firm Shearson Lehman Brothers.

Turbulence first hit the US industry after the Carter Administration deregulated the nation's airlines during the late 1970s. Mr. Fuqua says the industry is still going through the shakeout precipitated by that federal action.

"That caused financial hemorrhaging in some of the carriers," he says. "Before, everybody had a rate base and everything was going along pretty well. When deregulation came, they started getting their operating costs down."

To generate cash, Mr. Fuqua recalls, some airlines sold off part of their businesses and others sold off routes. Some airlines handled the changeover better than others.

The bankruptcy of Pan Am, for example, marked the culmination of negative trends dating from well before 1990. "That started many years ago," said Mr. Fuqua. "That didn't start this year. If you treat an infection by cutting off your finger, you'll have nothing left of your basic body after a while. That's what happened to Pan Am."

Whether the overall effect of deregulation is good or bad is still being debated. "It's been good for the consumer," says Mr. Fuqua. "People are still able to fly at a very reasonable rate."

As evidence, he cites the cost in the 1930s of flying from Los Angeles to Manila on Pan Am's China Clipper. The 1930s cost, $1,400, equals $14,000 in today's dollars. Americans can fly to the Far East today for a mere $1,000.

US Market Share by Major Carrier

(Based on revenue passenger miles, January–November 1991)

Airline	Percentage
United	18.5
American	18.4
Delta	15.1
Northwest	12.0
Continental	9.3
USAir	7.7
TWA	6.3
Pan Am	4.7
America West	2.9
Southwest	2.5
Eastern	0.2
Other	2.4

Source: Air Transport Association of America.

Wall Street analyst Becker goes even further. She argues that deregulation has been good not just for consumers but also for the airlines, although she admits her opinion is probably in the minority. Her calculations show that the industry's rate of return on invested capital was higher in the ten years after deregulation than in the ten years preceding it.

"We've gone through a huge period of consolidation," says Ms. Becker. "The problem was that the government deregulated the airline industry but didn't deregulate the airport industry or anything else to do with airlines. They deregulated fares and routes. They didn't deregulate airport access, who owns airport space, or who runs airports. They didn't deregulate or privatize the Federal Aviation Administration."

The result, she says, is that "huge bureaucracies" continue to govern a supposedly deregulated industry.

Fuel and Labor Costs Rise

The problems of the past two years battered not only the likes of Pan Am but also airlines with the lion's share of the market. In 1990, the airlines were hit by increases in two big costs, fuel and labor. These two items normally account for half of total operating costs. Both increased significantly.

Following the invasion of Kuwait, airline fuel rose from sixty-five cents a gallon (July 1990) to $1.40 a gallon (October 1990). Though it drifted back down after the end of the war, it has persisted at comparatively high levels. The cost of crude oil continues to hover at thirty percent above prewar levels.

Today, says Ms. Becker, the US industry "really needs to concentrate" on labor costs. The collection of airlines lost ten percent of its labor force in 1991, which has helped control employee costs. However, labor costs had already risen by eleven percent in 1990. Only three percent of this spectacular rise could be offset by productivity gains. Other labor-related costs, such as insurance premiums and payroll taxes, continued to rise in 1991, says Mr. Eser.

These costs all seemed to hit home late last year. As late as October 1991, the US airline industry was projecting losses of "only" $1.8 billion for that year. As the economy failed to revive, however, the industry slumped badly. Revenue projections for the last quarter of 1991 collapsed, and experts increased their estimates of the losses to some $2 billion.

These industry analysts maintain that both leisure travel and business travel have sagged. Flights taken by passengers dropped from 297 million in 1990 to 286 million in 1991. The numbers have been fairly flat for several years, Mr. Jackman says, but not since the recession of the early 1980s has the absolute number fallen.

Leisure travel has fallen off because many families cannot afford costly vacations in hard economic times. "Business travel also goes," says Mr. Jackman. "One of the first things to be cut in a company is the travel budget, and it's never the first to be reinstated. People find they can do the job without traveling, or they might start flying their employees coach."

In early 1990, one of the brightest spots for airlines was the prospect for increased international traffic. Then came Saddam Hussein, the invasion of Kuwait, and Operation Desert Storm.

Mr. Jackman says that international bookings plummeted the moment the first American bombs were dropped on Iraq on January 17, 1991, Baghdad time. Bookings around the world fell by twenty-five percent during Desert Storm, says Mr. Eser, and bookings to the Middle East fell by fifty percent. It was not until October that international travel began to rebound.

The Impact of CRAF Operations

US carriers also were affected by the first-ever activation of the Civil Reserve Air Fleet (CRAF) program, says Paul Hyman, ATA's vice president of Cargo Services and formerly the director of transportation policy at the Defense Department.

The Pentagon relied on more than 100 civilian airplanes operated by twenty-seven domestic and foreign airlines to fly troops and some equipment to Saudi Arabia and other Gulf nations. According to Mr. Hyman, US-flag CRAF planes carried two-thirds of the troops and twenty-five percent of the cargo.

Industry observers note that the CRAF firms are proud of their contribution to the war effort, but they also claim that the activation created problems. Some airlines lost business.

"CRAF got very mixed reviews during the war," says Ms. Becker. "Some in the Pentagon felt it went very well. The airline industry was not so enthusiastic. The only company thrilled to have aircraft committed was Pan Am. It kept them in business a couple of months longer."

American Airlines took the hardest hit, she says. The airline had hired many former servicemen as pilots, most of whom were affiliated with the Air National Guard and Air Force Reserve. Nearly ten percent of American Airlines pilots—526 of the 6,000 on the payroll—were called up. Another 400 were subject to call-up.

The Department of Defense commissioned the Logistics Management Institute to conduct a study of CRAF operations. The study called for major changes in activation, crew requirements, and war risk insurance. Other recommendations included calling volunteer aircraft first and releasing them last, while nonvolunteers would be released first. A lottery to select planes was also suggested so that all receive equal treatment.

The airlines didn't work for free in Desert Storm. Firms participating in the CRAF call-up received more than $1.8 billion from Military Airlift Command (MAC) in Fiscal Year 1991, most of it for Persian Gulf duty.

Still, the companies did not consider this a boon. "There were a number of concerns about cost raised by the airlines," says Mr. Hyman. "These included war risk insurance, indemnification for claims or losses, [and other] extraordinary costs. The industry [was] still waiting for claims to be processed by MAC eight months after the end of the operation." The claims also include the cost of extra crew time, rerouting expenses, and other "small things," Mr. Hyman says.

The airlines also lost business that was available in the Pacific, South America, and Australia during the war, Mr. Hyman says. He notes that the Pentagon's Gulf buildup took place during the peak season for commercial cargo business. He claims that the MAC payments did not compensate the carriers for losses in the commercial market.

"The MAC rates are administered and set in peacetime," says Mr. Hyman. "It was not a market rate." At the same time, hazardous-duty pay and increased insurance premiums absorbed by the airlines were not covered by the Pentagon.

Big CRAF Concerns

"Now that we've done it for the first time ever," says Mr. Hyman, "the benefits and the costs of CRAF are more vivid than ever in everybody's mind. Carriers now know that their war risk insurance was not comprehensive, and they were actually exposed when they flew. They recognize that they lost some market share by being patriotic. Japan Airlines and Nippon Cargo came in and scooped up [1990] Christmas business while our carriers were responding to the call of the nation. These are all concerns."

The MAC contracts covering the CRAF participants and the statute governing the contracts expire on September 30, 1992. The contract for international air transportation services, which incorporates CRAF, will be replaced by a new proposal for Fiscal 1993, which begins October 1, 1992.

Cuts in the armed forces will cause big reductions in the airlines' MAC business. The "fixed," or predicted, MAC budget for Fiscal 1991 was $236.2 million. The war caused that figure to soar, on a one-time basis, by $1.5 billion to $1.8 billion. The next three fiscal years, however, show a drop to $201 million.

The airline industry hopes that its fortunes—and revenues—turn around in 1992. When and if the general economy recovers, the industry will do better. "More people are traveling now than ever before in the history of aviation," says Ms. Becker. "That could explode in the 1990s, unless the industry is reregulated."

Both Ms. Becker and Mr. Fuqua maintain that the collapse of Soviet communism will have a large, beneficial effect on the airlines and aerospace industries. They say that the opening of the former Warsaw Pact nations and the republics of the old Soviet Union will be a boon as entire nations begin to travel. As for the aerospace manufacturing industry, "our companies are selling air traffic control systems to [former Communist nations]," says the AIA President. "In what was East Germany, traffic was restricted to Berlin. Now it will be going into a lot of other cities in Germany." The same is true of other eastern European countries.

Lean and Mean

The current hard times and a dozen years of deregulation have taught the airlines hard but useful lessons.

"They are now lean and mean operations," says Ms. Becker. "They are part of one of the few industries where US companies on a cost-per-mile and productivity basis are more efficient than their offshore competitors. . . . They have a huge advantage, especially over European-based airlines that are mostly government-controlled."

The ATA predicts the US airline industry will get back in the black in 1992, making a projected $300 million profit. "That's a pittance in an industry with $80 billion in revenues," Mr. Jackman admits, "but it is a profit."

That projection is based on assumptions that there will be a six percent increase in traffic and a leveling of fuel costs. Mr. Jackman admits to concern about the recovery of the domestic US market during the recession.

IATA foresees US passenger traffic increasing by 8.3 percent in 1992, 6.8 percent in 1993, and 6.6 percent in 1994. "We look to traffic recovery in 1992," says Mr. Eser, "provided the Western economies and Japan prove more resilient than they are looking at the moment."

Still, after the lean years, it is "difficult to see how the airlines will finance new aircraft," Mr. Eser warns. He notes that, even in the good times, the airline industry's profit margin is slim, only 2.6 percent of revenues in its best recent year, 1988. "The manufacturing industry makes twice that," observes Mr. Eser.

Mr. Fuqua points out that the backlog of planes on order is strong. Worldwide, there are 3,700 planes on order, of which an estimated 650 will be delivered in 1992. Some 2,000 of the total backlog, worth $130 billion, will be built in the US.

Part of the reason for this market strength, several experts agree, are US environmental standards that require US airlines to move up to Stage 3 jets, which are quieter and more fuel-efficient than current Stage 2 airplanes.

More than 2,600 aircraft in the US commercial fleet are older 727s, 737s, and MD-80s, all of which must be replaced or upgraded to meet the new environment standards. "A lot of those have been in service for some time," says Mr. Jackman. "A lot of that equipment will be replaced."

Ms. Becker, however, believes that sales have peaked. She notes that Delta and United still have big buying programs but that American recently announced it was cutting capital spending over the next decade by more than half, from $15 billion to $7 billion. USAir also has cut its procurement program.

The good news for the airlines is that the Stage 3 aircraft are all flown by two persons on the flight deck as opposed to the current crew-of-three system.

Overall, commercial aviation's future, most agree, promises to be better than the recent past. "It's got to get better than the last two years," says one frazzled official. "I can't imagine it getting worse." ■

Civil Reserve Air Fleet Missions Flown in Operations Desert Shield and Desert Storm

Carrier	Passenger Missions	Cargo Missions
US carriers		
America West	39	0
American	98	0
American Trans Air	494	0
Arrow	0	119
ATI	0	156
Buffalo	0	22
Connie Kalitta	0	370
Continental	91	0
Delta	26	0
Eastern	33	0
Emery Worldwide	0	152
Evergreen International	0	347
Federal Express	29	576
Florida West	0	54
Hawaiian	263	0
Northwest	268	117
Pan Am	335	69
Rich International	14	0
Rosenbalm	0	249
Southern Air Transportation	0	252
Sun Country	30	0
Tower Air	242	1
Trans Continental	5	0
TWA	236	0
United	177	0
United Parcel Service	0	123
World	188	149
Foreign carriers		
Alitalia (Italy)	0	27
Cargolux (Luxembourg)	17	0
KAL (South Korea)	0	70
Kuwait Airways	0	1
Martinair Holland	0	16
Total missions	**2,585**	**2,870**

Source: Air Transport Association of America.

Richard Mackenzie, a free-lance writer in Washington, D. C., was a war correspondent in Afghanistan from 1987 to 1990 and in the Persian Gulf War in 1991. His most recent article for AIR FORCE *Magazine, "Afghan Airlift," appeared in the February 1992 issue.*

The "Brown Cradle" EB-66 is all but forgotten now, but it paved the way for the stellar EF-111A.

The Other Jammer

By August R. Seefluth

IN TODAY'S tactical air forces, the EF-111A Raven is the heavy-duty jammer. It was a stellar performer in the Persian Gulf War. Whenever the Raven turned on its power, Iraqi radars went blind.

The first time something like that happened was in 1960, and it marked the birth of the tactical jammer airplane. Three converted US Air Force bombers, flying north, crossed the southern coast of Britain, passed London, and traversed the island to Scotland. Though British radars were looking intently, none ever saw the planes. The jammers in the bombers had saturated every radar in Britain, overdriving videos and blanking out screens.

The strange new airplane that befuddled the British radar that day was the EB-66B, a relatively primitive jammer developed in the late 1950s and flown in combat for the first time in the Vietnam War. It was the first tactical aircraft to be designed, configured, and operated exclusively for electronic warfare.

The EB-66 is all but forgotten. Though it was built for a war in Europe, it enjoyed remarkable successes in southeast Asia. In different forms, it provided electronic reconnaissance, cover for bomb carriers, radar guidance for F-105 fighters, and standoff jamming of antiaircraft missile radars.

The EB-66 laid the groundwork for the EF-111A. Yet it was almost by accident that the EB-66 came into being.

For some time, the strategic bomber force was virtually the only part of the Air Force to recognize unequivocally the benefit of outfitting aircraft with jamming equipment.

In World War II, the B-17, B-24, and B-29 heavy bombers carried ECM devices that transmitted radio frequency noise to interfere with enemy antiaircraft artillery fire. The noise emitted by these systems caused errors in the radar systems pointing the guns, decreasing their accuracy.

The bombers also filled the air with strips of aluminum foil, or chaff, to provide false targets for the radars.

In the 1950s, Strategic Air Command (SAC) continued improving ECM transmitters and chaff for bomber self-protection. SAC developed an extensive electronic reconnaissance capability, sweeping up electronic intelligence, or ELINT, data on enemy radars and communications. The information then was used for mission planning and for controlling enemy jammers.

SAC developed a substantial capability for jamming at "standoff" range—outside lethal range of enemy weapons. The 376th Bomb Wing, based first at Barksdale AFB, La., and later at Lockbourne AFB, Ohio, was the focus of this work.

This "Brown Cradle" B-66B (opposite) at RAF Chelveston, UK, was configured with S-band jammers, whose antennas are just visible under the bomb bay. The chaff storage area in the tailcone is outlined with tape in an effort to keep the chaff dry. The assembly hanging under the aft fuselage is the drag chute container.

The Blue Cradles

The 376th Bomb Wing flew B-47 aircraft whose bomb bays were filled with jammer platforms known as "Blue Cradles." Another wing deployed B-47s carrying a manned capsule in their bomb bays, which made for more precise jamming. These B-47s were loaded with many high-powered transmitters capable of blinding any radar within a hundred miles.

However, no comparable standoff jamming unit could be found in Tactical Air Command or in the regional air forces deployed in Europe and Asia. Fighters at the time had no recourse but maneuverability and swiftness of attack for defense against radar-controlled guns and missiles.

In 1952 came an airplane that would eventually change all that. The Air Force selected a redesigned version of the Navy A-3D light bomber to replace the Douglas B-26 used in World War II and the Korean War. The new plane was designated B-66.

In addition to five B-66As used for testing, the Air Force bought 289 production aircraft: seventy-two B-66B light bombers, 145 RB-66B photoreconnaissance planes, thirty-six RB-66C electronic reconnaissance planes, and thirty-six WB-66D weather reconnaissance planes.

Compared to tactical aircraft of the time, the B-66 was a big airplane, more than seventy-five feet long and twenty-three feet tall, with a swept wing spanning seventy-two feet. It had a maximum gross takeoff weight of 83,000 pounds. The fuselage was almost square in cross section, about seven feet wide and eight feet deep in the bomb bay area.

The plane's two Allison J71-11 or J71-13 turbojet engines provided 10,000 pounds of thrust each. It could achieve speeds of over 600 mph. Each B-66 powerplant came equipped with a constant-speed alternator system that produced forty kilowatts of 110-volt, 400-cycle electrical power. More important, each plane was prewired for electronic countermeasures transmitters and came equipped with the day's standard radar warning receiver, the AN/APS-54.

In thirteen of the B-66B bombers, the bomb bays had been engineered for installation of an ECM platform called the "Brown Cradle," similar to SAC's "Blue Cradle." The Air Force procured 113 ECM tailcones that could be traded out with the tail radar and 20-mm gun turret. The tailcone permitted installation of three AN/ALT-6B, AN/ALT-7, or AN/ALT-8B jammers and two AN/ALE-1 chaff dispensers. In 1957, the Air Force successfully tested the cradles and tailcones and then stored them.

Just Right for Electronic Warriors

The B-66, though it was a fine airplane, underwent so many design changes that the service declared the fleet obsolete a few years after the end of the production run. In time, the electronic warriors who created the EB-66 would rejoice at the availability of a nearly new but technically obsolete plane that had large internal volume, adequate electric power, proper wiring, and well planned and tested provisions for electronics.

One unit to receive the new aircraft was the 10th Tactical Reconnaissance Wing, which was based at

Spangdahlem AB, West Germany. The wing's 42d Tactical Reconnaissance Squadron already had RB-66C electronic reconnaissance and WB-66D weather reconnaissance aircraft. Also on hand were three squadrons of RB-66Bs equipped with vertical cameras, photoflash cartridges, and flash bombs. The 10th TRW had its own reconnaissance technical unit to analyze photos and electronic intercepts.

In short, the 10th TRW had all it needed to form a full-scale electronic warfare organization. The RB-66C crews collected the raw data needed to counter enemy radar across the Iron Curtain. The reconnaissance technical unit was the basis of a full ELINT organization and could provide data to preset USAF aircraft jammers.

Work toward this goal began. Knowledgeable officers at wing headquarters, USAFE headquarters, and the Air Staff agreed with the goals and assisted in gaining approvals. This permitted the wing to achieve mission changes, hardware acquisition and installation, and flight tests to meet the needs of war against the Warsaw Pact.

The B-66's status as "obsolescent" was significant, for a strange reason. Though the Air Force seldom approved formal modifications to aircraft, it permitted local, "informal" modifications. Technicians, investigating the effects of installing tailcones, found that they increased the speed of the RB-66B by thirty-five knots. When he heard this, Col. James D. Kemp, the 10th TRW's commander, agreed to permit installation of the cones on all the wing's aircraft, opening the way for operational deployment of jammers.

In late 1958, the Air Force revised the ECM annex to the NATO War Plan, incorporating the wing's new electronic warfare capabilities. The wing's primary combat mission was changed from photoreconnaissance to ECM.

The next step was to install jammers. Technicians quickly discovered that much of the aircraft wiring had to be checked and redone before the equipment would work. Standard configurations were established for the RB-66B and RB-66C. The modified airplanes carried three AN/ALT-6B or AN/ALT-7 jammers and two AN/ALE-1 chaff dispensers in the tailcone. Some RB-66B airplanes also had a forward compartment for two additional transmitters.

The unit organized regular radar jamming exercises, conducted principally in concert with the Royal Air Force. The RAF was the most cooperative of the NATO allies, and its bases were far away from the Warsaw Pact area and thus from the danger of Soviet interceptions of the emissions.

In the Vietnam War, the EB-66 performed standoff jamming and ECM escort for US strike aircraft. Here, an EB-66 guides a close formation of F-105 Thunderchiefs through clouds on a precision bombing mission while tuning in to North Vietnamese ground and airborne radar, ready to warn of a possible attack.

The wing's ELINT processing capability was upgraded to help it provide immediate updates of the electronic order of battle. Capt. Ted Noble and Lt. Bill Keels maintained a complete list of all known threat radars. This information was used to set the B-66 jammers for optimum effectiveness.

The Move to Britain

When the US was forced to move its nuclear-armed 49th TFW from France to Spangdahlem in 1959, the 10th TRW moved to bases in England. Headquarters and two photo squadrons went to RAF Alconbury. The 42d TRS went to RAF Chelveston, where the ELINT work continued. The Air Force reassigned the thirteen "Brown Cradle" B-66Bs from the 47th Bomb Wing at RAF Sculthorpe to the 42d TRS at Chelveston, providing a standoff jammer capability for protecting fighters.

Capt. Thomas W. Sumpter, chief of maintenance at RAF Chelveston, was responsible for modifying the B-66B aircraft to wing specifications, installing Brown Cradles, and configuring the ECM load. He had been a B-36 panel engineer and an expert electronic warfare officer, so he understood the airframe and electrical system in addition to electronics.

One morning in early 1960, three C-124 cargo aircraft landed at RAF Chelveston and disgorged everything that went with the thirteen B-66Bs, including Brown Cradles, tailcones, antennas, wiring harnesses, and cooling ducts. With the help of four contractor technical representatives and his squadron maintenance people, Captain Sumpter formed a production line to modify the airframes and wiring, install sixty-kilowatt alternators on the engines, install the cradles, and test the entire system. Each of the converted bombers received twenty-three jammers, some of them from the SAC inventory.

The 10th TRW, with RAF help, conducted an operational exercise to confirm the ECM performance of the B-66B and compare it with that of the standard RB-66B configuration. The results were dramatic.

The standard RB-66B photo airplanes, with their load of three to five jammers each, were assigned to penetrate English air defenses from the east, coming in over the North Sea. Though all of the airborne jammers were operating, ground-based radar emissions burned through the jamming and detected the Air Force planes, tracking them for interception by RAF fighters.

Then came the flight of the new standoff jammers. Three of the modified B-66Bs, equipped with Brown Cradles, came up from the south, all emitters in operation. I observed the exercise from a British ground control intercept radar near Newcastle, in northern England. The Brown Cradle planes never appeared on the radar screen until they reached Scotland, and London Traffic Control requested termination of jamming so it could resume commercial landings. The exercise was judged a success.

Wing officers proposed that some of the planes deploy to a forward base, where they would be in fifteen-minute alert status and ready to go with the first wave of bombers. These planes were assigned to Toul-Rosieres AB in northern France.

Testing Improvisations

As soon as enough B-66B Brown Cradle aircraft had been modified, the wing activated the forward alert at Toul. There was no way to test the twenty-three jammers without disrupting every radar in the area, so technicians devised a system of airborne testing using the RB-66C as the test set.

Before an airplane went on alert, all of its jammers were preset to known threat frequencies. The airplane, with an escorting RB-66C, would fly at least 200 miles out to sea, away from English radars. Each jamming system was turned on, one by one, while the reconnaissance airplane crew checked the jammer output and antenna pattern by intercepting the signal and moving around the cradle airplane. When the test was completed, the B-66B would land at Toul for its turn on alert.

Crew chiefs watch as EB-66s of the 42d Tactical Electronic Warfare Squadron (the last four in the USAF inventory) take off from Korat RTAFB, Thailand, on their final mission. The Brown Cradle EB-66 was retired in 1974 and replaced by the General Dynamics EF-111A Raven, the heavy-duty jammer of today's tactical air forces.

In 1966, the various B-66 derivatives were redesignated as EB-66s. The wing's tactical reconnaissance squadrons were redesignated Tactical Electronic Warfare Squadrons (TEWS).

The 42d TRS was deactivated in August 1966. Soon, however, the Vietnam War flared, and the 42d was reactivated with many of its original planes and crew members. The first contingent of five B-66B Brown Cradle aircraft was sent on temporary deployment from USAFE to Takhli RTAFB, Thailand, as early as October 1965. The remaining eight followed in May 1966. They moved to Tan Son Nhut AB near Saigon in June 1966, and then to Udorn RTAFB, Thailand, in September 1966.

In southeast Asia, the planes provided standoff jamming and ECM escort for US strike aircraft. In late 1966 and early 1967, with the fighter force's increased use of QRC 160 self-protection jammer pods, escorts were no longer needed. The EB-66Bs were assigned to support 13th Air Force's Thailand-based B-52 sorties and Navy carrier operations.

As the Vietnam War continued, older jammers in the B-66B Brown Cradle configuration were replaced by advanced systems. TAC and the 363d Tactical Reconnaissance Wing at Shaw AFB, S. C., began extensive modification of B-66 variants to meet the demands of war in southeast Asia. Fifty-two RB-66B photoreconnaissance airplanes were modified to become EB-66Es, with equipment and operator positions similar to those in the Brown Cradle aircraft.

The last of the B-66 electronic aircraft was deactivated in 1974. The replacement for the EB-66B Brown Cradle is the General Dynamics EF-111A Raven, the two-place fighter modified by Grumman in the early 1980s. The heart of the EF-111A is the AN/ALQ-99E jamming system, a version of the ALQ-99 used in the Navy's EA-6B Prowler. The Raven's intelligence support system is a computerized program that provides information about radars in the area where the Raven crew will be working. The plane's computer determines which enemy radar is "up," its priority as a target, and how to jam it. The computer can jam automatically, if need be.

Without question, the EF-111A represents a remarkable advance. Still, it was the EB-66 that showed the way toward deployment of an effective tactical jammer. ■

August R. Seefluth worked on the EB-66 program in the late 1950s and early 1960s as an electronic warfare officer (EWO) with the 42d Tactical Reconnaissance Squadron at Spangdahlem AB, West Germany, and as wing EWO at 10th TRW headquarters at Spangdahlem and RAF Alconbury, UK. His most recent article for AIR FORCE *Magazine was "Birth of the Pods" in the February 1992 issue.*

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Valor

By **John L. Frisbee,** Contributing Editor

A Good Thought to Sleep On

The rescue of Roger Locker did more than set a couple of Vietnam War records.

On May 8, 1972, President Nixon authorized the mining of Haiphong and other North Vietnam ports, together with regular and frequent air strikes north of the twentieth parallel. Operation Linebacker was on.

Two days later, the US Air Force launched 120 aircraft against targets in and around Hanoi. Oyster Flight, four F-4s from the 555th Tactical Fighter Squadron flying MiG-CAP, was led by Maj. Bob Lodge, an outstanding young combat leader. He and his backseater, Capt. Roger Locker, were veterans of the air war, both with previous tours in southeast Asia. Also in Oyster Flight were Capts. Richard S. "Steve" Ritchie and Chuck DeBellevue, who were to become the Air Force's only F-4 "ace" team with five victories.

As Oyster Flight neared the Red River at a point about seventy-five miles northwest of Hanoi, they were alerted to the approach of MiGs. In the ensuing battle, Lodge and Locker shot down a MiG-21 and were positioning themselves to fire on another when they were hammered by 30-mm shells from two MiG-19s. The F-4's hydraulic system was knocked out, making the aircraft uncontrollable. A fire in the rear of the fuselage forced Captain Locker to punch out while the plane was inverted. Major Lodge did not eject. Since no one in the vicinity saw parachutes, it was assumed that both men had perished.

Captain Locker had, in fact, landed in trees near a MiG base at Yen Bai, north of the Red River, shaken but uninjured. He could not retrieve his parachute, which was caught in the trees, or his survival pack. After a brief radio call, he sought to put distance between himself and the parachute, which inevitably would attract a search party. (His radio signal was received by friendly aircraft, but, since there was no voice transmission, the signal probably was thought to be sent by a North Vietnamese using a captured radio.)

Within minutes, Captain Locker heard sounds of a search party. Taking cover in a brush pile, he took stock of his situation. It wasn't encouraging. He had the contents of his survival vest, including two pints of water and a couple of snacks. Rescue so deep in enemy territory—some 350 miles north of the DMZ—was unlikely.

His best chance of rescue was to cross the heavily cultivated Red River Valley, swim the river, and work his way to the sparsely inhabited mountains about ninety miles to the west. The river lay several miles away through forested, hilly terrain. He would travel only at first light and at dusk, living off the land.

The enemy's search resumed the next morning. At one point, searchers came within thirty feet of Captain Locker's hiding place. On the third day, there were no sounds of a search party, and Locker could move somewhat more freely, but living off the land proved to be a greater problem than he had anticipated. It was too early in the season for ripened fruit, nuts, or berries. He ate what he could find, gradually weakening as the days passed. Water was no problem. There were plenty of small streams. There were also plenty of mosquitoes and drenching rains as he inched along at less than a mile a day.

Over his "Triple Nickel" cap, a haggard but happy Captain Locker dons that of the SAR unit that rescued him after twenty-three days in Hanoi's backyard.

Captain Locker frequently tried for radio contact, with no success. Then, on June 1, three weeks after he was shot down, as he was contemplating leaving the forest for a dicey venture into the valley, a flight of F-4s passed directly over him on their way home from a strike and, he hoped, with radio frequencies open.

Locker's call was picked up. Within hours, a small search-and-rescue (SAR) force was on its way from Nakhon Phanom, Thailand. After the A-1 Sandys were satisfied that they were talking to Locker, an HH-53C Super Jolly helicopter, flown by Capt. Dale Stovall, started in for the pickup, but the SAR force was driven off by missiles and MiGs. Maybe rescue was not possible so far north of the DMZ, after all.

Seventh Air Force thought otherwise. On June 2, another SAR force, supported by fighters, bombers, Wild Weasels, tankers, and ECM aircraft, numbering more than 100 in all, fought its way in. Captain Stovall's HH-53 picked up Roger Locker and returned him to Ubon RTAFB.

It had been a record-setting show. Captain Locker had eluded capture in enemy territory for twenty-three days, setting a record for successful evasion in the Vietnam War. Captain Stovall had twice flown his rescue helicopter further into North Vietnam than had been done before, earning him the Air Force Cross. All the principals emerged as heroes, but there is more to the story. Combat crews who would be flying Linebacker strikes north of the Red River now knew that eluding capture in that inhospitable land and rescue from Hanoi's backyard were indeed possible. That was a good thought to sleep on. ■

Books

By Frank Ollverl, Associate Editor

Flames Over Tokyo: The US Army Air Forces' Incendiary Campaign Against Japan, 1944–1945, by E. Bartlett Kerr. This book provides a comprehensive history of one of the largest air campaigns in history. Using interviews, firsthand accounts from US aircrew members who took part in the campaign, and extensive research, the author chronicles the technological developments and tactics that defeated Japan. Donald I. Fine, Inc., 19 West 21st St., New York, NY 10010. Including notes, photos, appendix, and index, 348 pages. $22.95.

Flying Tigers: Claire Chennault and the American Volunteer Group, by Daniel Ford. Here is the story of the 1st American Volunteer Group, more widely known as the Flying Tigers, who fought stubbornly to defend China and Burma against Japan during the winter of 1941 and spring of 1942. Reviewing personal papers from Claire Chennault, commander of the Flying Tigers, as well as Japanese, British, and American records, the author scours the myth to reveal the truth about the unit. Smithsonian Institution Press, 470 L'Enfant Plaza, Suite 7100, Washington, DC 20560. Including photos, notes, and index, 450 pages. $24.95.

The German High Command at War: Hindenburg and Ludendorff Conduct World War I, by Robert Asprey. The author outlines the careers of Gens. Paul von Hindenburg and Erich Ludendorff, who eventually came to hold the fate of the German nation in their hands in World War I. The book portrays the power of the German General Staff at the time, from the pinnacle of victory to final defeat, and details major battles in the Great War from the German point of view. William Morrow and Co., Inc., 105 Madison Ave., New York, NY 10016. Including photos, notes, and index, 558 pages. $27.00.

Just Cause: The Real Story of America's High-Tech Invasion of Panama, by Malcolm McConnell. During a year spent in Panama and visiting US military bases, the author interviewed numerous participants in the United States operation against Panama. These include Gen. Max Thurman, Commander in Chief, US Southern Command, at the time of the action; Gen. Marc Cisneros; and participating grunts, Rangers, and SEALs. Mr. McConnell attempts to answer questions and rumors about the campaign. St. Martin's Press, 175 Fifth Ave., New York, NY 10010. Including photos, notes, and index, 307 pages. $22.95.

Little Friends: The Fighter Pilot Experience in World War II England, by Philip Kaplan and Andy Saunders. Chock-full of illustrations, photos, and research, this book gives a feel for air combat in wartime Europe. Many firsthand accounts of air combat over Germany are related, along with humorous reflections about life on the ground and anecdotes from fighter lore. Random House, Inc., 201 E. 50th St., New York, NY 10022. Including index, 256 pages. $50.00.

Our Man in Panama: The Shrewd Rise and Brutal Fall of Manuel Noriega, by John Dinges. Documenting the rise and fall of the Panamanian dictator, the author shows how the US helped to place General Noriega in power and ultimately swept him from power. General Noriega's involvements with Fidel Castro, CIA Director William Casey, and White House operative Oliver North, among others, are documented. Drug kings, arms dealers, spies, and diplomats are shown playing their parts in Panamanian politics. Times Books/Random House. Including photos and index, 412 pages. $13.00.

The Prize: The Epic Quest for Oil, Money & Power, by Daniel Yergin. This book tells the story of the struggle for wealth and power that surrounds oil. This book, writes its author, "is as much a history of the modern world as of the oil industry itself, for oil has shaped the politics of the twentieth century and has profoundly changed the way we lead our daily lives." Touchstone, Simon & Schuster Building, Rockefeller Center, 1230 Avenue of the Americas, New York, NY 10020. Including photos, notes, and index, 918 pages. $16.00.

Russian Lindbergh: The Life of Valery Chkalov, by Georgiy Baidukov. Mr. Chkalov was a national hero in the Soviet Union for his flight from Moscow over the North Pole to America. The author, his copilot for the flight, provides insight into that flight and other feats accomplished by Mr. Chkalov. Smithsonian Institution Press. Including photos, index, and bibliography, 330 pages. $19.95.

To Command the Sky: The Battle for Air Superiority Over Germany, 1942–1944, by Stephen L. McFarland and Wesley Phillips Newton. The authors explore the doctrine of air superiority and its success in World War II, attempting to prove that the achievement of air superiority, not strategic bombing, led to the Allied victory in Europe. Also described are Luftwaffe chief Hermann Göring's disruptive influence on German tactics and strategy and the impact of attrition warfare on Allied aircrew morale. Smithsonian Institution Press. Including photos and index, 328 pages. $35.00.

Other Titles of Note

The Aviation/Space Dictionary, by Larry Reithmaier. Seventh edition. Definitions of numerous aviation and space-related terms, plus more than a dozen appendixes whose subjects range from aerodynamic concepts to aeronautical charts. Tab Books Inc., Blue Ridge Summit, PA 17294-0214. 461 pages. $32.95.

The Cold War: Fifty Years of Conflict, by William Hyland. A historical overview of the cold war, including an examination of US foreign policy throughout, an explanation of the contemporaneous Soviet perspective, and a contemplation of the post-cold war era from a senior foreign policy official in the Nixon and Ford Administrations. Times Books/Random House. Including bibliography and index, 222 pages. $12.00.

Duel of Eagles, by Peter Townsend. The Battle of Britain from the perspective of a British pilot, with tales of flying heroes on both sides. Presidio Press, 31 Pamaron Way, Novato, CA 94949. Including photos, illustrations, and index, 455 pages. $24.95.

Nixon: Ruin and Recovery, 1973–1990, by Stephen Ambrose. The essence of Mr. Nixon's fight to save his presidency, new insights into the private Nixon, and chronicles of "the hidden years, the days and nights of personal struggle, writing, travel, and networking" on the comeback road. Simon & Schuster, Simon & Schuster Building, Rockefeller Center, 1230 Avenue of the Americas, New York, NY 10020. Including photos, notes, and index, 667 pages. $27.50.

The Real Heroes: A Special Salute to the United States Air Force, by Randy Jolly. For airplane enthusiasts, a pictorial salute to the aircraft and the men and women of the Air Force. Specialty Press, P. O. Box 338, 123 North Second Street, Stillwater, MN 55082. 1991. 191 pages. $39.95.

Under Two Flags: The American Navy in the Civil War, by William Fowler, Jr. From primitive Union gunboats on the bayous of Louisiana to the clash of the *Monitor* and the *Merrimack*, here are the battles, strategies, mistakes, and heroes of the largely forgotten Civil War on the waters. Avon Books, 1350 Avenue of the Americas, New York, NY 10019. Including photos and index, 352 pages. $10.95.

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AFA/AEF Report

By **Dan Sheehan,** Assistant Managing Editor

Red McColpin, We Are Here

In 1917, with the ringing phrase, "Lafayette, we are here," US forces sought to acknowledge and pay back a debt of honor and joined France to defeat a common enemy. Exhibiting the same spirit in 1991 as an exchange pilot with US forces in the Persian Gulf, Flight Lt. Edward Smith, RAF, won both the US and the British Distinguished Flying Crosses, carrying on a long tradition of heroism in the service of allied cooperation.

He was not the first to receive dual DFCs. Early in World War II, before the US entered the fray, more than 200 intrepid Americans made their way to England to fight the Nazis, and several were honored with DFCs from Britain and, later, from the US. Of those, Col. Don Blakeslee, Col. Oscar Coen, Lt. Col. Gregory Daymond, and Maj. Gen. Carroll "Red" McColpin were alive to see Flight Lieutenant Smith become the first man in almost fifty years to match their achievement.

Flight Lieutenant Smith was the guest of honor at a ceremony hosted by **Utah AFA** and received an honorary membership in AFA from National Vice President (Rocky Mountain Region) Nuel E. Sanders in appreciation for his heroism in the Gulf. Flight Lieutenant Smith served with the 4th Tactical Fighter Squadron, 388th Tactical Fighter Wing, at Hill AFB, Utah, and when they went to war, so did he. He received his US DFC for his actions on an F-16 "killer scout" mission against the Iraqi Republican Guard in the Kuwait theater of operations.

Flight Lieutenant Smith spent two hours over the target, dodging surface-to-air missiles and antiaircraft artillery and directing 120 aircraft bombing high-priority Republican Guard targets. His killer scout flight inflicted more damage than any other, and his British DFC citation praised his courage, determination, and "exceptional leadership." Flight Lieutenant Smith has since completed his tour and returned to his RAF unit.

The occasion honoring Flight Lieutenant Smith also marked the two-year anniversary of the unique "Windows Across the Sea." Identical stained glass windows, one at Hill AFB and the other at RAF Grafton-Underwood, have been dedicated to the memory of the men who served with 8th Air Force's 384th Bomb Group (Heavy) at Grafton-Underwood during World War II. Kansas State President Samuel M. Gardner and Utah State President Dan Hendrickson spoke at the anniversary ceremony.

National Vice President (Rocky Mountain Region) Nuel Sanders (second from left) congratulates Flight Lt. Edward Smith (second from right) on his honorary membership in AFA, as National Director Nathan Mazer (left) and Hill Aerospace Museum Director John McLeary look on. Flight Lieutenant Smith became the first man in almost fifty years to win both the US and the British DFCs.

Chapter News

The **Hawaii Chapter** was in the thick of things during the fiftieth-anniversary observances of the Japanese attack on Pearl Harbor. The chapter hosted a breakfast meeting at which Rep. G. V. "Sonny" Montgomery (D-Miss.), chairman of the House Veterans Affairs Committee, addressed chapter members and answered questions from the audience. Rep. Bob Stump (R-Ariz.), the ranking minority member of the committee, and Rep. Ike Skelton (D-Mo.), a member of the House Armed Services Committee, also attended. After the meeting, Hawaii State President and Chapter President John Parrish presented a carved wooden bowl to Representative Montgomery in appreciation for his talk.

The **Miami (Fla.) Chapter** and the **John W. DeMilley, Jr., (Fla.) Chapter** joined forces to help stage a highly successful Victory Ball for the men and women of nearby Homestead AFB. Attended by more than 1,000 people, the ball also commemorated the Air Force's forty-fourth anniversary. Col. Stephen B. Plummer, commander of the 31st Tactical Fighter Wing, hosted the ball, which paid tribute to the more than 700 servicemen and -women from Homestead who served overseas before, during, and after the Gulf War. Colonel Plummer also had high praise for the support provided by the civilian community.

The **Lehigh Valley (Pa.) Chapter** continued its contributions to area young people through one of its favorite organizations: the General Carl A. Spaatz Civil Air Patrol Squadron.

Cadet Maj. Craig W. Huey accepted the Outstanding CAP Cadet Service Award from Chapter President Howard W. Smith and also received the Amelia Earhart Certificate from CAP headquarters at Maxwell AFB, Ala. Chapter stalwart Harry D. Yoder made his annual presentation of the trophy to the Spaatz Squadron Cadet of the Year. The most recent recipient is Cadet 2d Lt. Jason Rambo. CAP Lt. Col. Richard I. Ludwig represented the Pennsylvania CAP wing staff at the ceremony.

The sweeping, complicated transformation of the Air Force became a little more comprehensible to the members of the **Tidewater (Va.) Chapter,** thanks to a multimedia briefing given by Maj. Steve Carey and Maj. Dana Atkins of the Commander's Action Group from Tactical Air Command headquarters. Their topic, "Tactical Air Forces of Tomorrow and the Air Combat Command," covered the causes and the ramifications of the USAF reorganization, which will mark the end of TAC, SAC, and MAC as they are now constituted. The briefers used Gulf War footage to highlight the capabilities of the latest Air Force equipment, which will help the new Air Combat Command and Air Mobility Command respond quickly and accurately to any threat. Chapter President Ralph Renfroe and Chapter Vice Presidents Howard S. "Sam" Myers and John Gaffney praised the clarity of the briefing and presented Majors Atkins and Carey mementos of their visit.

Reorganization was also the topic at a recent meeting of the **David D. Terry, Jr., (Ark.) Chapter.** MAC Commander in Chief Gen. H. T. Johnson addressed a general membership meeting at the Little Rock AFB Officers Open Mess and concentrated on the effects reorganization will have on MAC in general and Little Rock AFB in particular.

At an earlier meeting, Bill Goodyear, manager of Northrop's B-2 Division, gave a keynote address praising the survivability of the new bomber. Comparing its stealthiness favorably with that of the F-117, Mr. Goodyear underscored the need for the B-2 and stressed that terminating the program at fifteen aircraft made no economic sense.

Chapter President Marleen Eddlemon is in the midst of a Community Partner drive. She calls the chapter's current total of seventeen Community Partners "a wonderful start," but she is leading an aggressive push to add more.

Finally, the chapter has pledged to increase its annual scholarship award from $600 to $1,000. The award goes to area high school students and has been renamed in honor of Lt. Timothy W. Kehler, a chapter member killed in an F-4 training mission in Florida in 1986. Former 314th Tactical Airlift Wing Commander Col. Bill Kehler, USAF (Ret.), and his wife Barbara have pledged to make up any shortfall in the $1,000 for the annual scholarship named after their son.

The **San Bernardino (Calif.) Chapter** commemorated the "Fifty Golden Years" of operations at Norton AFB, Calif. Former commanders of the base's 63d Military Airlift Wing and 445th Military Airlift Wing (AFRES) (Assoc.) were on hand for the celebration, as was former San Bernardino Mayor Evlyn Wilcox, a past chapter president. The 15th Air Force Band provided the music. Besides his work on the successful ball, Chapter President Bill Christensen has been working hard to keep chapter members abreast of the economic implications of Norton's impending closure.

The **Jackson (Miss.) Chapter** has broken the ice in its quest to find

Lt. Gen. Charles Horner (center), air boss of the coalition in the Gulf War, helps Chicagoland-O'Hare Chapter President Tony Brees (right) present Chapter Secretary George Nicklaus his Exceptional Service Award at a meeting late last year. National Directors Richard Becker and Walter Vartan also attended the meeting, at which Col. Robert Schuldt and his wife Caroline received a Jimmy Doolittle Fellowship.

Coming Events

March 20–21, **Great Lakes Region Workshop,** Fort Wayne, Ind.; March 20–21, **Texas State Executive Committee and Southwest Region Workshop,** Dallas Tex.; April 3–4, **Northeast Region Workshop,** Mechanicsburg, Pa.; May 1–2, **North Carolina State Convention,** Raleigh, N. C.; May 9, **Massachusetts State Convention,** Hanscom AFB, Mass.; May 9, **New England Region Workshop,** Hanscom AFB, Mass.; May 15–16, **Maryland State Convention,** Andrews AFB, Md.; May 15–17, **New Jersey State Convention,** Atlantic City, N. J.; May 16–17, **Oregon State Convention,** Klamath Falls, Ore.; May 22–24, **South Carolina State Convention,** Columbia, S. C.; May 23, **Alabama State Convention,** Birmingham, Ala.; May 29–31, **New York State Convention,** Tarrytown, N. Y.; June 5–6, **Tennessee State Convention,** Memphis, Tenn.; June 12–13, **Louisiana State Convention,** Bossier City, La.; June 26–27, **Mississippi State Convention,** Columbus, Miss.; June 26–27, **Missouri State Convention,** Whiteman AFB, Mo.; July 17–18, **Arkansas State Convention,** Little Rock, Ark.; July 17–18, **Colorado State Convention,** Lowry AFB, Colo.; July 17–19, **Michigan State Convention,** Marquette, Mich.; July 17–19, **Pennsylvania State Convention,** Harrisburg, Pa.; July 24–25, **Florida State Convention,** Panama City, Fla.; August 7–9, **California State Convention,** San Bernardino, Calif.; August 22–23, **Indiana State Convention,** Kokomo, Ind.; August 28–29, **New Mexico State Convention,** Alamogordo, N. M.; September 14–16, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.

Community Partners. Beech Aerospace Services, Inc., has become the chapter's first Community Partner. Chapter President Leonard Vernamonti made it official by presenting a plaque to Daniel A. Grafton, president of the company.

The **Brig. Gen. Frederick W. Castle (N. J.) Chapter** welcomed an unusual guest to a recent meeting. Master woodcarver Alfred C. Seebode, vice president (membership) of the **Admiral Charles E. Rosendahl (N. J.) Chapter,** visited the meeting with examples of his work. His avocation has also been his livelihood. He has designed models for amphibious aircraft, America's Cup yachts, and ship prototypes. Chapter members in attendance found his presentation fascinating.

Have AFA News?

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

Bulletin Board

Seeking information on **Lt. Col. John Pace,** (spelling uncertain) who was at RAF Greenham Common, UK, in 1943–44. He may have been with the 438th Troop Carrier Group, 53d Troop Carrier Wing, or the 82d Service Group. **Contacts:** MSgt. J. M. Bartels, 137 S. W. 7th, Moore, OK 73160. M. Miles, 15 Speen Lodge Ct., Speen, Newbury, Berkshire RG13 1QS, England.

Seeking the whereabouts of **Col. John G. Eriksen,** commanding officer of Waller Field, Trinidad, in World War II. Also seeking **George Alfred Bennett,** who graduated from Spence Field, Ga., in Class 43-C. **Contact:** Lt. Col. Robert W. Bliss, AFRES (Ret.), P. O. Box 107, Orford, NH 03777-0107.

Seeking the whereabouts of **Tom J. Miller** from Thomasville, Ga., who was a fighter pilot with the 370th Service Squadron in Australia in March 1943. **Contact:** Robert Sherrard, 715 Cranbrook, St. Louis, MO 63122.

Seeking information on **Sgt. Albert B. "Red" Coven,** a B-24 flight crew member of the 791st Bomb Squadron, 8th Air Force, who was killed in action August 3, 1944, over France. **Contact:** MSgt. Fred Schnettler, USAF (Ret.), 817 Stratford Dr., East Meadow, NY 11554.

Seeking contact with members of John "Jack" Weaver's bomber crew of the **360th Bomb Squadron,** 303d Bomb Group, from November 1944 to May 1945. **Contact:** SSgt. Arthur L. Bailey, USAAF, (Ret.), P. O. Box 263, Santa Maria, CA 93456.

Seeking a patch, cap, or appreciation-of-service plaque from the **18th Special Operations Squadron,** 56th Special Operations Wing. **Contact:** Lou Dunham, 9916 Falls Rd., Potomac, MD 20854.

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

Seeking information on **James Woods,** an American fighter pilot shot down over Yunan Province near the China-Burma border, who was captured by one of the hill tribes of China, lived with them, and returned to the US at the end of World War II. **Contact:** Charles Webb, 30 Primrose Ct., Hydethorpe Rd., London SW12 0JQ, England.

Seeking contact with members of the **31st Strategic Fighter Wing,** which was activated at Turner AFB, Ga., in 1947 or 1948 under the command of Col. William L. Lee. **Contact:** Lon Atkin, P. O. Box 50902, Amarillo, TX 79159.

Seeking contact with **Sgt. Lois M. Behrend** from Milwaukee, Wis., who was a member of the Women's Army Corps during World War II, stationed at US Strategic Forces Europe, Office of the Director of Medical Service, St. Germain-en-Laye, France, in 1944–45. **Contact:** Rita Crean Tlamsa, 162 Ellison Ave., Bronxville, NY 10708.

For a history, I am seeking reminiscences, information, and photos of **B-29s, B-50s, B-36s, and B-47s** taken during tours in the UK. **Contact:** Michael Bower, 32 Netherhall Way, Cambridge CB1 4NY, England.

Collector seeks **military payment certificates,** used overseas from 1946 to 1972. **Contact:** Nick Schrier, 4121 Exa Ct., Sacramento, CA 95821.

Seeking contact with individuals interested in **veterans' issues as they relate to women. Contact:** Linda Grant De Pauw, The Minerva Center, 1101 S. Arlington Ridge Rd., #210, Arlington, VA 22202.

Seeking military **patches** and stickers. **Contact:** Francisco Borja Timerez Crespo, 4460 Overland Ave., #47, Culver City, CA 90230.

Seeking contact with anyone who participated in or administered School of Aviation **swing sickness experiments** at Randolph AFB, Tex., in 1944–45. **Contact:** Lt. Col. Donald K. McClure, USAF (Ret.), 855 N. Marion Dr., Traverse City, MI 49684.

Seeking information on the history of these units: **118th Tactical Reconnaissance Wing,** Shaw AFB, S. C. (disbanded in 1953) and 66th TRW, Shaw AFB and Sembach AB, Germany. **Contact:** Jack Moore, 5510 Windsor Island Rd., Keizer, OR 97303.

For my collection, I am seeking **World War II squadron patches,** pre-1945 aviation wings, and autographs of famous military leaders and early aviators, especially Billy Mitchell, Glenn Curtiss, Claire Chennault, Hap Arnold, and Katherine Stinson. **Contact:** Tom Shane, 6109 Bridlington, Austin, TX 78745. ■

Unit Reunions

B-25 Bunch
The Bolling B-25 bunch will hold a reunion May 20–23, 1992, at Wright-Patterson AFB, Ohio. **Contact:** Clifford J. Smith, 5249 Old A&P Rd., Ripley, OH 45167. Phone: (513) 375-4671.

B-29 Anniversary
The Boeing Co., in association with the Museum of Flight, will celebrate the fiftieth anniversary of the B-29 August 14–16, 1992, in Seattle, Wash. **Contact:** Paul S. Friedrich, P. O. Box 3999, M/S 17-28, Seattle, WA 98124-2499.

CBI Hump Pilots
China-Burma-India Hump Pilots Association will hold a reunion August 29–September 1, 1992, at the Stouffer-Waverly Hotel in Atlanta, Ga. **Contact:** Mrs. Jan Thies, P. O. Box 458, Poplar Bluff, MO 63901. Phone: (314) 785-2420.

China-Burma-India Veterans
CBI veterans will hold a reunion August 25–30, 1992, at the Hilton Hotel and Towers in Atlanta, Ga. **Contact:** Kenneth J. Ruff, 7303 Carew St., Houston, TX 77074. Phone: (713) 774-6580.

F-86 Sabre Pilots
The F-86 Sabre Pilots Association will hold a reunion April 19–22, 1992, at the Sahara Hotel in Las Vegas, Nev. **Contact:** Hank Buttelmann, P. O. Box 97951, Las Vegas, NV 89193. Phone: (702) 435-0253.

P-47 Thunderbolt Pilots
Members of the P-47 Thunderbolt Pilots Association will hold a reunion May 13–17, 1992, at the Holiday Inn in Orlando, Fla. **Contacts:** Ray Sutton, 1023 W. Thrush Cir., Barefoot Bay, FL 32975. Phone: (407) 664-1293. Bob Richards, P. O. Box 3299, Topsail Beach, NC 28445. Phone: (919) 328-8781.

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Unit Reunions

SAC Communicators
Members of The Old Time SAC Communicators will hold a reunion June 12–13, 1992, at Offutt AFB, Neb. **Contact:** William M. Bloom, 1002 Day Dr., Bellevue, NE 68005. Phone: (402) 733-5340.

3d Air Division/Det. 1
Veterans of the 3d Air Division, Detachment 1 (Hq. SAC), and the 55th Strategic Reconnaissance Wing stationed at Yokota AB, Japan, between 1957 and 1966 will hold a reunion June 8–10, 1992, in Bellevue, Neb. **Contact:** Lt. Col. Bill Haskins, USAF (Ret.), 700 Cedar, Suite 103, Alexandria, MN 56308. Phone: (612) 763-5684.

3d Hospital Group
Former 3d Hospital Group and 7510th USAF Hospital personnel (Wimpole Park, England) will hold a reunion in June 1992 in Nashville, Tenn. **Contact:** Rowland D. Garver, 182 E. Fifth St., Peru, IN 46970. Phone: (317) 473-7184.

5th Station Hospital
Former 5th Station Hospital personnel (Johnson Field, Japan) will hold a reunion June 17–21, 1992, in Atlantic City, N. J. **Contact:** W. Seabock, Box 35372, Louisville, KY 40232.

9th Air Force
Members of the 9th Air Force Association will hold a reunion convention May 11–13, 1992, at the Holiday Inn in Orlando, Fla. **Contact:** Vito Pedone, P. O. Box 2733, Arlington, VA 22202. Phone: (703) 979-1992.

9th Bomb Group
Veterans of the 9th Bomb Group will hold a reunion August 10–14, 1992, in Seattle, Wash. **Contact:** Herbert W. Hobler, 295 Mercer Rd., Princeton, NJ 08540. Phone: (609) 921-3800.

9th Photo Tech Squadron
Veterans of the 9th Photo Tech Squadron who served on Guam (1945–46) will hold a reunion April 3–5, 1992, in Nashville, Tenn. **Contacts:** D. K. "Pete" Whitt, 19820 Island Parkway E., Sumner, WA 98390. Phone: (206) 862-3041. Evan Baugh, 319 E. South St., Linden, IN 47955. Phone: (317) 339-7959.

13th Bomb Squadron
Veterans of the 13th Bomb Squadron (Korea) will hold a reunion April 8–12, 1992, at the Hawthorn Suites Hotel in Charleston, S. C. **Contact:** Ed Lewis, 802 Lewis Rd., Sumter, SC 29154. Phone: (803) 775-6574.

20th Air Depot Group
Veterans of the 20th Air Depot Group, including all squadrons (World War II), will hold a reunion August 20–23, 1992, at the Stouffer Hotel in Dublin, Ohio. **Contact:** Norman H. Lane, 12917 Jerome Rd., Plain City, OH 43064. Phone: (614) 873-4300.

22d Airlift Squadron
Veterans of the 22d Airlift Squadron/Military Airlift Squadron/Troop Carrier Squadron/Transport Squadron (1942–92) will hold a fiftieth-anniversary reunion April 3, 1992. **Contact:** MSgt. Gary Jones, USAF, 22d Airlift Squadron, Travis AFB, CA 94535-5000. Phone: (707) 424-2248. DSN: 837-2248.

29th Air Service Group
Veterans of the 29th Air Service Group, 13th Air Force, including attached units, will hold a reunion July 13–18, 1992, at the Holiday Inn Airport East in Louisville, Ky. **Contact:** Frank Pace, 315 W. 15th St., Dover, OH 44622. Phone: (216) 343-7855.

48th Fighter Wing
The 48th Fighter Wing is planning to hold a reunion July 31–August 1, 1992, at RAF Lakenheath, England. Former members assigned to the wing from 1941 to the present are invited. **Contact:** Reunion Committee, 48th FW, RAF Lakenheath, APO AE 09464.

56th Fighter Group
Veterans of the 56th Fighter Group/Fighter-Interceptor Group/Fighter-Interceptor Wing and 56th Tactical Fighter Training Wing will hold a reunion June 13–17, 1992, at Selfridge ANGB, Mich. **Contact:** Leo D. Lester, 600 E. Prospect, Kewanee, IL 61443. Phone: (309) 856-6826.

58th Bomb Wing
Veterans of the 58th Bomb Wing will hold a reunion August 12–16, 1992, at the Doubletree Suites and Inn in Seattle, Wash. **Contacts:** Earl C. Lind, 1744 Britt Rd., Mount Vernon, WA 98273. Phone: (206) 424-7746 or (206) 722-9040 (Erik Tamminen).

58th Fighter Ass'n
The 58th Fighter Association will hold a reunion June 11–14, 1992, in Colorado Springs, Colo., for members of the 58th Fighter Group (World War II), 58th Fighter-Bomber Wing (Korea), and 58th Tactical Fighter Training Wing/Tactical Training Wing (Luke AFB, Ariz.) who served since 1969. **Contact:** Lt. Col. Anthony J. Kupferer, USAF (Ret.), 2025 Bono Rd., New Albany, IN 47150. Phone: (812) 945-7649.

63d Station Complement
The 63d Station Complement Squadron, 9th Air Force (World War II), will hold a reunion June 5–6, 1992, at the Holiday Inn in Wayne, N. J. **Contacts:** Verne Haight, 489 Lexington Ave., Clifton, NJ 07011. Lt. Col. John T. Gilmore, USAF (Ret.), 24 Wedge Way, Columbine Valley, CO 80123-6630.

69th Fighter-Bomber Squadron
Veterans of the 69th Fighter-Bomber Squadron (Korea) will hold a reunion June 11–14, 1992, in Colorado Springs, Colo. **Contact:** Roger Warren, 7550 Palmer Rd., Reynoldsburg, OH 43068. Phone: (614) 866-7756.

69th Fighter Squadron
World War II veterans of the 69th Fighter Squadron "Werewolves," 5th Air Force, will hold a reunion April 30–May 4, 1992, in Tempe, Ariz. **Contact:** George E. Mayer, 7445 Thomas Ave. S., Richfield, MN 55423. Phone: (612) 866-6073.

71st/341st Air Refueling Squadrons
Veterans of the 71st and 341st Air Refueling Squadrons and assigned units stationed at Dow AFB, Me., will hold a reunion October 1–3, 1992, at the Seven Oaks Hotel in San Antonio, Tex. **Contact:** Earl G. Blum, 4151 Stathmore, San Antonio, TX 78217. Phone: (512) 655-7030.

77th Troop Carrier Squadron
Veterans of the 77th Troop Carrier Squadron, 435th Troop Carrier Group (World War II), are planning to hold a reunion October 15–17, 1992, in St. Louis, Mo. **Contact:** Marion F. Busiere, 202 Division Dr., Collinsville, IL 62234. Phone: (618) 344-1590.

95th Bomb Wing
Veterans of the 95th Bomb Wing (B-52 era) will hold a reunion in October 1992 in El Paso, Tex. **Contact:** Alan Mossien, 1801 Ski Slope Crescent, Virginia Beach, VA 23456. Phone: (804) 468-4811.

311th Fighter Squadron
Veterans of the 311th Fighter Squadron (World War II) and the 311th Fighter-Bomber Squadron (Korea) will hold a reunion June 11–14, 1992, in Colorado Springs, Colo. **Contact:** E. R. James, 13083 Ferntrails Ln., St. Louis, MO 63141. Phone: (314) 878-5953.

330th Bomb Squadron
The 330th Bomb Squadron, 93d Bomb Wing, will hold a reunion June 19–21, 1992, at Castle AFB, Calif. **Contact:** Mike Bogna, 525 Baker Ct., Atwater, CA 95301. Phone: (209) 358-1051.

388th Bomb Group
The 388th Bomb Group and support units will return to England July 1–9, 1992. A Stateside reunion will be held September 21–27, 1992, in St. Louis, Mo. **Contacts:** Tamarac Travel, 5100 W. Commercial Blvd., Tamarac, FL 33319-2897. Phone: (800) 228-9690 (England). Edward J. Huntzinger, 1925 S. E. 37th St., Cape Coral, FL 33904-5076. Phone: (813) 542-4807 (St. Louis).

414th Bomb Squadron
Veterans of the 414th Bomb Squadron, 97th Bomb Group, will hold a reunion August 24–26, 1992, in Cedar Rapids, Iowa. **Contact:** Charles A. Merlo, 7335 Neckel, Dearborn, MI 48126.

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.

431st Test/Evaluation Squadron
The 431st Test and Evaluation Squadron ("The Red Devils") will hold a reunion the weekend of May 9, 1992. All former squadron members are welcome. **Contact:** Capt. Patrick M. Shaw, USAF, PSC Box 267, McClellan AFB, CA 95652.

506th Fighter Group
Veterans of the 506th Fighter Group (World War II) will hold a reunion April 5–8, 1992, at the Hacienda Resort Hotel in Las Vegas, Nev. **Contact:** J. J. Grant, 500 Palm Springs Blvd., Indian Harbor Beach, FL 32937. Phone: (407) 777-7660.

AFTAC Alumni
Seeking former members of the Air Force Technical Applications Center for a reunion May 1–2, 1992, in Cocoa Beach, Fla. **Contact:** AFTAC Alumni Reunion Committee, P. O. Box 0892, Patrick AFB, FL 32925-0892.

Tactical Recon Ass'n
We would like to hear from tactical (photo/weather) reconnaissance personnel who would be interested in attending our reunion September 30–October 4, 1992, in Sacramento, Calif. **Contact:** Tactical Reconnaissance Association, 2706 Edgewater Dr., Niceville, FL 32578.

32d/38th Tactical Recon Squadrons
For the purpose of planning a reunion, I am seeking contact with former members of the 32d and 38th Tactical Reconnaissance Squadrons who served at Phalsbourg AB, France, between 1957 and 1960. **Contact:** John Levanen, P. O. Box 94142, Washington, MI 48094. Phone: (313) 781-5113.

Class 44-C
For the purpose of planning a fiftieth-anniversary reunion, we are seeking contact with members of aviation cadet Class 44-C who attended Spartan School of Aeronautics in Tulsa, Okla., between September and November 1943. **Contacts:** Milo Balhorn, 223 Letsch Rd., Waterloo, IA 50701. Phone: (319) 233-8645. Oscar Bushwar, 1122 W. Northgate Dr., Irving, TX 75062. Phone: (214) 255-1742. ■

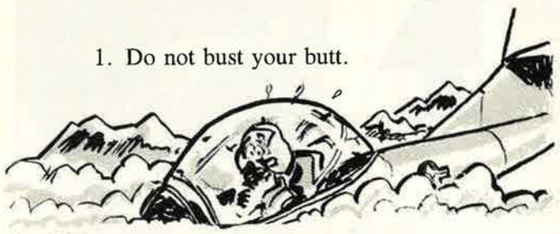
Bob Stevens'

"There I was..."

The origin of these pearls of wisdom is lost in antiquity, yet the message is as current as today's TV news. These rules rate with the ode "Why I Want to be a Pilot" as an aviation classic. Rule 3 is as old as Icarus – 5 through 9 came after blind flight and aircraft accident boards.

TEN RULES OF AVIATION

1. Do not bust your butt.



2. Do not let anyone else bust your butt for you.

3. Remember – the pilot is always the first to arrive at the scene of the accident.

4. When in doubt – get out!

5. In instrument flying, one peek at the ground is worth a thousand cross checks.

6. It's the same with thunderstorms and ice as it is with being pregnant – there is no such thing as 'just a little.'

7. Remember, airplanes fly because of Bernoulli, not Marconi (*e.g.*, don't drop the aircraft to fly the mike).

8. If a crash is inevitable, hit the softest, cheapest thing you can find, as slowly as possible.

9. What you don't say you don't have to take back at the board hearing.

10. Don't forget rule one!

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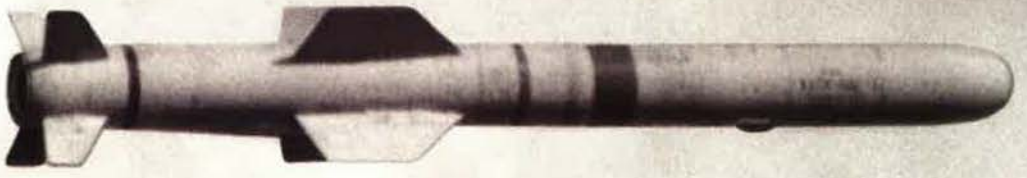

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