MARCH 1990/$5

AIR FORCE MAGAZINE

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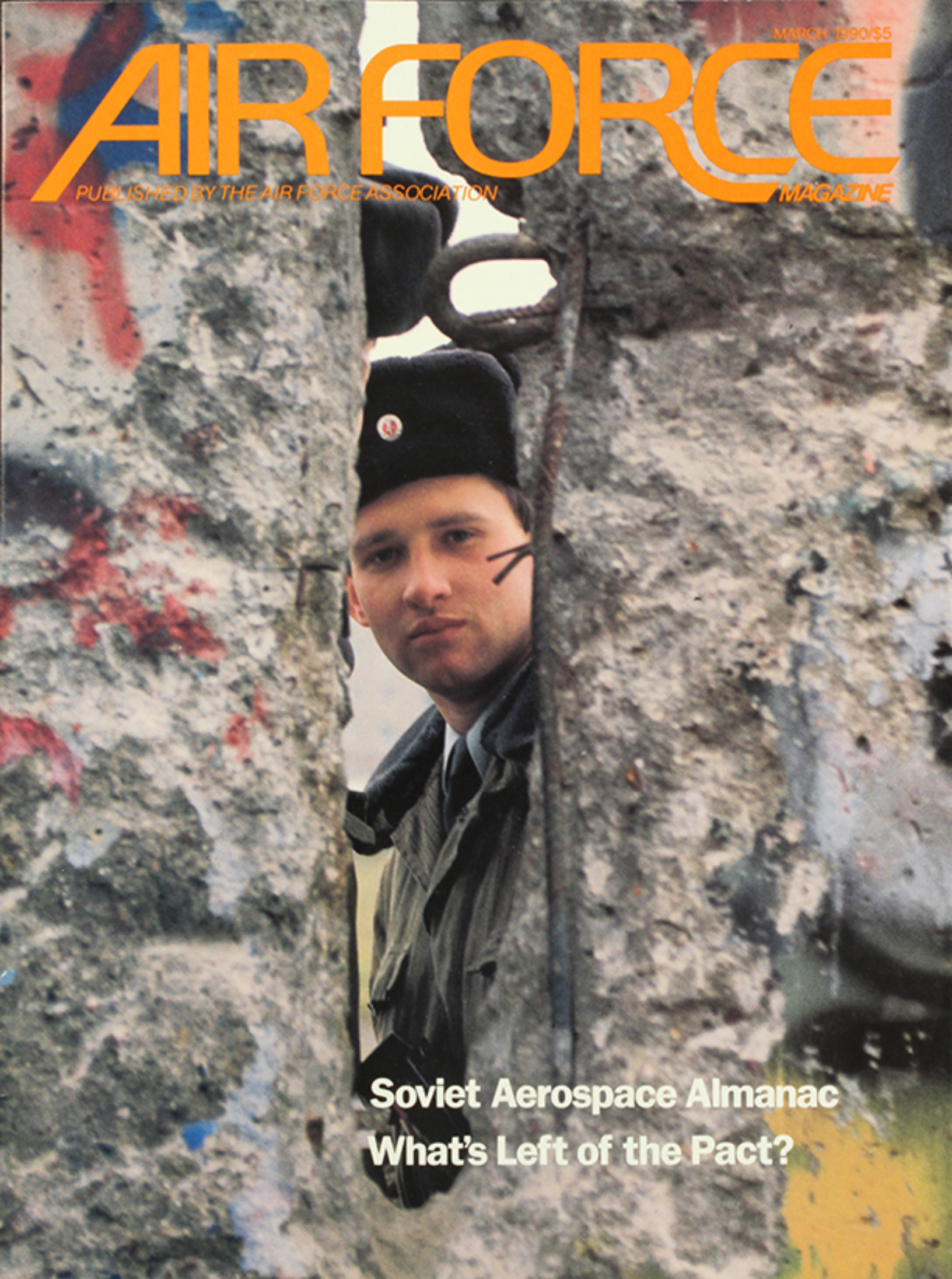

Soviet Aerospace Almanac

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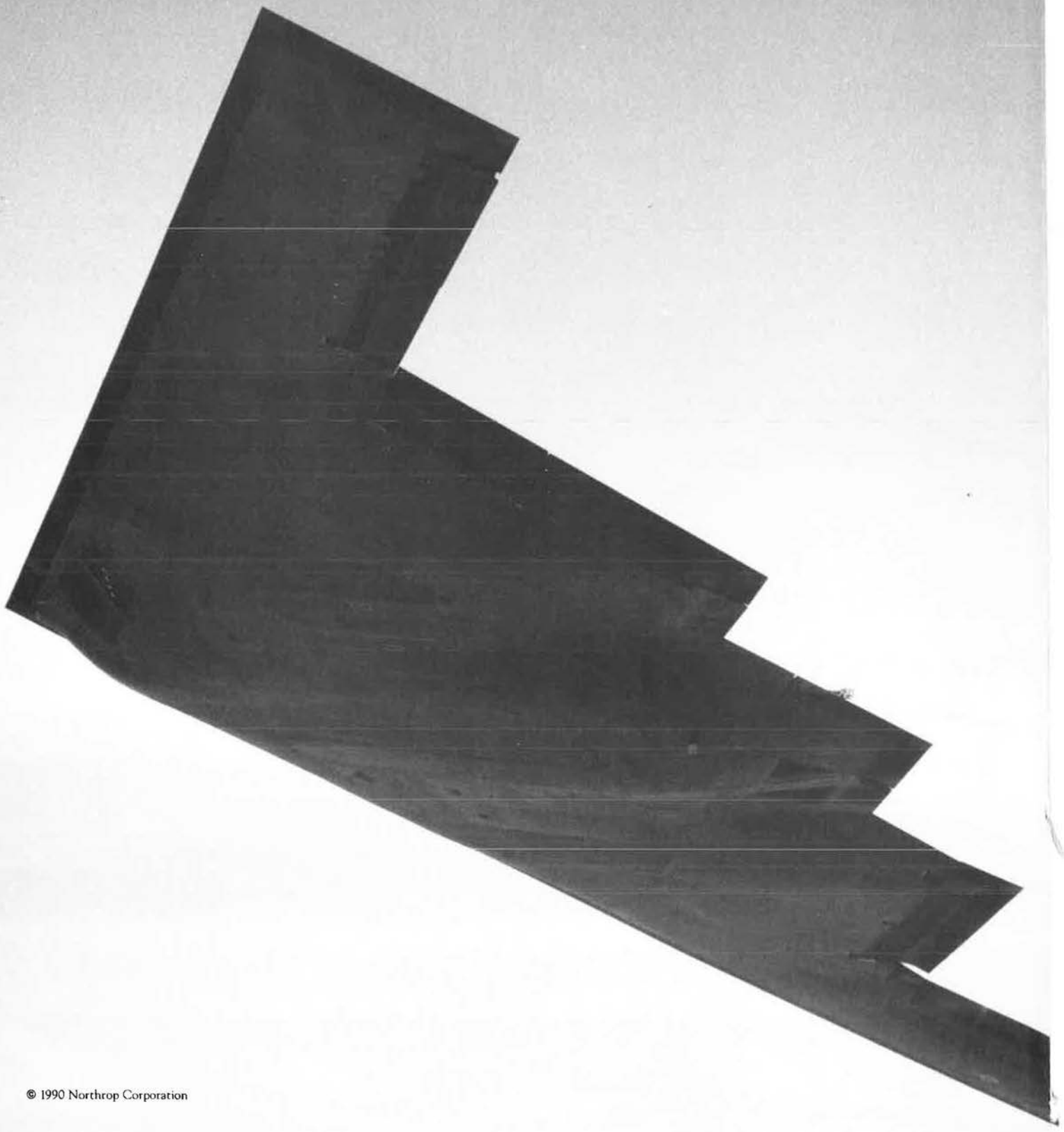

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VOLUME 73, NUMBER 3

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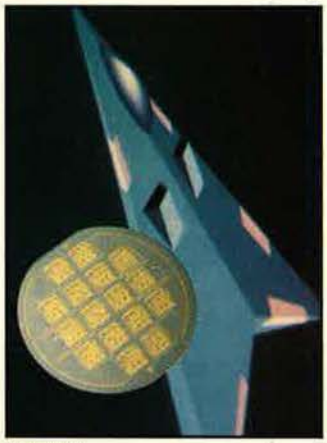

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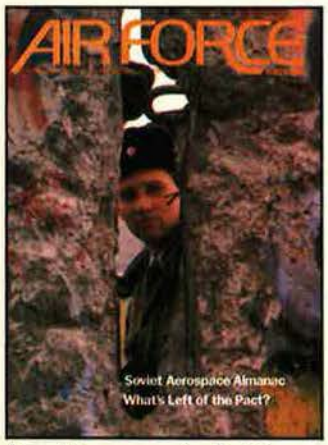

About the cover: An East German border guard peers toward the west through a crack in the Berlin Wall. The cracked wall is symbolic of the widening rifts in the Warsaw Pact and uncertainty over what will follow. Cover photo copyright Ken Sakamoto/ Black Star.

The East in Turmoil

Departments

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Editorial

By John T. Correll, Editor in Chief

The $64 Billion Question

In 1986, Democrats in Congress pronounced Ronald Reagan's defense spending proposal "DOA"—Dead on Arrival. The cutting and rearranging seemed severe at the time, but back then, standards for measuring severity were different. Compared to the 1991 defense budget presented on January 29, that DOA program in 1986 was a picture of health. If the congressional attack this year turns out to be as radical as the speechmaking suggests, defense could sink to uncharted depths.

From the perspective of the defense community, the budget proposal is harsh. It abolishes weapons and force structure by the wholesale lot. Adjusted for inflation and other economic factors, it provides $22.4 billion less in 1991 for defense than did the previous forecast—itself down considerably from earlier projections—issued last April. It takes another $167 billion out of the Five-Year Defense Plan. On top of earlier reductions, that amounts to $231 billion cut from the FYDP in the past twelve months.

By the end of Fiscal Year 1991, the Pentagon says, active-duty US military strength will fall back to where it was in 1980. Army and Air Force troop levels will be at their lowest since 1950.

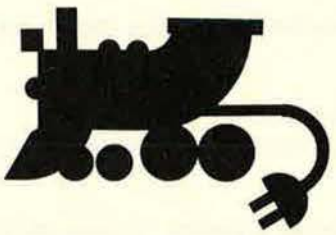
As seen by others—including some strong-minded members of Congress—the reductions are timid. A new arms-control offer, announced by President Bush in his State of the Union address, would bring 80,000 US troops home from Europe. That, too, was promptly derided as insufficient.

The stampede to cut defense is driven by two main sources of excitement. One, of course, is the revolution under way in the Soviet Union and eastern Europe. The other is a scramble over shares of the federal budget.

The ceiling set by the Gramm-Rudman-Hollings Act for the 1991 deficit is $64 billion. Even with bogus numbers and voodoo accounting, the government had great difficulty with the $100 billion ceiling for 1990. This year's goal is harder. If the regular process does not bring the deficit within $10 billion (the tolerance allowed) of $64 billion by October 15, Gramm-Rudman will allocate reductions automatically by predesigned formula.

The politicians are desperate for a "peace dividend" as leverage on the deficit. Sen. Jim Sasser (D-Tenn.), Chairman of the Senate Budget Committee, complains that the peace dividend from the 1991 defense budget is a "mere fraction" of what "we'll need to hit next year's deficit target under Gramm-Rudman."

From reducing the deficit to electrifying the railroads, everybody has an idea on how to spend the elusive peace dividend.



It is not simply the Pentagon that Congress must fight to get more deficit-reduction money. Citizens, conditioned to blame defense for hogging all the money, now believe there is to be a windfall, and they are lining up to spend some of it.

Seymour Melman, writing in the New York *Times* on behalf of the National Commission for Economic Conversion and Disarmament, lays out a program to use an envisioned peace dividend of $165 billion. Housing and education get $30 billion each. There is $10 billion to electrify the US rail system, and so on. In making his pitch, Mr. Melman repeats the old fiction that "half of all federal tax dollars go to the Pentagon."

It would be instructive for Mr. Melman to check the official *Budget of the United States Government.* From this six-pound document, he will discover that while defense did account for 50.8 percent of the outlays in 1961, its share today is 24.8 percent. By contrast, an aggregate of social and benefit programs that the budget groups as the "Human Resources Superfunction" has progressed from 30.5 percent of outlays in 1961 to 51.5 percent in 1990, rising to 56.0 percent by 1995.

On the present track—even with the reductions being so timid—defense outlays will be just 21.6 percent of the total by 1995. The 1991 proposal is for a 2.3 percent decrease, after inflation, in defense budget authority.

That has implications, both for Mr. Melman's plan to electrify the railroads and for deficit reduction. As Tom Kenworthy observes in the Washington *Post,* the Gramm-Rudman calculus has changed. The law is no longer the handy tool it once was for squeezing the Pentagon. Half of any automatic cuts still come from defense, which spends about a fourth of the money. The kicker is that cuts are from a "baseline"—last year's level of outlays, plus inflation.

The defense budget is already about $5 billion below its baseline. Automatic cuts might not take it much further down than the level Congress is likely to approve anyway. Some of the pressure from a budgetary impasse would, therefore, shift to domestic programs.

Defense will almost certainly be cut further, not because it's good strategy or because the Pentagon has hogged an ever-growing share of the resources, but because this budget is a movable object in the path of an irresistible force.

The government is confronted here by two tasks. It must resolve the federal deficit and also plan an adequate defense program for uncertain and changing times. Neither objective is well served by emotional or impulsive decisions. Those who insist on seeing an unlimited peace dividend at the end of the rainbow are not helping us reach any responsible solutions. ■

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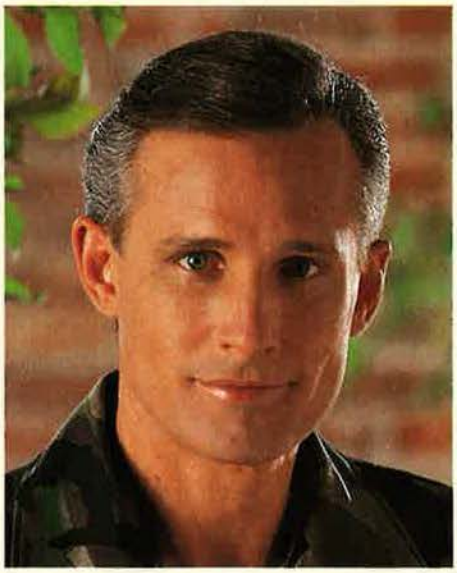

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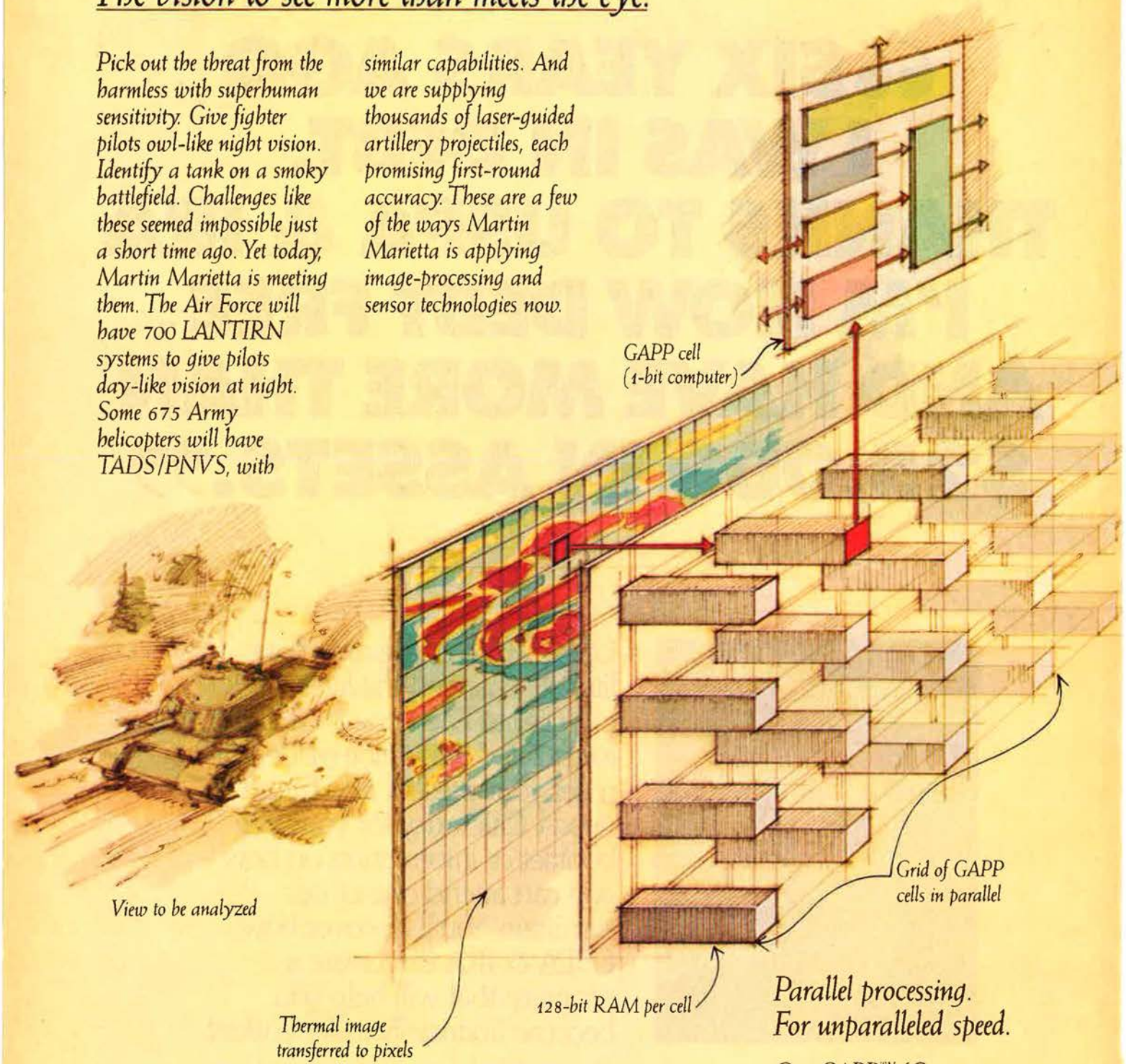

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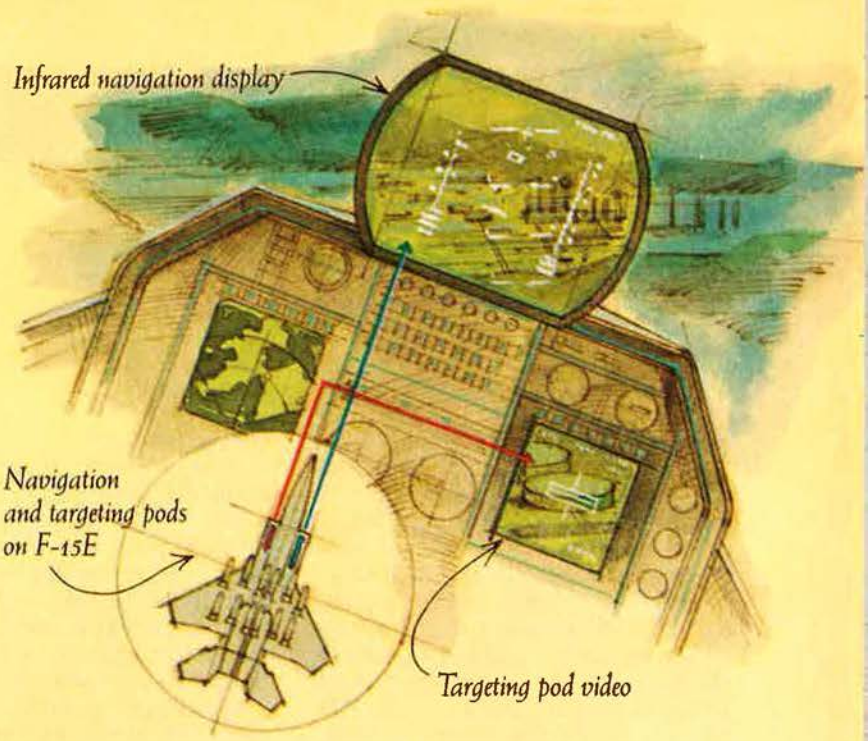

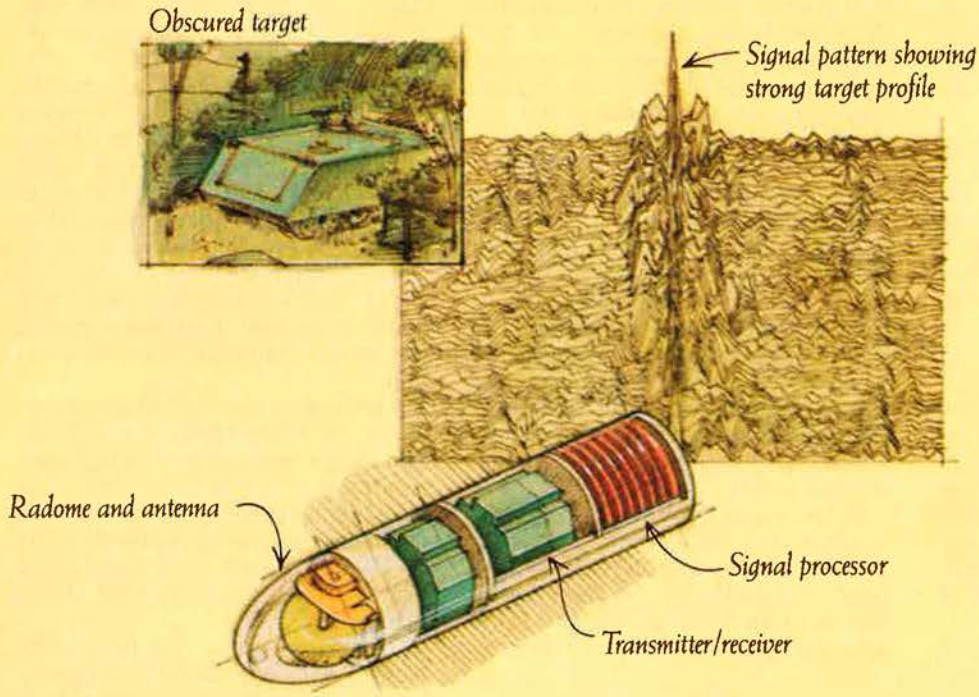

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Letters

Acquired Weapons

With regard to MSgt. James B. Walker's letter, "Guns and Medals" *[see "Letters," January issue, p. 10]*, in which he claims that that author John Frisbee misidentified "Mac the FAC's" weapon as an M1, I wouldn't bet against a FAC [forward air control] pilot having an M1 Garand aboard in 1965 or in 1970. I was the base ground weapons training officer in the 31st Security Police Squadron, Tuy Hoa, Vietnam, from September 1968 to September 1969. Even that quiet base and time had plenty of examples of acquired (as opposed to issued) obsolete American and foreign weapons. MACV (Military Assistance Command, Vietnam) issued bulletins, which were not religiously followed, on the risks of firing captured weapons and ammunition.

There were instances of the enemy substituting dynamite for powder in rounds of ammo. American obsolete weapons, like the M1, fired ammo available in the supply system. Their only drawbacks were faulty clips that held the ammo for auto loading in the weapon. As an auxiliary piece for those who weren't walking, it was an "in" thing. Our duty officers added it to their .38-caliber revolver, twelve-gauge shotgun, M16, [and various other weapons]. The jeep didn't care which weapon was fired, as a horse would have in earlier days. Shotguns were useful around aircraft (it was believed) to minimize collateral damage, but stray dogs suffered most of the collateral damage.

Obsolete weapons in the acquired category had another advantage (besides the M1's penetrating power). They could be lost or traded without paperwork. O-1s' and O-2s' STOL capability put some good trading posts within their available roster of recovery bases. Trading wasn't necessary for the cops. We had amnesty boxes near departure terminals for the grunts with the illegal stuff, which produced a harvest Sergeant Walker would have to have seen to believe.

Lt. Col. R. C. Brenzel, USAF (Ret.)
Louisville, Ky.

On the Ice Cap

Concerning your article "Arctic Sentinels" *[see December 1989 issue, p. 94]*, I have two comments. First, Lieutenant Sorenson is most deserving of recognition for her help in getting Christmas trees to Thule. I know how much that added holiday cheer means to our people at Thule who are unable to be home for the holidays.

My second point, however, concerns the wrong impression author Gierlich makes with his statement: "The Danes . . . keep apart from the Americans on base." During my year as Commander of Thule AB (1987–88), I [witnessed] very close working relationships between American and Danish personnel. One need only visit the base gym, hobby shop, recreation center, or consolidated club to realize that numerous activities exist that involve both Americans and Danes. I find it difficult to believe that Mr. Gierlich came away with this seemingly negative perception. More importantly, it is unfortunate that your readers might receive the wrong impression from . . . [his] statement.

To underscore the commitment to international relations, Danish Liaison Officer Cmdr. Erik Thomsen and Danish Contractor Site Manager Rasmus Lau work closely with US personnel to help ensure open and positive communication.

During my year at Thule, the morale among all "Thule-ites" was very positive, and there is no reason to believe it has changed. Despite the fact that most Air Force people stay for a one-year tour, it is not uncommon to find lasting friendships. To make the statement that the two nationalities "keep apart" and to note that "some anti-American sentiment" exists leads me to believe the author was, perhaps, blinded by Thule's winter darkness. I hope that he can visit Thule again soon and catch the real spirit of a unique place with very special people.

Col. Bill Pine, USAF
USAF Academy, Colo.

It would appear that Mr. Gierlich did not have a very good time during his visit to Thule AB. Although his facts about the base are essentially correct, I feel he left the site with a rather poor impression of the people and conditions.

Things may have changed since my tour, but at that time the vast majority of the USAF personnel there did not see the base as "a vision of Hell frozen over." In fact, during summer, when there is daylight, Thule offers some of the most spectacular sights on earth. Granted, there are nicer places in the world to serve. However, it was often commented that there were quite a few worse places to spend a short tour.

Additionally, we had three scheduled C-141s from McGuire AFB, N. J., every week [rather than one per week as stated in the article]. This may seem a small point to argue, but when the harbor is iced over and airlift is the only link to the rest of the world, three planes of mail a week is much better than one.

I must also note that the author missed two special units that also serve "on top of the world." The "Host Base Support Unit" in his organizational lineup is in fact the 1012th Air Base Group, which has the largest population of "blue-suiters" on site. Furthermore, he neglected to name the 1983d Communications Squadron (AFCC), the unit I was proud to command during my tour. As these units directly support 12th Missile Warning Squadron and Det. 3, 2d Satellite Tracking Group, their contributions deserve equal credit.

On the subject of Danish-American

Do you have a comment about a current issue? Write to "Letters," AIR FORCE Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Letters should be concise, timely, and preferably typed. We are sorry we cannot acknowledge receipt of letters. We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Photographs cannot be used or returned.—THE EDITORS

relations, I can say that they were tremendous and I witnessed no "barriers" to closer relations and very little anti-American sentiment. One would be naïve to expect completely harmonious relations in today's world.

If I were called on to pull another short tour, I would not hesitate to return to Thule AB. The camaraderie of the USAF members and the friendliness of the Danish and American contractors made it much easier to be away from home.

Maj. Jim Robilotta,
USAF
Las Vegas, Nev.

CAP and Pre-Eagles

Two items in the January 1990 issue particularly sparked my interest: 1st Lt. David Albanese, CAP, wrote an interesting letter concerning Civil Air Patrol's veteran role in the volunteer advancement of the Air Force mission *[see "Letters," p. 13]*. What he did not mention is that CAP flies more than eighty percent of the Air Force search-and-rescue hours in the continental US and is almost always the first organization mobilized to locate downed aircraft, either civilian or military, under directions from Scott AFB, Ill. CAP is always interested in new volunteers, and there are active squadrons all over the US.

Second, I was delighted to read David Johnson's "Pre-Eagles" piece on p. 92, because it shed some light on gray areas of my own studies of the original Number 71 Eagle Squadron of the Royal Air Force. Of those early pilots mentioned, Pilot Officer P. H. Leckrone transferred from 616 Squadron and was killed in action. Similar fates awaited Flight Lt. Andy Mamedoff, Pilot Officer V. C. "Shorty" Keough, and Pilot Officer E. Q. "Red" Tobin of 609 Squadron after their transfers to the Eagles.

One of the nicknames Mr. Pierson mentions but does not further identify is well-known to me: that of Flight Lt. Sam Alfred "Uncle Sam" Mauriello, holder of the Distinguished Flying Cross. Born in 1908 in New York, Sam came to the Eagles in 1940 by "the Canadian Route" from Binghamton, N. Y., where he had tried without success to enlist in the US Army Air Corps. His interesting biography, along with dozens of others, is detailed in a 1943 work by James Saxon Childers, *Eagle Squadron.* Probably long out of print, this book, published by Appleton-Century of New York and London, remains one of the most prized volumes on my own aviation bookshelf.

"Uncle Sam" Mauriello came home as a lieutenant colonel in the Army Air Forces and taught me to fly from the same field (Tri-Cities Airport in Endicott, N. Y.) that he had abandoned for the Eagle Squadron seven years before. Sam lost his life while practicing for a local air show in August 1950. (In fact, it was determined he had suffered a massive heart attack while aloft, and his Stearman found the ground on its own.) The Eagle had landed at last.

Capt. Lloyd A. Stevens,
CAP
Redondo Beach, Calif.

War and Peace

Kudos for your editorial, "The Peace to End All Wars" *[see January 1990 issue, p. 6]*. I think it brought to light what is certain to be the next fad of our highly publicized "think tanks" and the national media—defense-bashing. Everyone will come up with a myriad of ways to "trim the fat" from defense spending so they can transfer funds to their own pet programs.

Amazing as it may seem, the Air Force took a bold step a few years back and put together a diverse group of the service's mavericks from around the world under the guise of the Air Force Innovation Task Force. Members of the group were supposed to purge their minds of parochial and conventional thinking and look at all aspects of issues affecting the Air Force well into the next century. The group considered a number of different world structures, ranging from a bipolar world similar to the US-USSR superpower scenario to total anarchy around the globe. Included in this assessment were the possibilities of terrorist groups posing heightened threats, dominance of paramilitary forces under the control of cartels or multinational corporations, and a world where the Soviet threat was greatly diminished. Sound familiar?

Although many of the task force's conclusions and recommendations were so untraditional and nonparochial that they were beyond the comprehension of entrenched bureaucrats, the bottom line of their assessments was that a substantial military presence would be necessary well into the next century to deal with the wide spectrum of diverse threats to our country. Just because the East Bloc changes color does not mean that the long-range threat to our citizens diminishes appreciably, except in the minds of idealistic reporters and congressmen who want to believe that there will be no more wars. Centuries of history conclusively prove otherwise.

Now, more than ever, we need to maintain a strong, highly flexible defense establishment capable of global projection from the continental United States. We should not succumb to the "do more with less" and "leaner is meaner" hype to the point where our troops in the trenches find themselves trying to "do everything with nothing."

Lt. Col. James V. Kelso III,
USAF (Ret.)
Peachtree City, Ga.

I would like to comment on your incisive editorial, "The Peace to End All Wars."

Over the past five years, debilitating federal budget deficits have forced a fourteen percent reduction in [the US government's] inflation-adjusted defense spending. With even greater defense cuts a political and economic certainty, it has long been obvious that if the US is to sustain sufficient equipment, personnel, and training to protect our national security interests, the inordinate proportion of our defense budget that is spent on overseas troop deployments would have to be curtailed.

Ironically, this necessary reallocation of defense resources must be accomplished in a period of Western euphoria over Gorbachev's "tentative" *perestroika*. This circumstance obscures highly dangerous East Bloc instabilities that at some point will erupt into internal bloodshed when Soviet-led security forces are called on to brutally define the limits of communism's ideological retreat. Beyond question, a combination of factors accentuates the urgency for a determined commitment to making the near-term deployment of a US strategic defense a national priority.

While it is clear that the probability of a Soviet assault on western Europe that leapfrogs its fractured eastern European allies is rapidly diminishing, the salvaging of the Communist power base through *perestroika* cannot be achieved without access to "extensive" resources that can generate the necessary foreign exchange to sustain the massive Soviet military establishment (which continues its modernization unabated) and Communist Party infrastructure during what is certain to be an agonizing transition. . . .

To moderate our euphoric rush to decimate our own defense assets and accommodate communism's intensive-care recovery, hopefully there will evolve a sense of prudence that slows the pace of disproportionate disarmament and, as well, articulates a budgetarily constrained military restructuring that will enable us to meet

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Letters

an inevitable Soviet challenge in the Persian Gulf—and elsewhere.

Greg Neubeck
Lynnhaven, Fla.

In recent issues of AIR FORCE Magazine, you bleakly report about possible cuts in defense spending. I would offer the opposite point of view. I would welcome [the prospect of] possible spending cuts. As Americans, we must encourage the kind of change we have recently witnessed in eastern Europe. I trust that the President, Congress, and leaders of the Air Force appreciate the kind of political "heat" Mr. Gorbachev must be weathering at home. As formidable as the Soviet threat is, ask any of our operational commanders whether they would like to trade forces with the Warsaw Pact. My point is, our own forces are better.

Furthermore, I think the Soviets recognize them to be better, and any further perceived shift in the balance of power toward our side may force the Kremlin to undo all that has been done. We have the means to unilaterally make military concessions without selling the farm. In my opinion, a two percent real decrease in defense spending, given the recent world events, is better news than a two percent real growth would be. We must show Mr. Gorbachev's critics that we support his actions through our deeds, not rhetoric. Such deeds can come in many forms: force reductions in Europe, overall defense cuts, or even a temporary freeze in strategic modernization. Even more significant changes than those resulting from World Wars I and II now seem possible, without the anguish of a war. But we must "seize the moment." I am extremely worried that unless we quickly and fervently jump on the bandwagon started by Mr. Gorbachev, the momentum will stop and the world will stay on the same old story: mutual assured destruction. I am troubled that the single most influential voice of the Air Force fighting man doesn't share my emotion and sense of destiny.

Capt. James A. Jimenez, USAF
Eglin AFB, Fla.

There He Was

As a longtime member of the AFA, I have been a fan of Bob Stevens for many years; however, reading the December 1989 "There I Was . . ." was a special treat, since I was the PWSO (Pilot Weapons System Officer) featured in that issue. For your information, the mishap occurred at Takhli RTAFB on February 21, 1973, in F-111A Serial Number 67-071, nicknamed "Jessica," with twenty-four Mk 82 bombs and 30,000 pounds of JP-4.

Capt. Chuck Sudberry, the aircraft commander, and I were on takeoff roll at 1:30 a.m., when a bolt supporting the right main landing gear sheared as we accelerated past approximately 140 KIAS (knots indicated airspeed). Too slow to continue the takeoff, we aborted and quickly departed the right side of the runway, where we hit a 1,000-foot-remaining marker. This marker ruptured the fuel tank and caused the aircraft to catch fire. We skidded for another 3,000 feet and spun around before stopping. Then, as Mr. Stevens's strip shows, we wasted no time getting out of the aircraft and were quickly picked up by three security police in an armored personnel carrier. (Contrary to popular belief, I was only able to outrun the APC for about a half mile, being slowed considerably by the flight gear and survival vest.) My heartfelt thanks goes out to the SPs who drove dangerously close to the burning aircraft to rescue us.

Captain Sudberry and I both separated from active duty in 1975. In 1979 I returned to active duty. I've now logged more than 2,600 hours in the F-111 and EF-111. Although I have had many exciting times throughout my career, no sortie has been more memorable than that night in Takhli. My thanks to Roger Peterson for submitting the incident and to Bob Stevens and AIR FORCE Magazine for printing it.

Maj. Eric R. Puschmann, USAF
Sembach, West Germany

A Slap in the Face

Without question, an Aerospace World "Milestone" in your September 1989 issue *[see p. 47]* must have felt like a sharp slap to the face of all the female flight-test engineers who have graduated from the USAF Test Pilot School over the years. Captain Parker was simply the first female *pilot* to graduate; she was not the first female graduate. There are many, very capable, female flight-test engineers out there who have done very well on this same course and gone on to greater accomplishments—without your recognition. This latest incident must seem like a progression from insult to injury. . . .

Bruce Robinson
Cold Lake, Alberta
Canada

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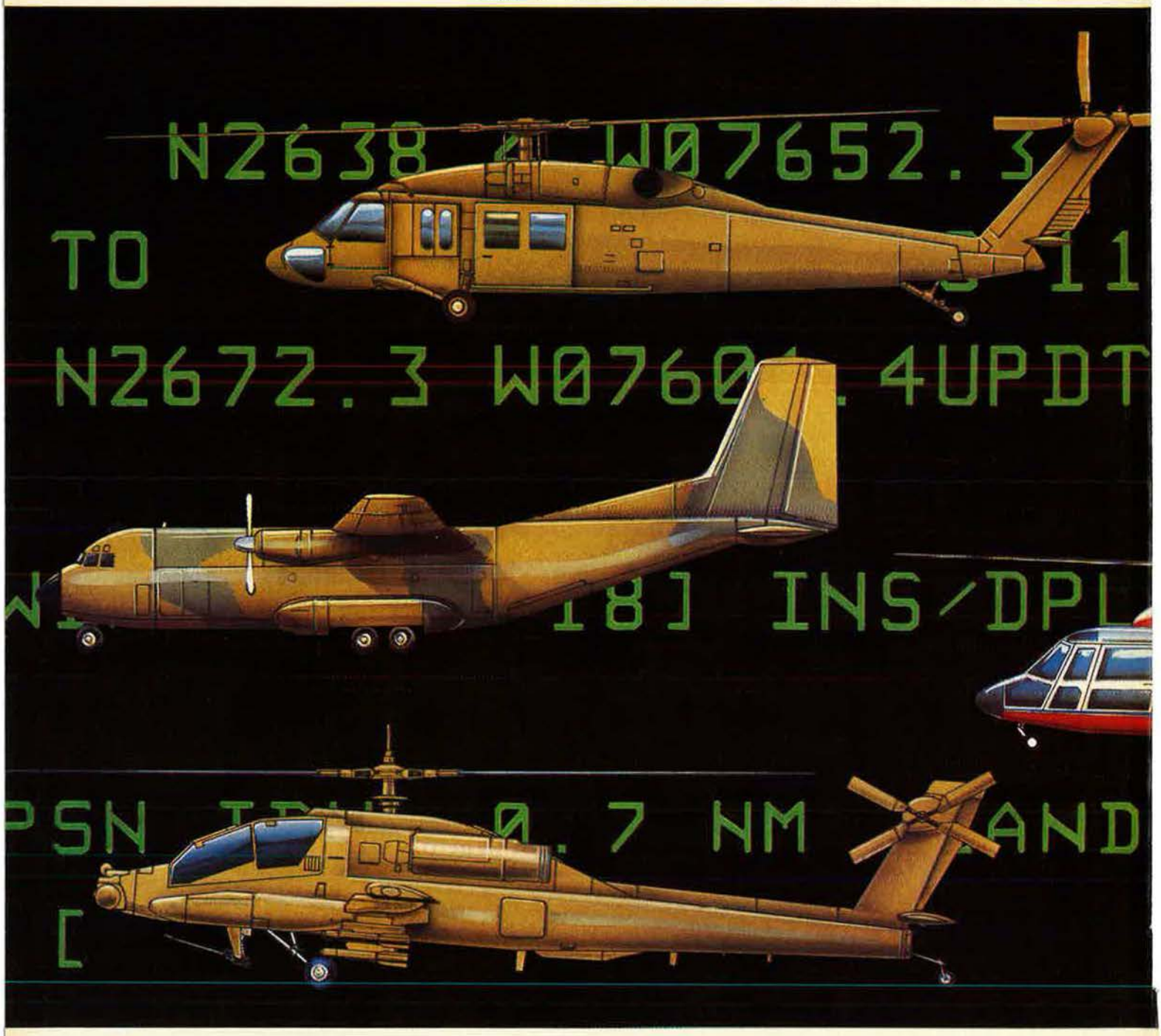

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Washington Watch

By John T. Correll, Editor in Chief

Streamlining With a Splash

On White House orders, the services plunged all the way into procurement reform. The systems commands are left with support roles, and an acquisition corps is in charge of programs.

Washington, D. C. For nearly four years after the Packard Commission report on defense management in 1986, the military departments had danced around the edges of its prescription for procurement reform. Then the Bush Administration, concluding that the services would never wade in very far on their own, decided to push. The splash came on January 11, when Secretary of Defense Dick Cheney announced the plan by which the Pentagon will now "fully implement" the Packard reforms.

The plan, presented as the "Defense Management Report," contains few real surprises. It follows the outline of Mr. Cheney's Defense Management "Review," published last July. However DMR spells out, it sweeps away the traditional command hierarchies in a wave of reorganization and reduction and replaces them with a radically streamlined business-style structure for acquiring weapon systems.

The services realized for months the general nature of what was coming. Consequently, they took it in stride and pledged their cooperation to make the new system work.

In truth, the Packard proposals have had some support in the military departments all along, and the reluctance that did exist had little to do with the substance of systems acquisition. Most officials who understood the process were in reasonable accord with Packard on the principles of how systems ought to be planned, budgeted, and procured. The sticking point was organization.

In Packard's view, program managers were severely hampered by an organizational overburden. The Commission felt it essential to purge the process of "never-ending bureaucratic obligations for making reports and gaining approvals." With fewer bosses, less red tape, and shorter reporting chains, program managers would supposedly have the flexibility to operate more like managers in private industry.

The services concentrated their reform energies on acquisition strategies, contractor performance assessments, source selection, and other initiatives bearing directly on the acquisition process. They made organizational changes, too, but not nearly enough to satisfy the critics. They never had much luck selling the idea that they had followed the spirit—if not the letter—of the Packard Commission reforms.

The quibbling came to an abrupt end with the DMR, which put into effect virtually every organizational suggestion offered by the Packard Commission. To the disappointment of some critics, the big military systems and materiel commands were not killed outright, although they have been stripped down to support and housekeeping roles. Their major missions of acquisition and program management were turned over to a specialized corps of experts, accountable only to a streamlined chain of command headed by a powerful Under Secretary of Defense for Acquisition.

The reorganization will bring savings of $39 billion and a personnel reduction of 42,000 over five years, but Mr. Cheney said that "the goal of the Defense Management Report is not simply to cut the budget. The changes we're making should lead to a more efficient system that can run with fewer people and greater accountability, and that will result in a system that costs less to operate."

The Pentagon said in a news release that "these efficiency-related [personnel] reductions do not include force structure reductions associated with the FY 1991 budget."

The Defense Department will make a "concerted effort" to handle the personnel reductions through attrition and relocation. "We are not planning to lay people off," said Deputy Secretary of Defense Donald Atwood, explaining that normal attrition over the five-year period should be about fifty percent higher than the reduction to be absorbed.

For its part, the Air Force expects to cut back by a net of 18,852 people as a result of DMR actions between 1991 and 1995. After adjusting for the conversion of about 9,000 military billets to civilian billets, that works out to a reduction of 13,463 military members and 5,389 civilians.

"As a general matter, we believe that all of these changes can be carried out through attrition, early retirement programs, and other voluntary moves of that sort," said Secretary of the Air Force Donald Rice. "We believe we can do it all without RIFs [reductions in force]."

In a session with reporters, Secretary Rice acknowledged that the Air Force is taking a proportionately large personnel cut but said the numbers were based on what the service itself felt it could achieve by streamlining and other efficiencies.

Secretary Rice said the Air Force will save $10.9 billion between 1991 and 1995 by this exercise. Most of that is the result of changes in acquisition and logistics, but about $1.7 billion comes from economies in operations and training. The Air Force, Secretary Rice said, chose "to apply the spirit and philosophy of DMR across the board."

The Pentagon said the DMR reform program was designed to achieve six broad goals: reduce overhead costs while maintaining military strength, enhance weapon system performance, reinvigorate the planning and budgeting process, reduce micromanagement, strengthen the defense industrial base, and improve observance of ethical standards in government and industry.

Under the new arrangement, managers of system programs designated as "major" report directly to a "Pro-

gram Executive Officer," or PEO, who in turn reports to the acquisition executive for that service. This three-tiered management structure was a leading objective, almost an obsession, for the reformers.

"Non-major" programs will be managed by the acquisition commands, but on program matters, the commanders become part-time PEOs and report to the acquisition executive.

"The military departments have developed plans to create dedicated corps of officers who will make acquisition a full-time career," the DMR said.

"They will be provided specialized education and training, attractive and equitable career paths, and opportunities for promotion to the highest ranks. Among actions to improve the civilian work force will be efforts to enhance recruitment and retention, provide career-related education and professional rewards, and increase professionalism within the acquisition-related fields."

The Under Secretary of Defense for Acquisition, John A. Betti, is vested, apparently, with the full clout of an "acquisition czar," something his two predecessors sought but never attained.

Acquisition executives report to their individual service secretaries, Mr. Betti said, but "I have the authority to direct the service secretaries in any acquisition matter. . . . I have the right to go into the system to review any acquisition program, any acquisition strategy, any acquisition decision I care to."

The Air Force will have six PEOs—five general officers and one Senior Executive Service civilian—answerable to the Assistant Secretary of the Air Force for Acquisition, John J. Welch, Jr., who serves as the USAF acquisition executive. The manager of one superprogram, the B-2 bomber, reports directly to Mr. Welch without going through a PEO.

At the Air Force Competition Conference on January 18, Mr. Welch said that the number of programs designated as major by the Air Force would be "in the high thirties or low forties," and that the defense-wide total of major programs would probably be in the range of 100. This would leave hundreds of programs outside the PEO structure, to be managed by the acquisition commands.

The program manager-PEO-acquisition executive chain will be free from lateral interference. "No one else in the whole Air Force hierarchy has any authority to cut into that chain," Secretary Rice said. "If there is anything to be raised about the programs, it has to come up to the Chief [of Staff] and myself, and we work with the service acquisition executive. If there's a change to be made, it has to go back down through that chain."

According to Air Force News Service, Systems and Logistics Command headquarters "will now be focusing on providing support functions such as testing, laboratories, contracting, and personnel management required for acquisition programs."

Secretary Rice said that the Air Force PEOs would have "relatively small" staffs. Eventually, if not initially, they will operate from Washington, D. C., locations. Each will oversee a portfolio of programs, the major ones divided as follows:

- *The Strategic PEO.* B-1 bomber, Peacekeeper and Midgetman ICBMs, the Advanced Cruise Missile, and the tactical variant of the Short-Range Attack Missile, SRAM-T. (The manager of the B-2 bomber program reports directly to the USAF acquisition executive.)
- *The Information Systems PEO.* Depot Maintenance Management Information System (DMMIS), Logistics Management Systems (LMS), and Personnel Concepts III (PC-III).
- *The Tactical/Airlift PEO.* Advanced Tactical Fighter (ATF), F-15 and F-16 fighters, C-17 airlifter, and Mark XV combat identification system.
- *The Space PEO.* Space boosters, Milstar satellite communications, the Navstar Global Positioning System (GPS), the Defense Satellite Program (DSP), and the Defense Satellite Communications System (DSCS).
- *The Command Control and Communications PEO.* Joint Tactical Information Distribution System (JTIDS), Tri-Service Tactical Communications (TRI-TAC), and the E-3 Airborne Warning and Control System.
- *The Tactical Strike PEO.* The Joint Surveillance and Target Attack Radar System (Joint STARS), Advanced Medium-Range Air-to-Air Missile (AMRAAM), Sensor Fuzed Weapon (SFW), Tacit Rainbow loitering antiradiation missile, and Direct Airfield Attack Combined Munitions (DAACM).

Realignments in the other services are similar. In the Navy, seven PEOs report to the acquisition executive, who holds the newly created post of Assistant Secretary of the Navy for Research, Development, and Acquisition. Three program managers also report directly to this official. The Army's arrangement has twelve PEOs accountable to the Assistant Secretary of the Army for Research, Development, and Acquisition.

In a step that received almost universal applause, the Defense Management Report launched a broad attack on excessive regulation and paperwork. Better yet, Mr. Cheney was able to cite some progress.

A regulatory relief task force scanned more than 1,200 Defense Department directives and policy memos and determined that 512 affected acquisition. So far, it has reviewed 383 of these, and it recommends eliminating sixty-one, canceling or combining 176, and revising sixty-three. Only eighty-three are worth keeping in their present form.

The task force has further proposed canceling, combining, or revising sixty-four percent of the 431 contract clauses and seventy-nine percent of the 66,665 lines of text in the Defense Federal Acquisition Regulation Supplement (DFARS). The task force has questionnaires out, soliciting comment on more than 50,000 specifications, standards, and related documents.

Another group, the "Advocacy Reduction" task force, examined 148 DoD-level directives and instructions put out by "single-interest program advocates" and suggested canceling 104 of them. The "advocates" thus curbed are functional experts in such areas as transportation, packaging, and "metrification" who "can pose restrictions but who possess no integrating authority or responsibility for the program process," the DMR said.

"In an effort to reduce internal micromanagement, the Department will overhaul completely the system of acquisition directives and instructions," the DMR said. "A new streamlined set of documents is expected to be issued by July 1990."

Not all of the micromanagement is internal. Meeting with reporters, Mr. Cheney displayed a 136-page book that summarized the list of all the reports that he owes Congress in Fiscal 1990.

"You'll discover, for example, that the Department of Defense is required to conduct a study this year of the cost-effectiveness of the advance placement of Army helicopter pilot trainees from the University of North Dakota," Mr. Cheney said.

"I could go on. There are other examples. The point is that we're spending an awful lot of time and energy and resources doing work that has absolutely nothing to do with the safety and security of the United States."

The excess of oversight is not confined to paperwork. The DMR is also

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concerned about ham-handed procedures. Deputy Secretary Atwood described, for example, a case in which forty auditors were sent to jack up a thirty-member system design team.

Mr. Betti said he asked a program manager who was briefing the Defense Acquisition Board how many times he had presented that particular briefing after reporting that it was ready for the DAB. "He said eighty times, and that sounded just outlandish, so we audited him," Mr. Betti said. "He was wrong. It was only sixty-seven times."

Curious by then, Mr. Betti audited the history of six other DAB briefings, two from each of the services. The fewest times that any of them had been previewed by checker-uppers at lower levels was twenty-four.

Other reform actions forecast by the Defense Management Report included these:

• *Contract management consolidation.* Contract administration services, which the military departments currently perform for themselves, will be consolidated under the Defense Logistics Agency. This is supposed to eliminate differences in contract management procedures and "present a single face to industry."

• *Industrial initiatives.* The Defense Department will "restrict severely the use of fixed-price development contracts," which have "put contractors in the untenable position of developing high-risk programs at a fixed price." The Pentagon is also "developing sound policies on profitability and progress payments." The DMR gave little detail on these measures, but both will be welcome news to industry, which has felt unfairly squeezed in the recent past.

• *Stock fund spares.* Army and Air Force users will now reimburse service stock funds for new reparable parts. Up to now, these items have been financed by the procurement account and issued free to units. The Navy moved its reparables to the stock fund several years ago and saw demand drop as users made cost-conscious decisions on whether to repair an item instead of replacing it.

• *Materiel management.* The Defense Department spends $30 billion a year on its supply system. The present inventory of supplies is valued at about $100 billion. Current procedures, the DMR said, "impede improved operations" and block "flexibility to make smart decisions." Among other things, the Pentagon hopes to increase the visibility of assets in the inventory to facilitate decisions on when redistribution rather than new procurement can satisfy needs.

• *Personnel Staff Mix.* "The Department has operated with a lower ratio of personnel staff to population served than most federal agencies," the DMR said, declaring that "all services should operate with the same ratio. . . . The Navy ratio is 1:61 and is the recommended mix."

Hard-core reformers will clamor for more changes. Their primary targets are likely to be AFSC and its counterparts in the other services.

• *Civilianization.* "DoD will substitute civilian manpower for military manpower in positions that do not specifically require a military incumbent," the DMR said. The forecast is that about 20,000 positions will be converted over the five-year period.

• *Uniform data systems.* The Defense Department spends $9 billion a year on automated information systems. Of this, about $4 billion is for development of new systems, many of which are service-unique although the service requirements are essentially the same as DoD requirements. The DMR said that "the development effort will gradually transition towards DoD-wide uniform systems."

Despite the dimensions of the splash on January 11, the issue of procurement reform is not nearly laid to rest. Mr. Cheney took pains to point out that he was presenting a "progress report" that highlighted "the first generation of DMR implementation actions." At the Competition conference, Air Force acquisition executive Welch said that this "may be one report of many. You may be hearing about DMR II and DMR III. There's more to be done."

The DMR said, for example, that study groups are investigating possibilities for consolidation or further streamlining of supply and maintenance depots, inventory control points, accounting operations, laboratories and test facilities, and automated data processing design centers. Reports are due to the Deputy Secretary of Defense by May 1.

Rep. Les Aspin (D-Wis.), Chairman of the House Armed Services Committee, liked what he saw in the DMR, but said congressional leaders will meet the Administration at an "acquisition summit" to assure themselves that reform is heading in the right direction.

Hard-core reformers think the DMR let the services off too gently. They will clamor for more changes. Their primary targets are likely to be Air Force Systems Command and its counterparts in the other services.

A November 1989 report from the General Accounting Office gave all of the services flunking grades on implementing the Packard reforms. It was especially critical of the Air Force and of Systems Command:

"The Director of the Packard Commission's Acquisition Task Force, who formulated the three-tiered concept, told us that Commission members reached a consensus that AFSC should be abolished; however, they did not reach a consensus to include such a recommendation in their report," GAO said. "The Task Force director stated that the current information chain would never possess the authority and control needed to function effectively so long as AFSC existed."

Nor, probably, has Mr. Cheney heard the last from the traditionalists who believe the old system deserved more credit than the reformers gave it. The new system, they point out, is greased for fast reporting and agile decision-making, but it is untested in solving problems.

However much a program manager may have been bogged down in the big organization by meddlesome supervisors and staff, they were also there when he or she needed help. It remains to be seen how well the streamlined structure will respond in such circumstances.

The traditionalists also note that so far, the reforms have not made a dent in funding instability—a problem that Packard and most other analysts have found to be among the most serious of all. As DMR implementation began, funding for major programs looked as uncertain as ever, and there were strong signs that it was about to get worse. ■

The Chart Page

Edited by Colleen A. Nash, Associate Editor

The Acquisition Work Force That Was

	Civilians	Military
Army Information Systems Command	18,817	1,701
Army Materiel Command	105,592	2,773
Office of Naval Research	5,029	114
Naval Facilities Engineering Command	19,650	730
Naval Air Systems Command	43,903	1,128
Naval Supply Systems Command	26,278	640
Naval Sea Systems Command	110,181	1,424
Naval Space/Warfare Systems Command	28,572	630
Air Force Logistics Command	86,676	3,109
Air Force Systems Command	28,366	10,407
Air Force Communications Command	6,921	4,088
Defense Logistics Agency	53,134	795
Other Organizations	18,645	2,828
Totals	551,764	30,367
December 1988: Total Civilians and Military	582,131	

Source: *Defense Management Review.*

The *Defense Management Report,* published January 11, forecasts a reduction of 42,000 in the acquisition work force. That force, as of December 1988, consisted of 582,000 persons. Despite the fanfare accompanying the abolition of Navy Materiel Command in 1985, the Navy still has significantly more acquisition personnel than the other services do.

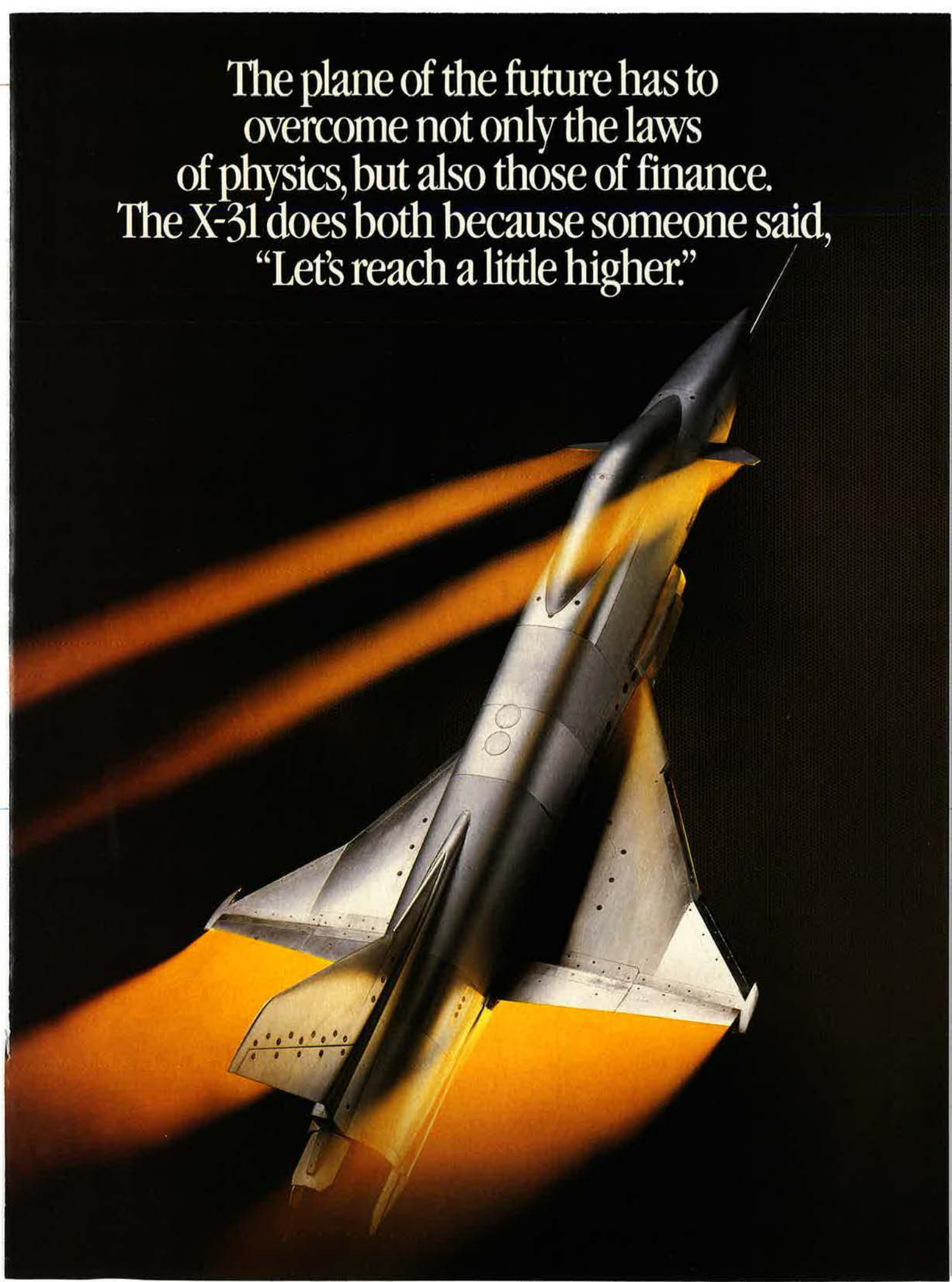
Total Force Transition, 1980–88

	Active Growth	Percent Change	Reserve Growth	Percent Change	Reserve Percentage of Force
Army	− 5,000	− 0.06	+188,000	+32	50
Air Force	+18,000	+ 3.2	+ 41,000	+26	25
Navy	+76,000	+14.7	+ 52,000	+54	20
Marine Corps	+ 9,000	+ 4.8	+ 8,000	+22	18

Source: US General Accounting Office.

In recent years, National Guard and Reserve components have become a larger part of the total US military force. Between 1980 and 1988, selected Reserve units grew by 289,000 persons—nearly three times the net increase in the active-duty forces.

The plane of the future has to overcome not only the laws of physics, but also those of finance. The X-31 does both because someone said, "Let's reach a little higher."



Mike Robinson
Director of
Development Programs
North American Aircraft
Rockwell International

Hannes Ross
X-31 Program
Manager, Messerschmitt-
Bolkow-Blohm

Given today's cost-conscious economic climate, money, not science, can be the limiting factor in developing new technology. But with international cooperation and a low-cost prototyping system developed by the North American Aircraft people of Rockwell, a new experimental plane is expanding the envelope of man's knowledge. Here's the story from the people who made it happen.

By permitting radical turning maneuvers conventional fighters can't duplicate, the X-31 gives its pilot a tactical advantage through faster targeting.

Les Lackman
Vice President, Director of Advanced Technology
North American Aircraft
Rockwell International

Wolfgang Herbst
Director of Advanced Design, Messerschmitt-Bolkow-Blohm

Herbst: The X-31 is an experimental aircraft. It's designed to maneuver beyond the limits of any plane yet operating.

Robinson: The Packard Commission's report to the Secretary of Defense stressed the value of flying prototypes. It said the Defense Advanced Research Projects Agency, sponsor for the X-31, was the U.S. government agency best able to make such programs happen.

Herbst: DARPA supports programs that have high technical risk, but commensurate high payoffs. The X-31 is just that kind of program.

Robinson: It's also right in line with the Nunn-Quayle Initiative calling for increased U.S.-Europe collaboration.

Lackman: It's a different way of working. Rockwell and MBB have two separate customers respectively – the American and German governments. But the companies don't have a formal contract between themselves.

Ross: So to create an aircraft using technology and people from both nations, we really have to work together as a team. By integrating our program, schedule and management styles, it has worked out very well.

Lackman: With the X-31, both nations are addressing new ways of managing the cost of creating prototypes. Another key goal of this program is the development of low-cost fabrication and design techniques for demonstrator-type aircraft.

Robinson: When you're amortizing costs over two airplanes, you do things differently than you would in production. We came up with a concept that minimizes the amount of tooling – the material that supports the plane during construction. We used the substructure of the airplane – the major bulkheads – as the tool. Then we built all the other substructures around them. In essence, when you fly the plane, the tool is flying with it.

Lackman: We truly applied principles of Total Quality Management.

Ross: We developed new design technologies and used new communications systems. Data is exchanged electronically from the West Coast to Europe overnight.

Herbst: We have both – Rockwell and MBB – profited from the X-31. I might even say that the experience of teaming to carry out this experimental program has been at least as valuable as the immediate technical product and know-how we've developed.

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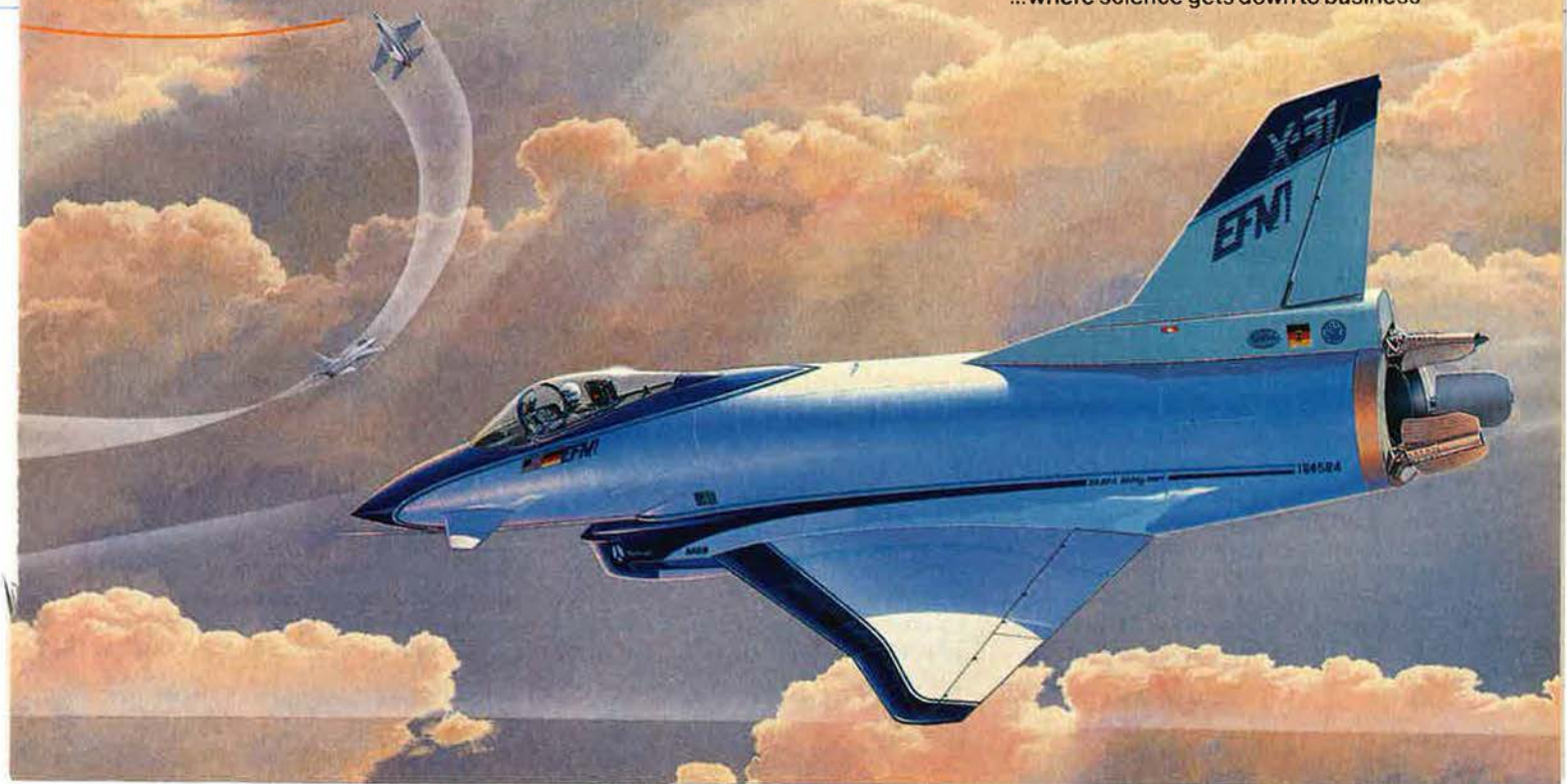


Aerospace World

By Jeffrey P. Rhodes, Aeronautics Editor

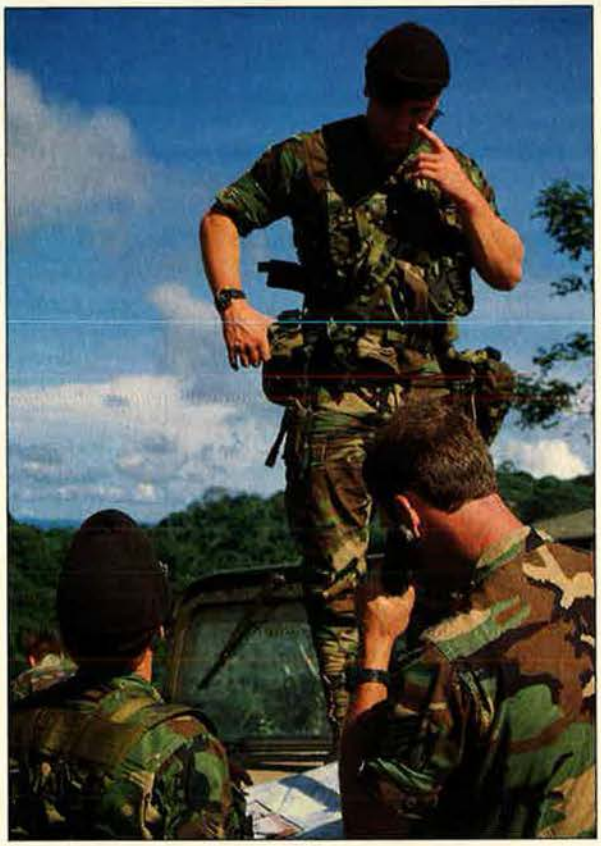
★ The Air Force played a significant role in Operation Just Cause, the US military action that started shortly before 1:00 a.m. December 20 in Panama. President George Bush said the action was taken to restore democratic government to Panama, to capture Panamanian dictator Manuel Noriega, and to protect American interests under the provisions of the Panama Canal Treaty. All of these objectives were eventually achieved.

Military Airlift Command played the largest Air Force role in the operation, as twenty-four active-duty units from ten US states participated in the operation. Nine Air National Guard and nine Air Force Reserve airlift units also took part. Units from 21st and 22d Air Force were involved, as were Special Operations assets from 23d Air Force. It was a 1st Special Operations Wing MC-130E crew that brought Noriega back to the US.

The employment phase of the operation included eighty-four airdrops, twenty-two C-130 missions, seventy-seven C-141 missions, and twelve C-5 missions. Forty C-141 and thirteen C-5 missions provided follow-on security-force airlifts. Humanitarian airlift missions began on December 27, and three tons of medical supplies, 10,000 blankets and sheets, 2,000,000 MREs (Meals, Ready-to-Eat), and tons of food staples for the Panamanians were airlifted.

Strategic Air Command KC-135 and KC-10 crews from fifteen units had flown more than 160 missions, logged 1,600 flying hours, and offloaded more than 10,000,000 pounds of fuel as of late December. Most of the offloading came in the first two days of the action.

The Lockheed F-117A Stealth fighter made its combat debut during the action, as an unspecified number of 37th Tactical Fighter Wing aircraft were used to drop 2,000-lb. bombs on a field near a Panamanian Defense Forces installation near Rio Hato. The mission on December 20 was flown in order to "disorient, stun, and confuse" PDF troops prior to paratroop landings by the Army's 2d and 3d Ranger Battalions. Secretary of Defense Richard B. Cheney later said that a more extensive use of the F-117 had been planned, but that operations with the aircraft had been scaled back.



—USAF photo by MSgt. Charlene C. Morgan

During the early hours of Operation Just Cause, the US military operation in Panama in late December, 24th Tactical Air Support Squadron tactical air control parties directed air support for US ground forces while under fire from Panamanian Defense Force troops. After the assault phase of the operation, TACP members (shown here several days later) helped patrol the secured areas.

Another US asset that saw its first combat was the Army's AH-64 Apache attack helicopter. Eleven AH-64s were sent to Panama by the 82d Airborne Division's aviation brigade, and, of the reported seven AGM-114 Hellfire missiles launched, all seven were direct hits. The Apaches also stood up well to small-arms fire. The AH-64s were flown to Panama aboard Air Force C-5s.

★ The standard-issue Army rifle has only been changed five times in the twentieth century. Some, like the M14, were only in use for a short time. Others, like the classic Springfield, the M1 Garand, and the M16, have soldiered on for decades. Earlier this year at Fort Benning, Ga., the Army began testing four candidate replacement rifles, one of which will likely be the first rifle of the twenty-first century.

All four candidates make use of advanced technology in their sights, mechanisms, and ammunition. Two fire fléchettes, or darts, instead of conventional bullets. The Advanced Combat Rifle (ACR) prototypes will be tested on the instrumented Buckner Range in two phases that will last until August. The tests during the two phases will be identical except for the shooters. A separate firing exercise for women will also be conducted. The current M16A2 will be tested as a control measure.

The Colt Industries candidate is an air-cooled, gas-operated, magazine-fed derivative of the M16A2. Colt has redesigned several parts to improve handling characteristics. The Colt rifle fires the standard M855 5.56-mm NATO round or the Colt/Olin duplex

round. The duplex round consists of two bullets placed nose to tail. The theory is that the first bullet will proceed downrange to the aimpoint, while the trailing projectile will have a slight random dispersion to compensate for the shooter.

The ACR candidate from AAI Corp. is a gas-operated, magazine-fed, fléchette-firing rifle. The gun has a long and unobscured upper surface, much like a shotgun, that aids the shooter's aim. The round is a steel dart roughly one-sixteenth inch in diameter and one and five-sixths inches long, with long fins and a sharpened point. It is held in place by four plastic sabot segments and an O-ring. After firing, the sabot segments separate and the fléchette goes to the target. The gun has a muzzle velocity of 4,600 feet per second.

Heckler & Koch's prototype rifle is a gas-operated, caseless weapon in a bullpup configuration with a single-row magazine holding fifty rounds. The sight is built in and also serves as a carrying handle. The firing mechanism is described as a radially reciprocating chamber. The 4.92-mm projectile is fully telescoped within the propellant body and is held in the machined cavity by a glued-on end cap. The rounds are sealed to protect them from moisture.

The final prototype is from Steyr-Mannlicher. It is a novel bullpup-style, gas-fed weapon, featuring a rising chamber mechanism and a side-initiating round. It weighs less than any of the other ACR candidates and has a long, shotgun-style, rib/carrying handle along the top surface to act as an aiming device for rapid target engagement. It fires a fléchette similar in size to that of the AAI prototype, but it has a plastic rather than a brass case.

The final report on this demonstration is due in late November. If one of the guns is found to be superior, the weapon could be fielded as early as 1995. The Army has already spent $40 million in testing and evaluation to narrow the field in this demonstration to the four candidates. The Air Force is actively involved in the ACR demonstration.

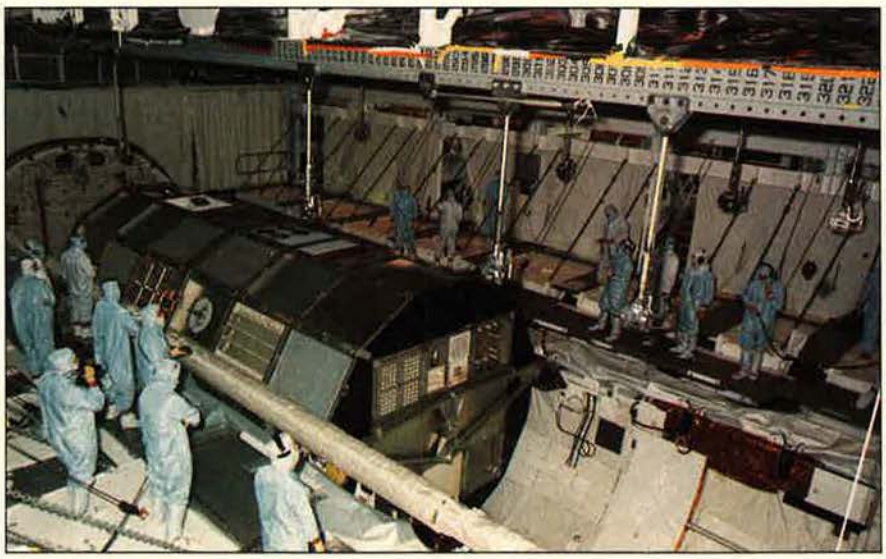
★ If the five astronauts on board *Columbia* felt like couriers, they were justified, because the STS-32 space shuttle mission was a matter of making a delivery and a pickup. The delivery was relatively easy—launching the Navy's Syncom IV-F5 UHF satellite from the shuttle's payload bay. The pickup of the Long Duration Exposure Facility (LDEF) was a little more difficult, but the crew executed the retrieval with precision.

One of these four Advanced Combat Rifle prototypes could be the next standard-issue Army rifle. To be tested this year at Fort Benning, Ga., are guns from (starting at the top left) Steyr-Mannlicher, Colt, Heckler & Koch, and AAI Corp.

The thirty-third shuttle mission overcame several delays. Last September, while *Columbia* was in the Orbiter Processing Facility at the Kennedy Space Center, a fire-suppression system was activated accidentally and drenched the spaceship. After being dried out, *Columbia* was found to be undamaged. The shuttle stack was then assembled and rolled to Launch Complex 39A, which was last used in January 1986. The launchpad was in the final stages of a $50 million refurbishment, and completion of these renovations pushed the liftoff into January. Bad weather delayed liftoff until 7:35 a.m. EST on January 9.

After *Columbia* launched the Navy satellite on the second day, the chase was on, first to catch up with, then to capture, LDEF. Navy Capt. Daniel Brandenstein, the mission commander and chief of NASA's Astronaut Office, and Navy Lt. Cmdr. James Wetherbee, *Columbia's* pilot, made up the 1,500 miles that had separated the orbiter and LDEF when the shuttle reached orbit. With an assist from mission specialist David Low, they brought the spaceplane to within thirty feet of LDEF using a unique "-R Bar" approach, where the orbiter passed below the satellite and then circled up and over it with its payload bay facing Earth.

Once *Columbia* was in position, mission specialist Dr. Bonnie Dunbar moved its remote arm slowly halfway



On January 30, technicians at the Orbiter Processing Facility at the Kennedy Space Center got a first look at the Long Duration Exposure Facility (LDEF) after it was retrieved during space shuttle mission STS-32. The long, foil-wrapped object in the foreground is the remote manipulator arm used to grab LDEF.

down LDEF's thirty-foot length and made contact with the primary grapple fixture. Once contact was made, Dunbar maneuvered the "catch of the day" so LDEF's twelve sides could be photographed. She was assisted by mission specialist Marsha Ivins. After the pictures were taken, the 21,393-pound satellite was berthed in the payload bay.

LDEF had been delivered to Earth orbit by the crew of Mission 41-C on April 6, 1984. It was scheduled to remain in orbit for only a year, but shifts in the mission schedule and then the *Challenger* accident prevented it from being picked up until now. LDEF was recovered at an altitude of 206 miles, but the satellite was losing one-half mile of altitude a day from friction with Earth's atmosphere. Retrieval would have been impossible at an altitude of 130 miles or less. LDEF had made 32,423 orbits before the rescue.

LDEF's fifty-seven experiments were designed to see how various materials reacted to long exposure to outer space. While many of the experiments, three of which belong to the Air Force Weapons Laboratory, were damaged, the extra exposure may prove beneficial. Twelve million tomato seeds were in one experiment tray, and these seeds, along with seeds in a control group that remained on Earth, will be sent to schools across the US to see if exposure to space has any effect. It is thought that at least some seeds will still grow. LDEF was disassembled after the orbiter was returned to the Kennedy Space Center, and the experiments were sent back to the laboratories that devised them.

Although there were some problems with an inertial measurement unit and a malfunctioning orbital maneuvering system rocket engine during the second week, the astronauts spent the rest of the mission performing scientific experiments and making Earth observations. Three of the astronauts (Wetherbee, Ivins, and Low) were rookies.

The unusual night landing (third in shuttle history) at Edwards AFB, Calif., was delayed a day until January 20 because of high winds. Captain Brandenstein landed the orbiter on the base's concrete Runway 22 at 1:35 a.m. PST. *Columbia* weighed almost 115 tons on its ninth landing, nearly five tons heavier than the weight at which any other shuttle has landed. The flight lasted ten days and twenty-one hours, or more than thirteen hours longer than the previous shuttle record, set by the STS-9 crew in 1983.

★ **HONORS**—Air Force Chief of Staff **Gen. Larry D. Welch** will be inducted into the **Air Force Order of the Sword** in ceremonies at the Air Force Museum at Wright-Patterson AFB, Ohio, on March 3. General Welch is being cited specifically for his implementation of the new enlisted evaluation system and for opening the Senior NCO Academy to master sergeants. The Order of the Sword is the highest honor the enlisted force can bestow on a senior officer or civilian. General Welch joins Gen. Charles A. Gabriel and Caspar Weinberger, the only other Air Force Order of the Sword honorees.

The winners of the **Harmon Trophy,** awarded more-or-less yearly for outstanding achievements in aeronautics, were announced in early January. Soviet cosmonauts **Vladimir Titov** and **Musa Manarov**, hot-air balloonists **Per Lindstrand** (cited twice) and **Richard Branson**, and flyers **Kanellos Kanellopoulos, Allen E. Paulson, CWO-3 Jon Iseminger, Anne Baddour,** and **Lois McCallin** were all cited for their achievements during 1986–88. The Harmon Trophy was established in 1926 and is administered by the National Aeronautic Association.

In one of the more unusual honors, the Omaha (Neb.) Press Club has named Strategic Air Command Commander in Chief **Gen. John T. Chain, Jr.,** its latest **"Face on the Barroom Floor."** The club places a caricature of each honoree in a special frame that is initially placed on the barroom floor and is later displayed on a wall in the club. General Chain, well-known in the Omaha community, is the first military member to gain this recognition.

★ **PURCHASES**—The **second competitive Increased Performance Engine buy** between General Electric and Pratt & Whitney **ended in a dead heat.** Pratt & Whitney will build 113 F100-PW-229 engines for the planned FY 1991 purchase of thirty-six new production F-15Es and a portion of the planned buy of 150 new F-16s. Nearly all of General Electric's 114 F110-GE-129 engines will power F-16s. A small number of engines from each contractor will be used for maintenance training only. No contract values were released. Counting the original Alternate Fighter Engine buys, this marked the seventh annual competitive fighter engine purchase.

On December 20, after seven years of competition, **South Korea selected the McDonnell Douglas F/A-18 Hornet** over the General Dynamics F-16 as the winner in the **Korean Fighter Program** (KFP) effort. The KFP calls for 120 aircraft, with McDonnell Douglas to build twelve F/A-18s (with first deliveries in 1993), thirty-six to be built from kits by Samsung Aerospace Industries, and the remaining seventy-two Hornets to be built under license by Samsung in South Korea. The Koreans will also buy 252 General Electric F404-GE-402 engines, with GE to provide twenty-seven engines, eighty-one kits, and gradual increases in parts

General Dynamics recently opened its Combined Arms Systems Engineering (CASE) laboratory in Fort Worth, Tex. The 100,000-square-foot, $30 million facility is an integrated center for the study of future battlefield environments and related weapon system requirements. The location and movements of troops and equipment are displayed electronically during battlefield simulations.

Late last year, several major C-17 components were moved from their assembly jigs at the Douglas Aircraft Co. plant in Long Beach, Calif., in preparation for joining operations. The first section of wing, ninety-two feet long and weighing 28,000 pounds, was placed in an interim jig before being moved to a horizontal fixture where it was joined with the other half of the wing in January.

production on the remaining powerplants. The $4 billion KFP deal is expected to generate stiff opposition in Congress.

Texas Instruments received a $297.3 million Naval Air Systems Command contract on January 10 for the FY 1990 procurement of **AGM-88A High-speed Antiradiation Missiles** (HARM). The 1,604-missile buy calls for 1,112 HARMs to be built for the Navy, 276 for the Air Force, and 216 for West Germany. Delivery is expected to be completed in 1992. TI recently completed the seventh consecutive year of on-time HARM deliveries.

Rockwell's Space Transportation Systems Division received a $375 million NASA contract extension on December 14 for a set of **space shuttle orbiter structural spares.** The parts include wings and elevons, a vertical stabilizer and rudder/speedbrake, a body flap, an orbital maneuvering system, a reaction control system and RCS pods, a crew module, upper and lower forward fuselages, mid and aft fuselages, nose and main landing gear doors, and payload bay doors. Work on the complete set of spares is expected to be completed in 1994.

Raytheon received a $174 million contract from Air Force Systems Command's Electronic Systems Division in late December for **Low-Rate Initial Production of Air Force airborne and ground Milstar satellite system terminals.** The company will also provide spares, installation support, and documentation for the terminals that will be installed in airborne command post aircraft, in strategic bombers, at fixed and mobile ground command and control posts, and at ground-based warning sites. Deliveries are expected to start in 1992.

Unisys Federal Information Systems Division received a $36.3 million contract from Air Force Computer Acquisition Center on January 5 **to upgrade the Air Force Global Weather Central (AFGWC) computer system** at Offutt AFB, Neb. Operated by Miliary Airlift Command, AFGWC collects, analyzes, models, and disseminates meteorological and astrogeophysical data and products for Department of Defense customers. The company will provide two new mainframes and other peripherals that will double the current computer storage capacity.

★ **MILESTONES**—When the nomination for promotion of **Col. Marcelite J. Harris,** currently Commander of the 3300th Technical Training Wing at

Texas Instruments recently received a contract for the FY 1990 procurement of AGM-88 High-speed Antiradiation Missiles. HARM, shown here being checked by SrA. Robert Collins at George AFB, Calif., is used by the US Air Force and Navy and by West Germany to suppress enemy radar emitters.

—Staff photo by Guy Aceto

Keesler AFB, Miss., is approved by Congress, she will become **the first black woman in the history of the Air Force to be promoted to the rank of brigadier general.** Colonel Harris, forty-six, was one of the Air Force's first female maintenance officers and became the first female maintenance squadron commander in Strategic Air Command in 1981. She has also served staff assignments in Washington, including a tour as an aide to President Jimmy Carter.

The **first commercial Martin Marietta Titan III space booster was successfully launched** from Launch Complex 40 at Cape Canaveral AFS, Fla., on December 31. The two-stage, 155-foot-tall rocket boosted two satellites, Skynet 4A and JCSAT 2, into low-earth orbit. Skynet 4A, a communications satellite for the British Ministry of Defence, and JCSAT 2, a television relay satellite for the Japan Communications Satellite Co. were boosted into geosynchronous orbit by separate spacecraft propulsion systems. The liftoff had been delayed first because of technical glitches and then eight times by the weather.

The **total test time for the Rocketdyne Space Shuttle Main Engines (SSMEs) topped the 400,000-second mark** after a recent test at NASA's John C. Stennis Space Center in Bay St. Louis, Miss. The total is equivalent to 267 space shuttle flights, as the orbiter's three SSMEs fire for approximately 500 seconds each on each flight. Of the total test time of 400,225 seconds, the SSMEs have been run at a 109 percent power setting for 72,520 seconds and at the nominal flight level power setting of 104 percent for 127,722 seconds. The rigorous test program is being conducted for engine development, life extension, certification for flight readiness, and reliability demonstration purposes.

Air Force Systems Command's Munitions Systems Division (MSD) at Eglin AFB, Fla., recorded two milestones in December. First, **MSD's Armament Laboratory demonstrated a real-time display of high-resolution range imaging LADAR** (laser radar). The LADAR first sends a beam of laser light out to a target and starts a timer. After the laser light reflects from the target to the sensor, the timer stops. The on-board computer notes the elapsed time and converts the information into a false-color, three-dimensional image that can be built with only one sweep of the scanner. In this image, the target appears in a multicolored field, with gradients and

The first commercial Martin Marietta Titan space booster was successfully launched from Cape Canaveral AFS, Fla., on December 31. The commercial Titan III, a derivative of the Titan 34D, is capable of lifting 32,500-lb. payloads to low-Earth orbit.

March Anniversaries

- *March 19, 1910:* Orville Wright opens the first Wright Flying School at Montgomery, Ala., on a site that would later become Maxwell AFB.
- *March 3, 1915:* Congress approves the act establishing the National Advisory Committee for Aeronautics. The NACA is to "supervise and direct the scientific study of the problems of flight with a view to their practical solution." The Committee, initially given a budget of $5,000, would evolve into the National Aeronautics and Space Administration.
- *March 9, 1935: Reichsmarschall* Hermann Göring announces the existence of the Luftwaffe in an interview with London *Daily Mail* correspondent Ward Price. This statement implies a gross violation of the Versailles Treaty, which prohibits Germany from having an air force.
- *March 9–10, 1945:* The first low-level, incendiary raid against Tokyo is carried out by 279 XXI Bomber Command B-29 crews. Nearly one quarter of all buildings in the city are destroyed.
- *March 14, 1945:* The first Grand Slam (22,000-lb.) bomb is dropped from an Avro Lancaster flown by Royal Air Force Squadron Leader C. C. Calder. Two spans of the Bielefeld railway viaduct in Germany are destroyed.
- *March 15, 1950:* The Joint Chiefs of Staff, in a statement of basic roles and missions, give the Air Force formal and exclusive responsibility for strategic guided missiles.
- *March 22, 1960:* The Civil Aeronautics Board reports that slightly more than ten percent of revenue passenger miles flown in scheduled domestic operations during 1959 were flown by pure jet aircraft.
- *March 29, 1960:* The Naval Weapons Station Annex at Charleston, S. C., which provides a final assembly capability for UGM-27 Polaris sea-launched ballistic missiles and also for loading them on submarines, opens.
- *March 1, 1965:* An unarmed Boeing LGM-30B Minuteman I intercontinental ballistic missile is successfully launched from an underground silo ten miles north of Newell, S. D. It is the first time a site other than Vandenberg AFB, Calif., or Cape Canaveral AFS, Fla., is used for an ICBM launch.
- *March 2, 1965:* Capt. Hayden J. Lockhart, flying an F-100 in a raid against an ammunition dump north of the Vietnamese DMZ, is shot down and has the dubious distinction of being the first Air Force pilot to be taken prisoner by the North Vietnamese. He would not be released until February 12, 1973.
- *March 23, 1965:* Air Force Maj. Virgil "Gus" Grissom becomes the first astronaut in the manned spaceflight program to go aloft a second time, as he and Navy Lt. Cmdr. John Young are launched on the first Gemini mission, Gemini 3. This three-orbit, four hour and fifty-three minute shakedown flight is also the first time a spacecraft's orbit is changed in space.
- *March 19, 1970:* Air Force Maj. Jerauld Gentry makes the first successful powered flight of the Martin Marietta X-24A lifting-body research aircraft over Edwards AFB, Calif.

changes in color indicating distances at a glance. LADAR technology is being developed for use on smart submunitions.

The second MSD milestone occurred when an AGM-65 **Maverick air-to-surface tactical missile fitted with a millimeter-wave seeker made its first captive-carry flight.** An active radar using millimeter-wave technology, along with on-board computer processing, allows the weapon to detect a number of mobile and fixed targets, select a target for attack, and then track to the target for a direct hit even in adverse weather. At the completion of the captive-carry tests, the new Maverick, which has not yet been assigned a new model designation, is scheduled to undergo cold-weather tests in Michigan.

The **number-four Bell-Boeing V-22 Osprey made its first flight** from the Boeing Helicopters Flight Test Center at the Greater Wilmington (Del.) Airport on December 21. This marked the start of V-22 flight-test activities at Boeing's facility near Philadelphia. The aircraft, the third Osprey to fly, was the first to sport a camouflage paint scheme. Boeing pilots Dick Balzer and Ray Dunn made the fifty-minute flight entirely in the helicopter mode. The first two Ospreys are in flight test at Bell's facility in Arlington, Tex., and have accumulated forty-five flight-hours. Six V-22s will eventually be involved in the flight-test program.

A Canadian C-130 crew made the first trial flight of the proposed "Open Skies" policy over Hungary on January 6. The C-130 crew, with Hungarian observers on board, took off from Budapest and overflew several Hungarian and Soviet military installations in a large figure-eight pattern during the three-hour flight. The crew flew through three air traffic control sectors at altitudes ranging from 2,000 to 30,000 feet. The "Open Skies" policy, if accepted, would allow NATO and Warsaw Pact nations to make short-notice surveillance overflights of each other's territories to verify arms levels. The US and Soviet Union both have reservations about certain provisions of the proposed policy, but seem willing, in principle, to accept it. The foreign ministers of the twenty-three NATO and Warsaw Pact countries were scheduled to meet in Ottawa in February to start hammering out details of the proposed policy. A Hungarian Air Force crew was also expected to make an overflight of Canada in February. President Dwight Eisenhower first proposed the "Open Skies" policy in 1955, and President George Bush revived the idea last year.

Air Force Systems Command's **Contract Management Division marked its twenty-fifth anniversary** on January 4. When formed in 1965, CMD combined the three contract management regions into one organization headquartered at Los Angeles AFS (now AFB), Calif. The organization moved to Kirtland AFB, N. M., in 1972. Today, approximately 400 military and civilian employees work at Kirtland, and roughly 3,300 more are assigned to twenty-five contractor plants throughout the US. CMD has twice received the Air Force Organizational Excellence Award.

★ **NEWS NOTES—Military Airlift Command announced** on January 12 **that female aircrew members will now be allowed on C-130 and C-141 airdrop missions.** Previously, women had only been allowed to fill a limited number of crew stations on selected special-duty variants of the C-130. Although they could serve on C-141s, female crew members were only allowed to fly on airland missions. The policy change came about while MAC officials were reviewing plans for fielding the C-17. After taking into account recent changes to the combat exclusion policy for women in the Air Force, officials decided that women should be assigned not only to the C-17, but to the C-130 and to C-141 airdrop missions as well. The policy was approved December 14, but no women had been trained in airdrop procedures prior to the military action in Panama.

AFSC's **Munitions Systems Division is now testing** a program that is not only of great importance to Special Operations Forces, but also has one of the best acronyms ever devised. The Beam Sight Technology Incorporating Night Vision Goggles, or **BSTING,** system allows gunners on Special Operations helicopters to find targets without using tracer rounds. This capability maximizes the element of surprise and limits degradation of the night vision goggle image because of light saturation. BSTING uses a gun-mounted infrared laser (that can only be seen through the NVGs) to show the gunner exactly where the rounds will hit the target and a ballistic prediction computer that makes corrections automatically.

Secretary of Defense Richard B. Cheney announced a department-wide civilian hiring freeze on January 12. The ban on new hires extends through the remainder of FY 1990 and is an effort to cut the size of DoD's work force. A normal rate of civilian attrition (generally around 80,000 people a year) should be sufficient to avoid any layoffs. Exceptions to the ban include hiring commitments made before January 11 and medical, safety, and security workers. DoD employs 927,000 civilians on a permanent basis and 123,000 on a temporary or part-time basis.

The **Navy successfully carried out the seventh and eighth undersea test launches of the Lockheed UGM-133A Trident II, or D5, sea-launched ballistic missile** on January

The fourth Bell-Boeing V-22 built became the third Osprey to fly when it took off at Boeing's test facility near Philadelphia, Pa., late last year. It was also the first of the tilt-rotor aircraft to fly in a camouflage paint scheme. The V-22 program is threatened by the congressional budget wars.

15 and 16. Both launches were made from the USS *Tennessee* (SSBN-734) while submerged off the coast near Cape Canaveral AFS, Fla. These latest tests cap a flurry of launches (there were three in December) conducted for several reasons: to ensure the fix of the first-stage nozzle works, to free up production monies held up by Congress in the wake of two failures in the first three undersea test launches, and to reach initial operational capability with the missile on time later this month when the *Tennessee* is scheduled to go on patrol. The sub's home port is Kings Bay, Ga.

The four major companies that were in competition to build the National Aerospace Plane have decided to make the program a collaborative effort instead. The companies—airframers General Dynamics, McDonnell Douglas, and Rockwell, along with powerplant companies Rocketdyne (a Rockwell division) and Pratt & Whitney—are pooling their resources in an effort to cut costs and increase the likelihood that the effort will actually result in two hypersonic, single-stage-to-orbit X-30 research vehicles. Funding for the NASP has slowed dramatically as a result of the recent budget battles, and the companies' joining forces is a sensible way to proceed. Rockwell Vice President Barry Waldman was named as the NASP Program Director.

On December 19, **McDonnell Douglas announced that production of the Navy's T-45A Goshawk jet trainer will be moved** from two Douglas Aircraft plants in California to McDonnell Aircraft in St. Louis, Mo. The move was made so that approximately 1,800 workers at the Douglas plants in Long Beach (where the forward fuselage was built) and at Air Force Plant 42 in Palmdale (where final assembly was done) could work on the company's commercial jetliners and the Air Force's C-17. A like number of workers in St. Louis will come from the F-15E and AV-8B production lines, which will soon start to wind down. The T-45 has experienced a number of development problems, and overcoming these deficiencies has pushed initial operational capability back six months to July 1991. The first production T-45 is scheduled to be delivered this June.

The **second captive-carry flight of the Pegasus air-launched space**

Senior Staff Changes

RETIREMENTS: L/G Richard A. **Burpee;** B/G Albert A. **Gagliardi,** Jr.

PROMOTIONS: To be **Lieutenant General:** John B. **Conaway;** David J. **Teal.**

To be **Brigadier General:** Jerrold P. **Allen;** George T. **Babbitt,** Jr.; Richard C. **Bethurem;** Bruce J. **Bohn;** Roy D. **Bridges,** Jr.; Jeffrey G. **Cliver;** Sebastian F. **Coglitore;** George P. **Cole,** Jr.; Stewart E. **Cranston;** Lee A. **Downer;** Ralph E. **Eberhart;** Kenneth E. **Eickmann.**

Jerry D. **Gardner;** Richard N. **Goddard;** Marcelite J. **Harris;** Henry M. **Hobgood;** Thomas C. **Hruskocy;** Joseph E. **Hurd;** Kenneth R. **Israel;** Albert D. **Jensen;** Eldon W. **Joersz;** William E. **Jones;** Nicholas B. **Kehoe** III; Jerome A. **Landry.**

Mark H. **Lillard** III; Lester L. **Lyles;** Michael A. **McAuliffe;** John O. **McFalls** III; Michael D. **McGinty;** David W. **McIlvoy;** Kenneth G. **Miller;** Kenneth A. **Minihan;** Bob L. **Mitchell;** Jimmey R. **Morrell;** David **Oakes;** Charles H. **Roadman** II.

James C. **Roan,** Jr.; Charles T. **Robertson,** Jr; Hallie E. **Robertson;** Eugene D. **Santarelli;** James S. **Savarda;** Dale E. **Stovall;** Richard T. **Swope;** Floyd K. **Tedrow;** Arnold R. **Thomas,** Jr.; W. Thomas **West;** Joseph C. **Wilson,** Jr.; William L. **Worthington,** Jr.

To be **AFRES Major General:** Dale R. **Baumler;** Shirley M. **Carpenter;** Glenn W. **Redmond;** James E. **Simon;** Raymond B. **Stewart,** Jr.

To be **AFRES Brigadier General:** Almon B. **Ballard;** Gerald F. **Crump;** Jimmy G. **Dishner;** Ray F. **Garman;** David C. **Gildart;** James W. **Hart,** Jr.; John F. **Harvey;** William H. **Lawson;** David R. **Smith;** William D. **Tracy;** Frank D. **Watson;** Wallace W. **Whaley;** Walter L. **Winters,** Jr.

CHANGES: B/G Dennis C. Beasly, from Dir., C4 Sys., J-6, Hq. USTRANSCOM, Scott AFB, Ill., to Dep. Dir., Defense Communications Sys., DCA, Arlington, Va., replacing B/G Phillip E. Bracher . . . **B/G Phillip E. Bracher,** from Dep. Dir., Defense Communications Sys., DCA, Arlington, Va., to Dir. for C4 Sys., J-6, Hq. USEUCOM, Vaihingen, Germany, replacing B/G (M/G selectee) Carl G. O'Berry . . . **Col. (B/G selectee) Roy D. Bridges, Jr.,** from Cmdr., Eastern Space and Missile Ctr., Space Sys. Div., AFSC, Patrick AFB, Fla., to DCS/Test and Resources, Hq. AFSC, Andrews AFB, Md., replacing M/G Frederick A. Fiedler . . . **M/G (L/G selectee) John B. Conaway,** from Vice Chief, National Guard Bureau, Washington, D. C., to Chief, National Guard Bureau, Washington, D. C. . . . **B/G Gary L. Curtin,** from Ass't DCS/P&P, Hq. SAC, Offut AFB, Neb., to JCS Rep. for START, J-5, Joint Staff, Washington, D. C. . . . **B/G Kenneth L. Hagemann, Sr.,** from CINCSAC Rep. to JCS, and Dep. Dir., Analysis, Concepts, and Sys., JSTPS, Hq. SAC, Offutt AFB, Neb., to Cmdr., 7th AD, SAC, and DCS/Strategic Forces Conventional Application, Hq. USAFE, Ramstein AB, Germany, replacing retiring B/G Loring R. Astorino.

Col. (B/G selectee) Jerome A. Landry, from Cmdr., Airlift Communications Div., Hq. AFCC, and DCS/C4 Sys., Hq. MAC, Scott AFB, Ill., to Dir., C4 Sys., J-6, Hq. USTRANSCOM, Scott AFB, Ill., replacing B/G Dennis C. Beasly . . . **B/G (M/G selectee) Carl G. O'Berry,** from Dir. for C4 Sys., J-6, Hq. USEUCOM, Vaihingen, Germany, to Dir., C2 Sys. and Log., J-4/J-6, Hq. USSPACECOM, and DCS/Sys. Integration, Log., and Support, Hq. AFSPACECOM, Peterson AFB, Colo., replacing retired B/G Victor S. Stachelczyk . . . **Col. (B/G selectee) Charles T. Robertson, Jr.,** from Cmdr., 384th Bomb Wg., SAC, McConnell AFB, Kan., to Ass't DCS/P&P, Hq. SAC, Offutt AFB, Neb., replacing B/G Gary L. Curtin . . . **B/G Ronald N. Running,** from Dep. Dir., Int'l Negotiations, J-5, Joint Staff, Washington, D. C., to Dir., Plans, Policy, and Doctrine, J-5, Hq. USSOCOM, MacDill, AFB, Fla., replacing Col. Dale E. Stovall . . . **M/G (L/G selectee) David J. Teal,** from DCS/Sys., Hq. AFSC, Andrews AFB, Md., to Vice Cmdr., Hq. AFSC, Andrews AFB, Md., replacing retiring L/G Spence M. Armstrong.

SENIOR EXECUTIVE SERVICE (SES) RETIREMENTS: Aubrey L. **Freeman;** James A. **Means;** Frank J. **Rehm;** Stephen W. **Tsai.**

SES CHANGES: Anthony J. DeLuca, to Dir., Office of Small and Disadvantaged Business Utilization, OSAF, Washington, D. C., replacing retired Donald E. Rellins . . . **Anthony Salvucci,** to Executive Dir., ESD, AFSC, Hanscom AFB, Mass. . . . **Ronald P. Sanders,** to Dep. Dir. for Work Force Effectiveness, Hq. USAF/DPC, Washington, D. C., replacing Roy Gay . . . **John K. Scott,** to Dep. Ass't Sec'y (Accounting, Finance, and Banking), OSAF, Washington, D. C. . . . **Billy E. Welch,** to Dep. for Science, Technology, and Operational Aeromedical Support, HSD, AFSC, Brooks AFB, Tex.

SCIENTIFIC AND TECHNICAL (ST) RETIREMENT: Randall E. **Murphy.**

ST CHANGE: Charles B. Hogge to Tech. Adv., Advanced Radiation Technology Office, Space Sys. Div., AFSC, Kirtland AFB, N. M. ■

Engineers at Air Force Systems Command's Arnold Engineering Development Center prepare a one-twelfth-scale model of the Advanced Fighter Technology Integration F-111 for wind-tunnel testing. The test provided aerodynamic data on characteristics of configurations of the plane's Mission-Adaptive Wing in different positions.

booster over the Pacific on December 15 **revealed anomalies that will require a third captive-carry test.** The problems centered on the booster's launch support equipment on board the NB-52 carrier aircraft. All mission procedures were successfully tested, as was the computer sequencer. The flight also showed that the flaking of the thermal protection system and the electrical noise problems detected on the first flight had been corrected. The third captive-carry test was scheduled for late January or early February. The first launch is scheduled for early spring. Pegasus is a joint venture of Orbital Sciences Corp. and Hercules.

The city of **Sumter, S. C., annexed nearby Shaw AFB** on December 19, which allowed the city to get revised statistical data to the US Bureau of the Census by the December 31 deadline. The 3,363-acre annexation has little effect on the base, but could boost the population of both the city and county of Sumter to qualify the area as a Standard Metropolitan Statistical Area. After a county has 100,000 residents and one of its cities has at least 50,000 residents, it becomes an SMSA. The SMSA designation allows the city to qualify automatically for annual federal grants and is often a determining factor when retail and restaurant chains look for new locations.

A New Hampshire Air National Guard KC-135E Stratotanker exploded on the ramp at Pease AFB, N. H., on January 11. One firefighter suffered a dislocated shoulder while fighting the blaze. No other injuries were reported, no other aircraft were involved, and no one was on board the aircraft at the time of the explosion. The accident is under investigation. This was the third KC-135 explosion (two E-models and one A-model) in five months.

America will now have almost completely smoke-free skies. **Under the FY 1990 Transportation Appropriations Bill, smoking has been banned on all domestic airline flights.** The ban applies to all domestic flights except those that begin in, or are bound for, Alaska or Hawaii and are longer than six hours in duration. The new provisions expanded those restrictions, passed in 1987 and scheduled to expire in April, that banned smoking on flights of two hours or less. The ban also helps airline scheduling, as a separate smoking section will no longer be needed for a majority of domestic flights.

The **Air Force Museum** at Wright-Patterson AFB, Ohio, **recorded another banner year in 1989.** A total of 1,433,150 visitors passed through the turnstiles, which was the second-highest yearly total in the museum's sixty-six-year history and only 60,834 people off the record set in 1988. Attendance has averaged more than 1,000,000 people a year since 1972.

★ **DIED—Gen. Albert C. Wedemeyer,** who, as a staff officer in the War Plans Division, formulated the World War II "Victory Program" of defeating Nazi Germany first and Japan second, of Alzheimer's disease at Fort Belvoir, Va., on December 17. He was ninety-two. In 1935, General Wedemeyer was the first American officer to graduate from the German general staff college, which prepared him to fight a war in which Germany was the principal enemy. In 1944, at age forty-seven, General Wedemeyer was placed in command of the China theater of operations, making him the youngest theater commander in the war. After the war, he commanded the Second and Sixth Armies before retiring in 1954. ■

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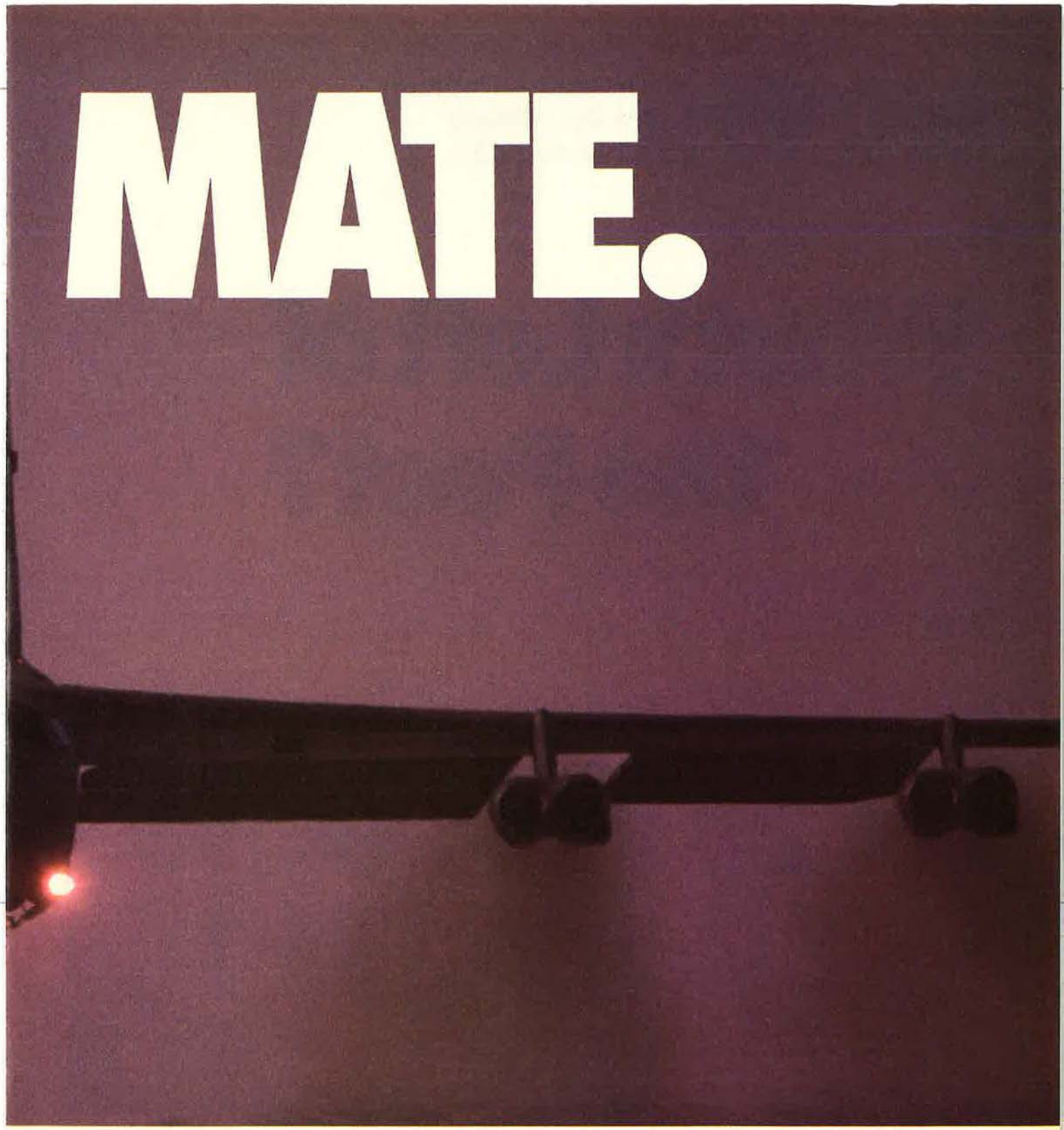

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THE SENSIBLE SOLUTION

The force structure of the east European alliance is still there, but its military value to the Soviet Union is dubious.

What's Left of the Pact?

By Thom Shanker

AT THE far end of Gorky Street, a Moscow thoroughfare that begins at the Kremlin, there stands a collection of pastel green buildings: Byelorussia Railroad Station. This ornate, czarist-era railway bazaar is a key starting point for westward travel. From there, trains hurtle through Russian forests and farmlands, cross the border at Brest, then drive on across Poland into Germany.

The railway, an axis with extremities at Moscow and Berlin, defines a centuries-old corridor of commerce and conflict between Russia and the rest of Europe. The route has seen its share of drama. Over it marched Napoleon's Grand Armée and Hitler's Wehrmacht. These forces saw it twice, once advancing and once in retreat. Stalin's Red Army, marching westward, traveled the same course. Kremlin leaders always thought it could do so again.

The image of Russian travelers standing at Byelorussia Station is an apt metaphor for Soviet power in the 1990s. Mikhail Gorbachev sees that, in politics and economics, the Soviet Union must figuratively go

As its former staunch allies yield to the will of the people (above, Czech protesters in Wenceslas Square), the USSR's ability to launch an invasion of the West is dramatically weakened (at right, Soviet army troops).

west if it wants to join other nations in "a common European home." For Soviet military leaders, however, the trip may look too harrowing to take anymore. Indeed, nothing has had a more destructive impact on Soviet ability to threaten the West than the disintegration of Moscow's east European empire.

Strategic affairs experts maintain that, in the wake of democratic uprisings that have toppled Communist governments in eastern Europe like so many dominoes, the Soviet Union could be left with an undependable Warsaw Pact alliance. It hasn't happened yet, or at least no official will say so publicly, but the situation remains fluid in the extreme.

With sizable troop rosters and weapon stocks, the Pact will continue—on paper—to be a significant and dangerous military force. In reality, eastern Europe's volatile shift toward democracy has dramatically weakened the USSR's ability to launch an invasion of the West.

Even hard-line military affairs analysts agree that the threat of blitzkrieg from the East into NATO Europe has declined. They point out, however, that the USSR is capable of dangerous unilateral actions. The Kremlin can enlist individual governments—Syria, Libya, North Korea—and even the intelligence services of the East Bloc to assist in activities hostile to US interests worldwide.

Intelligence analysts who specialize in Soviet affairs believe that there has been a massive splintering of the command and control arrangements necessary to organize an efficient invasion by the seven national armies of the Pact.

Even more significant, according to Pentagon experts, is an apparent lack of will among the armies of eastern Europe to assist in any way in an invasion of NATO, particularly as new governments in Berlin, Warsaw, Prague, Budapest, Sofia, and Bucharest look away from Moscow and to the West for political support—and economic salvation.

"The teeth are still there," says one defense official. "Whether the jaws are tired and can still chew is another thing."

Aware of how his changes are playing in Washington, Gorbachev gladly anticipates ever-mounting pressure in Congress to bring home more of the approximately 320,000 US troops and billions of dollars of equipment stationed in western Europe to deter a Soviet-led sweep across the continent.

Intelligence experts and Pentagon policy analysts warn that much of their assessment of events under way in the Warsaw Pact is necessarily tentative.

"The inherent military capability—the force structures, weapons stocks, reserve manpower—is still there," says one Defense Department official. "But any assessment of forces is just one part of it. It is much less easy to get a solid fix on political reliability and quality of training in this time of 'meltdown.' It's a question of physical assets vs. will and motivation. It's a matter of capabilities vs. intentions."

Protests within the Soviet Union, such as this demonstration for independence in Estonia, indicate that the USSR can no longer count on its own republics for military manpower. Antimilitary sentiment and calls for military reform are widespread.

A Nonfunctioning Alliance

In the bad old days of the NATO-Warsaw Pact standoff—which means any time prior to about nine months ago—Pentagon planners generally assumed that a bolt-from-the-blue attack from the East would require fourteen days of troop movements and similar maneuvers detectable by early-warning spy satellites.

Under these scenarios, the Soviet Union would launch its first, deep thrust into the West from its forward bases in Warsaw Pact nations, with east European armies assigned to protect the flanks, occupy towns, and secure railroads and other important lines for logistical supplies or communications.

"It is fair to say that the dramatic decline in the Soviet Union's ability to rely on east European armies means these second-echelon functions so critical to an offensive have to be done by somebody else," says Phillip Karber, Senior Vice President for National Security Programs at BDM International. Karber is one of Washington's premier private-sector experts on Soviet and Warsaw Pact conventional forces.

"No prudent planner on the Soviet general staff would be optimistic about how strongly the armies of his allies would fight today," says Karber, who toured military bases in eastern Europe and the USSR last summer as an advisor to the House Armed Services Committee.

"So the Soviets would have to put more of their forces to cover these secondary sectors and secondary missions," Karber continues. "Whatever the Soviets needed a year ago to pull off a short-warning attack, they would need twice as much time today to pull enough troops from Soviet territory to the front."

Karber declines to join those who predict—with no small pleasure—that Soviet armies would even have to fight their way across Poland and East Germany en route to Bonn and Paris, but he did have a bottom-line

analysis that, if true, marks a dramatic break with postwar history.

"The Warsaw Pact," he maintains, "is no longer a functioning military alliance."

Indirect Hostilities

"If you are talking about activities other than a massive assault—for example, international terrorism, the illicit acquisition of Western technology with military implications, or propping up regimes hostile to the West—there is still a threat from the Soviet Union and these east European countries," says Frank Gaffney, Jr., who held a number of senior Pentagon positions during the Reagan Administration and is now Director of the Center for Security Policy in Washington, D. C.

His concern is echoed by professionals in the US intelligence community who point out that espionage agencies in Warsaw Pact nations are remaining loyal to their Communist Party spymasters during the infancy of the new East Bloc governments. There is little evidence that connections with the KGB, Moscow's Committee for State Security, have thus far been severed.

Working unilaterally, the KGB is expected to be given an even more important mandate under Gorbachev's "peace offensive." During a period of conventional or strategic arms reductions, verification becomes a priority for both Moscow and Washington. As the Kremlin attempts to create a leaner, meaner defense structure, savings achieved by stealing military secrets from the West become more important.

In their Third World empire, the Soviets have yet to cut back on military aid to governments whose interests oppose those of the US. Surely there is a closed-door debate in the Kremlin over the bottomless pit of aiding the likes of Cuba and Ethiopia, but MiG-29 fighters were sold to North Korea last year, and the USSR is expanding its presence in Syria.

Gaffney also quarrels with those US analysts who hope that the Soviet Union maintains at least a shell of its Pact alliance to guarantee stability in eastern Europe among newly sovereign nations with historic boundary or ethnic disputes. Some of these specialists voice fears that the evaporation of the Warsaw Pact may save Europe from World War III, but bring a replay of the national rivalries that led to World War I.

© Peter Turnley/Black Star

The East German army, once one of the USSR's strongest Pact resources, will shrink by 10,000 troops in 1990. Another 19,000 soldiers will be diverted to general assignments. Training of some 20,000 reservists scheduled for 1990 has been canceled.

Gaffney asserts that, if the price of allowing the Soviet Union to maintain the Warsaw Pact alliance "is that you maintain Soviet military presence and everything that goes with that—particularly the intelligence apparatus," then it is "too high a price to pay."

Reviewing the Situation

All of the remarkable changes under way in the Soviet sphere are volatile and perhaps reversible, but they warrant a fresh review of the military threat presented by the Kremlin. How do Soviet military officers see their situation today? A working paper drafted by a political and military affairs specialist at the State Department attempts to duplicate the threat assessment certainly being conducted by the Soviet General Staff. It notes that:

- Each of the Soviet Union's six Warsaw Pact allies radically altered its government or political orientation in the final four months of 1989. The Stalinist system that maintained order within the Bloc and fealty to Moscow has been repudiated.
- In Poland, the government will disband four of its thirteen military divisions, taking 40,000 soldiers out of service. Two divisions are being placed on standby, which puts ninety percent of those troops into reserve status. Polish authorities have told Moscow that Poland will not participate in upgrading Warsaw Pact forces.
- The size of the East German army will drop by 10,000 in 1990; another 19,000 soldiers, though still in uniform, will be diverted to assignments in the general economy. About 20,000 reservists scheduled to be called up for training in 1990 will stay home. The armed forces will retain a political officer corps, but it will no longer act as the eyes and ears of the Communist Party.
- Hungary will chop its armed forces by up to twenty-five percent over the next two years, and tours of duty in the army will be cut from eighteen months to a year. Plans to purchase an array of new offensive weapons have been scrapped, and military forces are being regrouped from the Western frontier.
- The new leadership in Czechoslovakia seeks talks with the Kremlin on reducing the number of Soviet troops that have been stationed there since the 1968 invasion crushed the "Prague Spring" reform movement.
- In the Soviet Union, growing antimilitary sentiment is evident. Western diplomats report that draft resistance and other forms of antimilitary protest are spreading in the non-Russian republics. *[See "Red Army Blues," p. 36, this issue.]*

More than 200 Latvian youths reportedly refused to answer draft notices. In Soviet Georgia, the number of conscientious objectors is said to total more than 1,500. Lithuania is calling for the creation of a national military service that would station its youth in the home republic, not at bases of Moscow's choosing.

"It is impossible to imagine, now, the Warsaw Pact as a cohesive force in the way we have long calculated for Western defense," says Richard Perle, Assistant Secretary of Defense for International Security Policy in the Reagan Pentagon. "One can no longer imagine a cohesive, integrated battle managed by the Soviets."

This perceived dissolution of Moscow's control over the Eastern alliance may not be cause for unalloyed joy, Perle warned, because of the instability it may engender in Europe and the USSR.

Gorbachev's Grand Strategy

"Clearly, we are in for a period of extraordinary turbulence," Perle says, adding his prediction that Gorbachev is unlikely to survive for long as Soviet leader.

But Gorbachev has continued to confound naysayers who have predicted his ouster with regularity since he ascended to the pinnacle of Kremlin power in March 1985.

Peter Reddaway, a professor of political science at George Washington University, says Gorbachev's plan for political survival includes maintaining a "very weak leadership" in the military. This "makes it much easier for him to impose his policies," says Reddaway, former program secretary at the Kennan Institute for Advanced Russian Studies.

Even this tactic may not work forever, Reddaway warns, because in two or three years Communist Party conservatives "may capitalize on mounting problems of economic confusion, poor economic performance, increasing political disorder, and, possibly, crises in eastern Europe" in order to form a coalition to oust Gorbachev in favor of retrenchment and a return to stability.

Gorbachev has put into action a grand strategy in hopes of averting this defeat. On the level of military affairs, he hopes to rid the nation of unnecessary defense spending, which is a weight on the already overburdened economy.

By slicing the military budget, Gorbachev's public affairs army explains, the Soviet President hopes to free the capital goods, work force, and industrial base to kick-start the stalled economy. If, in so doing, he can moderate Western fears of the USSR, then his nation will be granted access to high technology and loans.

At the same time, he has sought through word and unilateral deed to portray the Soviet Union as no threat to the West. Indeed, he is trying to act like the World War II ally rather than the postwar adversary.

To a large extent, the "peace offensive" has worked. Western public opinion has been swayed. President George Bush declared in his New Year's message that the United States seeks no unilateral advantage to the detriment of Soviet security from changes in eastern Europe.

Most important, this perception of a diminished Soviet threat has prompted the Bush Administration to reconsider military strategy and ponder huge reductions in arms spending over the next five years. By giving way in order to throw his adversary off balance, Gorbachev appears to be working his will on the American military machine; his talk of builddown is accomplishing more than did Leonid Brezhnev's buildup.

The fundamental question, then, is this: What will the Soviet military machine look like during this period

Although current Soviet plans appear to focus on cutbacks and modernization of existing weapons (like this upgraded MiG-29), future generations of weapons are still being researched. Strategic modernization is progressing as well.

of public retrenchment for the USSR and its military alliance in the East?

The New Soviet Military

The Soviet Union appears to be on schedule in withdrawing forces from eastern Europe, but it has made little progress on military reductions within its own borders, according to a study ordered by US Rep. Les Aspin (D-Wis.), Chairman of the House Armed Services Committee.

Soviet armed forces have begun pulling back as part of unilateral reductions announced by Gorbachev in his landmark speech to the United Nations on December 7, 1988, but the promised withdrawals of six tank divisions, 50,000 men, and 5,000 tanks from eastern Europe have not been undertaken in the fashion that Western experts expected.

The motorized rifle regiment assigned to the tank divisions is being transferred to a division that will remain in eastern Europe, and a tank regiment from that division is being withdrawn instead, according to the Committee's report. Along with this restructuring, the Soviet army in eastern Europe is upgrading communications networks and researching future generations of weapons.

"Soviet forces are clearly being pulled back from eastern Europe into the Soviet Union," the report stated, "but little is known so far about what is happening to Soviet forces inside the Soviet Union."

In his UN address, Gorbachev pledged to trim Soviet forces on USSR territory west of the Ural Mountains by 10,000 tanks, 8,500 artillery pieces, and 800 combat aircraft over two years.

"It cuts both ways," Representative Aspin said when asked to analyze the Soviet unilateral reductions. "In some areas they've cut back, in others they haven't."

One Pentagon official says he continues to question exactly what Gorbachev means when he speaks of deactivating units.

"Is this the physical disposal of equipment, the physical destruction?" he asked. "Will whole garrisons be disbanded so they cannot be called up again quickly?" He also challenged Soviet proposals to beat swords into plowshares—or, in this case, tanks into tractors.

© Tom Sobolik/Black Star

Czechoslovakia wants the Kremlin to reduce the number of Soviet troops stationed there since the 1968 invasion. Here, Alexander Dubcek, ousted as Party leader in 1968 but now heading a new Czech revolution, addresses crowds in Prague.

Pentagon specialists predict that Soviet force restructuring will mirror plans in the United States calling for increased mobility and flexibility from an armed force whose overall readiness is notched back by several degrees.

In the naval arena, the Defense Department's annual publication, *Soviet Military Power,* states that patrols by Soviet warships outside home waters dropped by fifteen percent. It predicts that these patrols, particularly of missile-carrying submarines, may drop further. Specialists also note that the Soviet Union is scrapping a number of older vessels because operations and maintenance costs were too high.

"Even at current production rates, Moscow is not producing warships and submarines fast enough to maintain the strength of its rapidly aging fleet," writes Barry Blechman, Chairman of the Henry L. Stimson Center, a research organization. "Soviet civilian analysts say that the next five-year plan includes major cutbacks in shipbuilding."

Strategic Modernization

As in the American military, nuclear forces continue to be a relatively cost-effective branch of Soviet national defense, and analysts across the political spectrum agree that strategic modernization has continued in the USSR. A new model of the SS-18 is on the scene, as well as working variants of rail- and truck-borne mobile missiles. The Pentagon's plans for placing the Peacekeeper missile aboard railroad cars and hauling the Midgetman in trucks remain on the drawing board.

Gorbachev, the master political juggler, now must perform on the high-wire as well, for military analysts say he must balance his desire for reform with a knowledge that the rest of Moscow's leadership will not tolerate widespread public disorder.

Karber agrees, saying that the most important event of 1989 was the one that didn't happen: Gorbachev did nothing to halt the spread of democracy within eastern Europe and, to an extent unthinkable in the past, has allowed reform in his own nation.

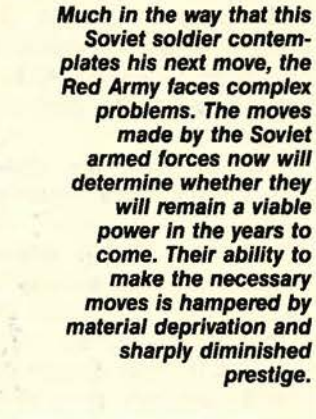
"If we are lucky, the Soviet Union and the Warsaw Pact will end up being a mutual defense society that also is an arms-control accounting agency for its members," Karber says. "I can see no reason to object to such a defensive alliance." ■

Thom Shanker, who covers defense and national security for the Chicago Tribune, *was the* Tribune's *correspondent in Moscow from 1985 to 1988. His most recent article for* Air Force *Magazine was "The Soviet Empire Seeks a Course" in the November 1989 issue.*

The old prestige of the Soviet armed forces is gone. Morale and confidence are down, too.

Red Army Blues

By Harriet Fast Scott



Much in the way that this Soviet soldier contemplates his next move, the Red Army faces complex problems. The moves made by the Soviet armed forces now will determine whether they will remain a viable power in the years to come. Their ability to make the necessary moves is hampered by material deprivation and sharply diminished prestige.

"A MILITARY coup is possible in the Soviet Union!" So warned the Soviet journal *Ogonyek* in a recent critique of the USSR defense establishment. Not surprisingly, Soviet military men were livid, and probably not just because of this one accusation.

Marshal Sergei Akhromeyev, the former Chief of the Soviet General Staff and now an advisor to Mikhail Gorbachev, vehemently denounced the charge. Deputy Defense Minister Vitaly Shabanov called it "an unforgivable lie."

The anger displayed by the two leaders suggests that they were reacting to something more than an isolated criticism. It's not hard to see what it is. These are hard times for the Soviet armed forces. All signs are that they feel beleaguered as never before. *Glasnost,* with its embarrassing exposure of deep military problems, has shattered the mystique of the Soviet forces.

This is hardly a secret. Evidence of turmoil can be found in Soviet military and civilian publications almost every day.

The military's image of invincibility is dead, having been battered regularly in print and on television. It is now admitted that troops should never have gone to Afghanistan, that training is poor, and that many officers want to get out. Military leaders express great concern about a loss of prestige.

In addition, material deprivation within Soviet forces is great. Until recently, military families have been able to live reasonably comfortable lives. Evidently, this is no longer the case. Moreover, Soviet forces are afflicted by widespread internal corruption, both financial and moral. Bribes and black marketeering are systemic. Drug and alcohol abuse are on the rise. Brutal hazing of young soldiers is commonplace.

The press has even reported the formation of "Shield," a union to protect servicemen and their families. Shield's founder, M. S. Semokhov, states that problems in the army are so acute that they "are destabilizing the armed forces and combat readiness."

Are the Soviet armed forces falling apart? Have things gotten worse, or has *glasnost* merely exposed problems that always existed? The torrent of disclosures must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© International Defense Images

The Soviets are having trouble getting cadets such as these into service as resistance to conscription grows. The recruits they do get are of such low quality that one Soviet officer has referred to them as "degenerates" and "aesthetes."

be viewed with caution; the military may be exaggerating the problems to put pressure on Kremlin leaders to ease up on the armed forces. Even so, the seriousness of the difficulties is evident.

A Tarnished Image

Nothing concerns Soviet military men more than the collapse of the armed forces' once-unassailable public image.

Speaking to the Supreme Soviet, Deputy Defense Minister Shabanov was blunt: "The prestige of the military profession is falling. Never before have we had such a situation. . . . Certain publications have become the mouthpieces of forces trying to paint a black picture of life in the army."

Former military men observe the mounting criticisms with disbelief. "I was watching 'Topical Interview' on channel one," wrote one veteran, "and it made me sick. Undermining the Soviet Army's prestige has become the fashion. The negative aspects are exaggerated. The army is protecting the motherland, helping people in distress, as at Chernobyl, and schooling young people. This is scarcely mentioned."

The picture of military life presented by Soviet TV and in the press is having an impact. Applications to military schools are falling off, indicating that young Soviets no longer are attracted to the profession of arms.

The new attitude is increasingly manifest in physical assaults on Soviet military personnel, once an unthinkable event. One leading military journal goes so far as to claim that "an antiarmy syndrome has appeared."

For example, it said, Gen. Maj. A. Arutyunyan, the Military Commissar in Yerevan, tried to address some young men protesting a military call-up. "A frenzied crowd beat him up for more than twenty minutes," the journal reported. "It's a wonder he was not killed."

Gen. M. Moiseiev, Chief of the General Staff, gave startling crime statistics to the Congress of People's Deputies. "Attacks on officers are increasing," he said. "Fifty-three officers were killed [in 1989], eleven of them senior level officers and twenty-three warrant officers. They were performing their military duty."

The largest number of these murders, General Moiseiev said, took place in the Leningrad, Far East, Moscow, Transcaucasus, and Turkestan Military Districts. He added that attacks on officers by "hooligans on the streets of Moscow and Leningrad" are growing more frequent.

Morale Is Suffering

Morale within the military appears to be suffering from turbulence and uncertainty. Gorbachev's move to reduce the Soviet armed forces by 500,000 men by the end of 1990 is not going smoothly.

The reductions are seemingly haphazard. Last summer, early release from the military for former students caught educators by surprise. "Every class in our institute is already full," moaned one school official, "and just weeks before the fall term starts, we get 500 additional students. Where can we put them?"

Queried on TV about changes in the armed forces, Marshal Akhromeyev noted that forty-five percent of the top military leadership and sixty percent of mid-level leaders had recently been replaced.

Increasingly, young Soviet officers want to get out. Lt. Col. V. Vasiliev, a unit personnel officer, finds a long line of them each morning seeking to resign. Seventy percent are under twenty-five; more than ninety percent are under thirty. Why do these men, the youngest and most capable, want to leave the service?

Vasiliev cited the case of one army lieutentant. After Afghanistan, "I served in a couple of regiments," the lieutenant said. "Nobody wanted me. There was nowhere to live. I had to sleep in reading rooms, on bare chairs. I didn't get the medals awarded me. Tell me, would you want to serve after that?" He continued, "In Afghanistan I was busy. Here, I have to conduct political studies and do bookkeeping. People fussing, 'Stand there. Come here.' Nobody talks, nobody has a conversation. I'm treated like a robot."

The declining prestige of the military and military service also is reflected in changing Soviet attitudes toward compulsory military duty, accompanied by an apparent increase in draft evasion.

"We have a new problem," maintains Gen. Lt. N. Ter-Grigoryants, a deputy chief of the Ground Forces Main Staff. "Many young people are reluctant—and I stress I am not talking about isolated cases—to fulfill their Constitutional duty."

General Moiseiev recently gave 7,500 as the number of people refusing to perform military service. Criminal proceedings have started in Latvia, Estonia, Lithuania, Moldavia, Armenia, and Georgia against 1,482 of these offenders.

Increasingly, local officials seem to wink at the problem. General Ter-Grigoryants has stated that boycotts of conscription are taking place right before the eyes of local officials, who do not respond. He accused them of "keeping quiet and pretending that nothing is happening." In one Armenian region, groups blocked the way of draftees trying to enter the military commissariat building.

In the Baltic republic of Lithuania, activists have distributed booklets containing the following statement: "Since the Lithuanian state has been occupied by the Soviet Union, the republic's citizens have the right to refuse to serve in the Soviet Union's occupation troops." Nothing, apparently, has been done to halt such distributions.

Soviet law stipulates that all males aged fifteen and sixteen must receive "beginning military training," followed by "specialist training" at seventeen. At eighteen, they are called up for active military duty. Although their records may show that the required training has been completed, actual tests often indicate that no training whatsoever has been given.

A check of the instructors' qualifications explains why. More than one half of military instructors in the high schools have had no formal military education. In Central Asia, at least one half of the military instructors had never served on active duty.

It's not just a tarnished image that bothers Soviet troops. Equally troubling to senior Soviet military leaders is widespread material deprivation of troops and even officers.

Inadequate Housing

The Soviet military newspaper *Red Star,* under the headline "From Flying a High-Performance Aircraft to This," printed a telling series of photographs. One shows a certain Air Forces Captain Rachkov alongside his expensive fighter aircraft; a second shows his plainly dejected young wife, Olga, sitting in a single, cramped room under a line hung with clothes. On one side is a bed with two sleeping children. On the other, behind a refrigerator, is the couple's bed. According to the paper, frost forms on the floor at night.

An article in *Moscow News* described living conditions at another military post: "For a total of twelve married officers—a total of sixty adults and children—there are two toilets, one bath, two showers, and three stoves."

Complaints about the lack of housing outnumber all others. About 100,000 officers are being forced out of jobs as a result of Gorbachev's cut in the armed forces. Where will they live when they retire? As Marshal Akhromeyev explained it: "The armed forces build their own bases and quarters. Each year, 4.3 million square meters of housing—86,000 apartments—are commissioned. But each year they lose 70,000 apartments to officers who retire." The 16,000 that remain are not nearly enough to meet the need. "We permanently have 155,000–160,000 people without apartments," estimates Marshal Akhromeyev.

One *Red Star* reporter queried Defense Minister Dmitri Yazov about housing shortages. "Is the figure of 7,500 officers without apartments in Moscow alone a realistic one?" "It is," General Yazov answered.

Gen. Maj. M. V. Malkov says that more than 100,000 officers do not have their own place to live. Junior officers get only 180–300 rubles per month (the official rate of exchange is now six rubles for one dollar). Out of this, they have to pay for transportation and rent.

As General Malkov sees it, "the prestige of the army has fallen mostly because of bad living conditions."

The problem is widespread. A recent poll taken of Soviet officers requesting retirement showed that only thirty-nine percent have their own quarters; twelve percent live in communal quarters; twenty-three

Demographics also work against cohesion in the Soviet armed forces. Ethnic troops often would rather fight with each other, and in some units the largely Russian-nationality officers must travel in groups to protect themselves from the largely non-Russian rank and file.

percent live in barracks; twenty-six percent rent shelter with money from their own pockets.

For veterans, the shortage of housing is particularly acute, with many lacking any kind of individual shelter at all. "All those people rightfully count on priority for living space, but we cannot give it to them," confessed one town's mayor. "Let's be realistic. We don't have enough construction workers. Last year only 273 apartments [in his town] were completed. At the same time 371 families were added to the list."

Retiring after thirty years of active duty, Col. G. Pikiner and his wife had decided to settle in the town of Tula. However, he found that they must wait two years for an apartment. There was a catch-22: They could not get on the civilian housing list until they gave up military quarters.

© Anna Clopet/IDI

Soviet pilots can be proud of their aircraft, as this MiG-29 pilot clearly is. Their living conditions are another matter. A Soviet newspaper related the tale of one air force captain forced to live in conditions reminiscent of a US inner-city slum. Many young military pilots earn half the salary of a Soviet bus driver.

Inadequate Pay

Articles in the Soviet press make clear that military pay is inadequate. The United States has suddenly become a model.

"In the United States," one officer writes, "a man in uniform enjoys great social respect. His welfare provisions are high. In our country, this has long been a failure. An officer gets a family allowance of only seventy rubles per month. Many officers say outright that they live below the poverty line. A young military pilot, for example, averages between 240 and 250 rubles per month. This is half as much as a bus driver gets!"

The prospects for improvement are remote, as Defense Minister Yazov candidly acknowledged to the Supreme Soviet recently. "Many people are raising the question of [creating] a professional army," Yazov noted. "Let me say straightaway we cannot afford a professional army."

Married officers with families now speak up. Maj. O. Kortyshkov has brought up at Party meetings the need to have one or two Saturdays off each month. He must use public transportation to get to work. His commander is assigned a car and driver. "Just once," the angry Major said, "I would like to have him travel to work on public transportation. Maybe then something would change."

Another officer said that he works 320 hours a month, 240 hours of which are on combat alert duty. He calculated his pay at less than a ruble an hour. Because of frequent moves, his wife, a trained engineer, has found work only two years out of the last twenty.

Officers' wives complain that their husbands go to work when the children are still asleep and return after they have gone to bed. One claimed that she and her husband had been separated for more than half of their marriage's eighteen years.

Bad as the situation is for active-duty servicemen, it is worse for veterans. In 1989, the Chairman of the War and Labor Veterans Council told the Supreme Soviet that 22,000,000 veterans receive a monthly pension of sixty rubles or less. Ten million of them have no other source of income.

Construction of a new Moscow veterans' hospital, reports Col. F. Lushnikov, started seventeen years ago; it won't be completed for another three years.

Disabled veterans from both the "Great Patriotic War" and Afghanistan are said to suffer from neglect, waste, and inefficiency. For example, Soviet-designed wheelchairs have the big wheels in front, a design quirk that greatly multiplies the strength a person needs to use it. Invalids beg for East German models.

Artificial limbs are badly made and poorly fitted. Wearers claim it is "torture" to wear them. Some veterans ask to go to Czechoslovakia or East Germany to be fitted properly.

Rampant Corruption

In addition to problems created by a tarnished image and declining living standards, the Soviet armed forces also seem to be feeling the negative effects of an internal ethical and moral collapse.

Petty corruption appears to be widespread. Published reports make clear that bribery of Soviet military officials may not be an uncommon practice. *Red Star* reported a case where a father paid 100 rubles and supplied a case of vodka to get his son assigned in the Moscow area. One Russian mother is said to have paid 400 rubles to make certain that her son continued to be based near her home.

Corruption extends to the sale of military equipment. In fact, foreign tourists are advised to be careful about walking outside their hotels in the evening. Streets and subways of major cities are no longer safe. Today criminals possess a variety of weapons, many obtained from military sources.

Col. A. Rybchinski was asked about reports that some soldiers,

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Parades of military might notwithstanding, the Soviet armed forces face daunting obstacles if they are to achieve more than just the appearance of strength. Housing shortages, rampant corruption, and low morale are just some of the factors arrayed against those attempting to increase military capability.

NCOs, and even commissioned officers have sold combat weapons. Thefts are most prevalent, he said, in the Transbaykal, Far East, Turkestan, Byelorussian, and Transcaucasus Military Districts and in the Pacific Ocean and Baltic Fleets. Stealing weapons is not difficult, since "a number of storage facilities do not have bolts or locks, doors do not shut properly, and there are even gaps in the walls."

A variety of weapons is now in the hands of civilians. A. Karpov, an *Izvestia* reporter, writes that "a taxi driver found a grenade that had been 'forgotten' by one of his passengers." In addition, he said, "workers found a mine for an 82-mm mortar near their factory; horsemen almost ran into two antitank mines in the city race course; and someone discarded a sack containing ammunition—grenades, mines, and rounds for a submachine gun and heavy machine gun—in a Dushanbe cemetery."

Soviet military leaders are displeased with what they view as the low moral character of today's recruits. General Lizichev, Chief of the Main Political Directorate, was frank about this problem.

"The radical improvement of discipline demanded of us today by the Party and by *perestroika* has not been achieved," he conceded recently. "We had to defer the call-up of students. This decision is undoubtedly correct, but once again a sizable proportion of young people are being called up, primarily into construction troops, who already have criminal records, have moral and physical defects, and are already familiar with both drugs and alcohol."

Defense Minister Yazov confirmed that the armed forces, "very regrettably," have called up more than 100,000 conscripts who already have spent some time in jail. Col. K. Golubevas, of the Lithuanian Military Commissariat, complained that recruits are frequently "degenerates." "It is simply depressing to look at some of these soldiers-to-be," lamented the Colonel. "Pale, eighteen-year-old aesthetes. It is no secret that there is an increase of those addicted to alcohol, narcotics, and drugs."

Brutality in the Services

In truth, Soviet military service doesn't seem to improve the caliber of the individual very much. The brutality and personal corruption of those who have been in the service for a while is startling. Hazing is widespread. Vicious beatings of new soldiers are only too common.

"At the very beginning of our service," one soldier wrote, " 'governors' in the battery took the 'youngsters' into the storeroom and began to 'explain the service.' They said it was all a case of 'keeping your nose to the grindstone' in your first year. Then after a year, you yourself would get others to do the running around.

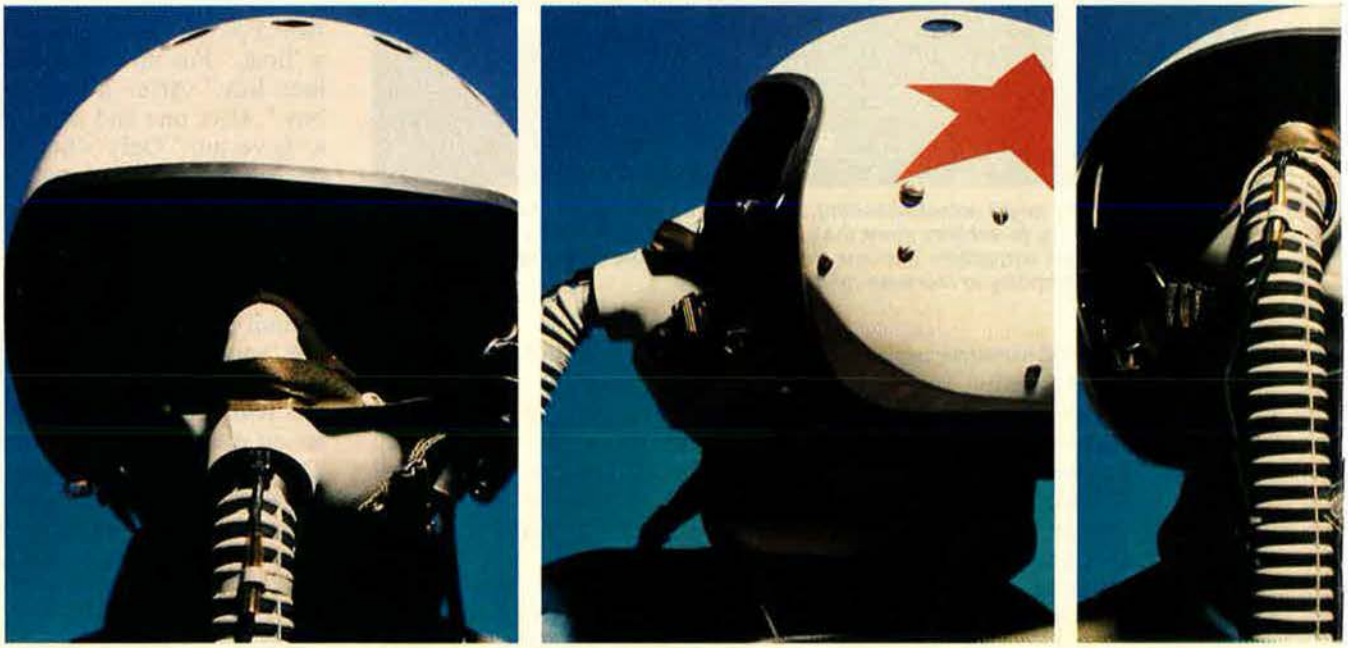
"Service years were divided this way: For the first six months you are a 'float.' For up to a year, a 'bootlace boy.' After a year, a 'brush boy.' After one and one-half years, a 'governor.' Only when you leave do you become a citizen. All these nicknames degrade human dignity, and the sacred words behind military duty—protector of the motherland, soldier—are forgotten. I still cannot forget the terrified look on the 'youngsters'' faces."

In the Soviet armed forces, there are two types of bullying. One is based on length of time in service. The second type, which is growing more commonplace, is based on racial and ethnic differences. One soldier reported that "we Russians" always tried to stay out of the barracks dominated by non-Russians, choosing instead to live, eat, and sleep in an abandoned cabin 4.5 square meters in size. When necessary, he said, the Russians went to their unit area in groups. If one went alone, he would be "brutally beaten up, regardless of length of service or personal qualities."

When ethnic incidents mounted in the Transcaucasus, Armenians began beating up Azerbaijanis and vice versa, no matter where they were stationed. The Soviet press has reported that it is no longer safe to conduct exercises in night fighting.

In sum, Soviet armed forces face a huge internal challenge, one that is certain to affect the fighting capability of the force for years to come. ■

Harriet Fast Scott, a Washington consultant on Soviet military affairs, is a member of the General Advisory Committee on Arms Control and Disarmament. She has lived in and traveled extensively through the USSR and maintains a large private library of Soviet military publications. Her translation and analysis of the Third Edition of Marshal V. D. Sokolovski's Soviet Military Strategy *is a standard reference work, as are her four other books*—The Armed Forces of the USSR, The Soviet Art of War, The Soviet Control Structure, *and* Soviet Military Doctrine, *all written with her husband, Dr. William F. Scott.*



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GENERAL DYNAMICS

Berlin, consumed by change and uncertainty, epitomizes the challenge ahead for Europe and the superpowers.

Beyond the Wall

By Charles W. Corddry

TO BE in Berlin at the close of 1989 was to witness stupendous change and joyous visiting back and forth through the increasingly porous Wall, the crowds undaunted by freezing cold. Up to 500,000 East Germans were said to be jamming West Berlin, a city of 2,000,000, on weekdays, and Mayor Walter Momper's office put the number at 1,000,000 on Saturdays and Sundays. It was only the first wave of East German visitors to what surely will be a reunited capital city—probably sooner than many think.

What clearly seems to have disappeared in the East is fear. You think back twenty-nine years to the shooting scenes on the Bernauerstrasse as East Germans tried to escape through windows of buildings that became part of the Wall, the bricking up of those windows, and eventually the destruction of the buildings to give a clear field of fire.

Now, you hear, thousands of former secret police (the Stasi) have new employment in the mines. Infuriated opposition groups went on the offensive, without fear, when they discovered that the Stasi, though slated for dissolution, still had 60,000 employees drawing paychecks.

Viewing the incredible events of November, the East German author Stefan Heym told the Munich newspaper *Suddeutsche Zeitung:* "The old authorities and forms of rule are bankrupt." A convinced socialist and long a thorn in the side of the hard-line Communist regime, Mr. Heym traced the beginning of the end of rule by force to Hungary's dismantling of the barbed wire on its border with Austria last May. A flood of East Germans to the West followed in September—through Hungary, Austria, Poland, and Czechoslovakia. There had been nothing like it since the Wall went up in August 1961.

"The moment the Wall had a hole in it, everything was settled," Mr. Heym said in the interview, which was reprinted in the British newspaper *The Independent*. He meant that the goose was cooked for the old authorities and their ways. And so it was, in East Germany and the other former Soviet satellites.

"The moment the Wall had a hole in it, everything was settled." But there is no clear path ahead for new authorities or certainty about who they will be.

Unforeseen Challenges

That did not mean that there was a

clear path ahead for new authorities or much certainty about who they would be, especially in East Germany, where Communist reformers were doing their best to keep power. Elections promised for this month in East Germany already have brought turbulent times, as fragmented opposition groups have tried to get their programs together and overcome whatever advantages lay with the distrusted incumbents, while popular anger over the economy and past corruption has called for action now.

Large, fundamental issues have a way of taking time to be settled, often only to spawn new ones. Berlin, its western sector still surrounded by a potentially explosive East Germany and by Soviet forces, was a lens that brought into sharpened focus some of the challenges and uncertainties for the 1990s:

- A seeming convergence of United States and Soviet interests and attitudes toward events in Central Europe.
- Changed roles for the North Atlantic Treaty Organization and Warsaw Pact military alliances, their transformation into chiefly political institutions, and their possible (some said probable) dissolution.
- Reunification (or, as many prefer, unification) of the East and West German states. An article from Berlin in the London *Financial Times* suggested, "Berliners—East and West—like to think that the way the two halves of the city start to live together could be a model" for reunification of the country.

Theories of ultimate superpower convergence of some sort have been spun out over much of the cold war, but have been too broad and too radical to attract many fans. But, as noted by analysts at the International Institute for Strategic Studies, several quite specific areas were now developing where interests seemed to converge—perhaps lastingly—not all to huzzahs from allies on either side.

"While it is not for the United States and the Soviet Union to design the future for Europeans or for any other people," President Bush said during the Malta summit at the beginning of December, where that future was plainly a transcendent issue, "I am convinced that a cooperative US-Soviet relationship can indeed make the future safer and brighter. . . .

"I am optimistic that, as the West works patiently together and increasingly cooperates with the Soviet Union, we can realize a lasting peace and transform the East-West relationship to one of enduring cooperation. . . . That's the future that Chairman [Mikhail S.] Gorbachev and I began right here in Malta."

In another three weeks, the "cooperative relationship" had come to the point where a US Secretary of State, James A. Baker III, could say that Soviet intervention in Romania on the side of those fighting the dictator Nicolae Ceausescu would be acceptable.

Points on which US-Soviet positions appear to converge include caution and restraint on German reunification, maintenance of the two alliances, continuing the role of in-place forces in Europe, and reduced deployment of short-range nuclear forces (SNF) after a treaty establishing parity in conventional forces is completed.

No Hurry to Reunite

Moscow has geographic and strategic reasons, and memories of the "Great Patriotic War," to explain its aversion to any haste in reuniting the two Germanys. Despite Mr. Gorbachev's visit to and popularity in Bonn and expanding economic relations, the specter of German unity was enough to move Moscow from favoring to opposing the dismantling of the alliances. It might be rather hard to imagine what the two alliances would look like if there were a united, powerful Germany in central Europe. It would be less difficult to imagine if the two German states were to remain in their respective alliances, with their own foreign policies, while pressing forward with the partnership arrangements that West German Chancellor Helmut Kohl envisions as steps on the way to unity.

I met a Muscovite residing in East Berlin, a man who must be described as "tuned to the home frequency," who argued the necessity for the alliances on much the same basis as many Americans argue it. In terms so broad that East and West Germans see them as ducking the unity question, he asserted the continued need for the alliances to manage change and maintain stability, with military forces acting as an important element.

Peace does not persist forever, he stated, without pursuing the point and without acknowledging an East German's derisory enquiry, "Who's going to fight, Austria and Hungary?" The Soviet citizen seriously put it to me that the United States wanted the Russians to stay in East Germany "to justify US presence in Europe." If so, that would be a remarkable bit of convergence, overturning forty or so years of stated US policy maintaining that the Red Army ought to go home.

For the present, the two sides do favor continued stationing of forces in Europe as they negotiate them downward at the Vienna sessions on Conventional Armed Forces in Europe (CFE).

The Russians are in deep crisis at home. But, says Hans Binnendijk, IISS Director of Studies, "with all this instability, they want traditional structures to remain; they fear moving too fast."

He reports a twist in the Soviet approach to arms control, one that could cause a new outbreak of the German nuclear allergy but would sit well with the US and Britain.

"The Soviets now see a role for SNF," Mr. Binnendijk asserts. "A CFE treaty with parity makes them think about the nuclear deterrent." The Russians appear to have 500 to 1,000 SNF warheads in mind, which could lead to the long-planned reduction in the US arsenal in Europe of something under 4,000 and might somewhat mollify West Germans.

On the other hand, the seemingly dying issue of SNF modernization in the West would probably be restored to full vigor. It would not do, after all, to stay with the present weapons; their range would take them only to what are hoped to be the emerging east European democracies.

Obsolete Alliances?

What of the alliances? The Warsaw Pact is formally intact, having not been questioned much during the upheavals in the ex-satellites, and so, obviously, is NATO. Their futures are widely and hotly debated. Some contend that other ensurers of European security are tak-

"Berliners—East and West—like to think that the way the two halves of the city start to live together could be a model" for reunification of the country.

ing on increasing relevance, such as the Conference on Security and Cooperation in Europe process and the European Community, with its economic integration coming in 1992 and its probable broadening to include breakaway east European countries. Nobody can foreclose possibilities of renewed repression in the East and bloody crackdowns, but these are not scenarios with many adherents these days.

David Anderson, a former US Ambassador to East Germany who now directs the Aspen Institute in West Berlin, says that, whether or not Gorbachev survives, developments in eastern Europe have gone too far to return to the old ways. Even if the Soviet leader falls, the same desperate economic conditions will afflict the Soviet Union, and the nationality problems will still threaten the Soviet empire.

"Probably in the next five years," says Mr. Anderson, "alliance systems as we know them will be gone. They are military structures. When military threats are reduced, what are the alliances?" Soviet military planners, looking ahead five or ten years, "have to write off eastern Europe as a source of support." Anyway, the Soviets, Anderson reckons, "don't take the threat from the West very seriously."

In the West, of course, efforts are under way to assign a more political role to NATO, an institution that provides the United States its main presence in Europe. The CFE negotiations are being conducted by the two alliances. They would be the obvious structures for overseeing and verifying the reductions expected from a CFE I treaty and from a later CFE II on which negotiations presumably would follow.

As for the Warsaw Pact, though it still is formally intact, its military cohesion is rated as close to nil. The East's spasms have answered for now the old question about Pact forces' reliability. It seemed plain enough to many, when the Soviet Union alone deployed forces in Europe at least equal to NATO's, that Moscow's expectations of its allies, if war came, were quite modest. The political disaffection with communism would seem to have made even modest expectations unrealistic.

It seems obvious that direct Soviet control of east European armies in time of external crisis is now ended. Under little-known Warsaw Pact command and control arrangements, the Soviet high command could order those forces without approval from national authorities. Under the Moscow-sanctioned "Sinatra doctrine" ("I did it my way"), new regimes hardly would tolerate such foreign control. To survive, it would seem, the Pact must now become an alliance of sovereign states in which each can speak its piece. Such pluralism already manifests itself in the CFE talks. It is open to question to what extent Moscow now could exercise strategic control over the East in a conflict.

Edward L. Warner III, a senior defense analyst at the RAND Corp., not long ago estimated for the House Armed Services Committee that planned Soviet unilateral force cuts in eastern Europe would reduce the combat power of ground forces there by twenty to twenty-five percent. On reexamination, he has now cut that estimate to fifteen percent, because the Soviets are leaving behind more artillery than he had expected.

However, says Mr. Warner, that change pales beside the consequences of east European defec-

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"The Soviet position here in Germany, which you would think is the last holdout, is just being tossed overboard. They just don't care anymore."

tions, unreliability of forces there, and greater warning time available to the West before attack.

At the Aspen Institute, Deputy Director Daniel Hamilton marvels at the "nonchalance" with which the Soviets seem to be giving up their east European empire so they can deal with crises within the Soviet Union. Of course, as other analysts note, Mr. Gorbachev wants a nonpariah, noninterventionist image for his country, and anything he might have done when the blow-up came in East Germany would have run against his own interest. Still, as Mr. Hamilton mulls it over, it appears that "the Soviet position here in Germany, which you would think is the last holdout, is just being tossed overboard. . . . They just don't care anymore. . . . It's quite striking."

Crisis at Home

What this suggests is that Mr. Gorbachev is in too deep a crisis at home to deal with such issues, says Mr. Hamilton.

Military men, bearing heavy responsibilities and needing to look at capabilities as well as at will and intention, perforce must take the cautious, conservative view.

From his Berlin vantage point, Army Maj. Gen. Raymond E. Haddock, the US Commander and highest-ranking American in the city, fully accepts that in the current superpower atmosphere, no Soviet attack is to be expected. Certainly the warning time has expanded for the reasons others cite. The Soviets have begun the drawdown that Mr. Gorbachev promised, at the United Nations in December 1988, to carry out over the following two years. They have removed 20,000 of a promised 50,000 troops and 3,000 tanks. Their army, navy, and air force strength in East Germany totals 470,000.

Cuts in the forces around Berlin "look on track," the General says. "What was not clear were the changes" to be made in remaining forces. Tank divisions are converting to mechanized rifle units, and some of the divisional equipment is being retained in the readjustment. A major modernization is simultaneously in progress, General Haddock says. He mentions air defenses, artillery, and armored troop carriers with antitank missiles. On balance, and for what it is worth, Soviet capabilities in East Germany are "only slightly smaller" than they were at the end of 1988.

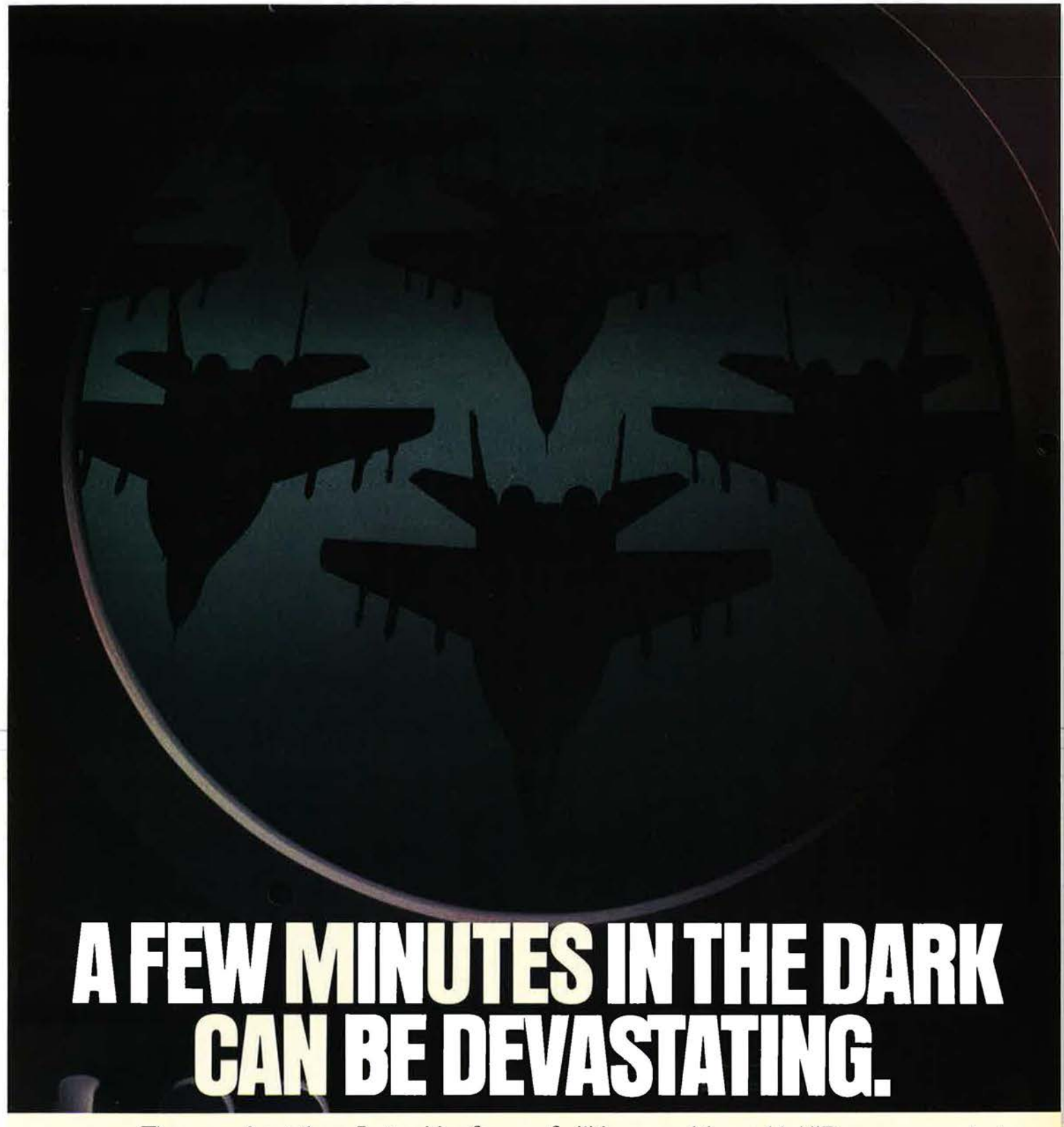
Meanwhile, as Mr. Hamilton forecast, the unification cry gains volume and will be a full-blown issue in the elections scheduled in both Germanys this year. Governments and diplomats will be nervous about keeping matters under control. Politicians will want to win. In the streets of East Germany, where the agenda was really being set at the end of last year, the demands will continue to center on reform and renewal. It will be quite a mixture.

I talked in East Berlin with two representative intellectuals, both of whom had crossed swords with the Erich Honecker regime at one time or another and were now enjoying East German *glasnost*—Franz Köhler, a diplomat who lectures at the Institute for International Relations, and Gerhard Scheumann, a documentary film producer. Both were longtime Communist Party members, but they had quite different views on the future.

Mr. Köhler had thrown in the towel, saying he did not have another forty years to wait for a better life and that East Germany's nearly insoluble problems must be dealt with through drastic economic reform. Mr. Scheumann retained his idealism, believing that in the land of Marx and Engels corruption could be ended and socialist utopia achieved.

Both agreed that the impetus for unification, which did not appeal much to them (and was opposed by the Communist government of the moment), was coming from East Germany, from the streets. Skilled and unskilled people were leaving, as they did before the Wall was built, because, Mr. Köhler said, "they waited forty years for a better life that has not come, and the young ones don't believe it anymore." ■

Charles W. Corddry, Washington-based defense correspondent for the Baltimore Sun, has covered military and foreign-policy issues for more than forty-eight years. His most recent article for Air Force *Magazine was "The Chairmen Size It Up" in the February 1990 issue.*



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Defense Minister Yazov must surely have his fingers crossed when he says the B-2 bomber would be no challenge.

Stealthy Pressures on Soviet Air Defense

By John W. R. Lepingwell

THE SOVIET Union fields the largest air defense system in the world. No agreement exists about its capabilities, though this factor is now of decisive importance in planning future US bomber forces.

The current system consists of some 2,200 interceptors, 7,000 surface-to-air missile launchers, 9,000 air-defense radars, and more than 500,000 troops. In forty years of existence as a separate service, the Soviet Air Defense Troops (*Voyska Protivovozdushnoy Oborony,* or VPVO) have spent $400 billion developing and maintaining this force.

The size of the system is impressive, but how effective is the VPVO? Opinion varies widely.

Soviet authorities, at least in public, say that the system is formidable; Defense Minister Dmitri Yazov maintains that even the USAF B-2A Stealth bomber "is not considered a challenge."

US Air Force spokesmen, acknowledging that the air defense system will, over time, pose a serious challenge to the B-1B bomber, maintain that defending against the B-2A will be "extremely difficult and costly to achieve."

Others believe that both sides overstate major parts of their cases. Rep. Les Aspin, the Wisconsin Democrat who chairs the House Armed Services Committee, is demanding a fresh Pentagon assessment of the Soviet air defense system. He believes that it is impossible to determine the requirement for new strategic bombers without knowing more about the capabilities of the Soviet air defense system.

Even more important are questions about whether and how the Soviet Union will react to the defensive challenge posed by a new generation of stealthy US bombers and cruise missiles.

The evidence indicates that the Soviet Union will attempt to meet the American stealth threat by making incremental changes in existing technologies and programs and by proposing vigorous diplomatic and arms-control initiatives to prevent or limit B-2 bomber and Advanced Cruise Missile forces.

USAF officials say that the formidable Soviet air defense system (including the SA-9 "Gaskin," above) will eventually pose a threat to the Air Force's B-1B, but defending against the B-2A (right) will be difficult and costly.

A Response to the Strategic Bomber

The foundation of the modern VPVO was laid in the autumn of

1941, as German forces closed in on Moscow. Stalin reorganized weak Soviet air defenses into a single command to concentrate and coordinate the air defense of strategic targets. This set a precedent for a separate service for strategic air defense. When the US strategic bomber threat grew, the VPVO was created.

The VPVO probably cannot use its combat equipment fully and effectively.

Goaded by American U-2 overflights, Nikita Khrushchev gave the VPVO high priority, believing that new air defense technologies such as SAMs would stop the overflights and render the US bomber force ineffective. By the mid-1960s, the VPVO had deployed a sophisticated air defense system.

When the 1972 ABM Treaty foreclosed the possibility of creating a comprehensive strategic air and missile defense, the VPVO's prestige and share of defense budgets began to wane. The VPVO maintained its forces, adding the mission of theater air defense of Warsaw Pact lines of communication. To accomplish this mission, the VPVO was reorganized in 1981. Control of half its interceptors passed to the Soviet Air Force, and other VPVO forces were subordinated to local and theater commands.

The new setup met with harsh criticism, and in 1986 the VPVO returned to its old force structure. The theater mission has been retained, but the overwhelming bulk of VPVO attention focuses on the resurgent US strategic air threat to the Soviet homeland.

VPVO force size has remained fairly constant over the last decade. The system is based on area defenses of the European USSR, the Kola Peninsula, the Far East, and a strip along the Sino-Soviet border. Augmenting these broad-area defenses are point defenses of critical targets. Soviet SAMs are arranged in belts, reinforced near major cities, industrial areas, and significant military targets. The Moscow Air Defense District, covering the nation's industrial, military, and political heart, is accorded special prominence.

SAM Capabilities

Most of the deployed SAMs were designed in the late 1950s and early 1960s. These systems, though they have undergone major upgrading, have little capability against cruise missiles or low-flying bombers.

A recently deployed Soviet SAM, the SA-10 "Grumble," is credited with an ability to destroy low-altitude intruders. It is being deployed around Moscow and other sites, replacing old SA-1, SA-2, and SA-3 SAMs first deployed in the 1950s. Some 1,700 fixed and mobile SA-10 launchers have been deployed. It appears that the VPVO has not deployed the new SA-12B "Giant" SAM, although it has been fielded by Soviet Army air defense units.

The VPVO has taken simple measures to increase the low-altitude combat capabilities of SAM units. For example, it is now equipping them with visual observation posts to augment radar coverage. Moreover, some SAM posts have been provided with antiaircraft machine guns and portable, shoulder-fired SAMs. Older SAMs have been fitted with electro-optical guidance, permitting their use even under conditions of heavy jamming.

Such low-tech measures may not be terribly effective, but they are cheap and provide some additional capabilities while more sophisticated low-altitude systems are developed.

Looking at the VPVO's interceptor force, one finds that the majority of planes are older aircraft such as the MiG-23 "Flogger," MiG-25 "Foxbat," and Su-15 "Flagon."

The age of the force, however, is changing as more modern aircraft enter the VPVO inventory. During the 1980s, the VPVO took delivery of more than 400 MiG-31 "Foxhound" and Su-27 "Flanker" aircraft, both equipped with look-down/shoot-down radars that give them considerably more capability than their predecessors had against low-flying targets. The Su-27 is particularly well suited to air-to-air combat.

In addition, the VPVO is also deploying a modern airborne warning and control system (AWACS) aircraft, the Il-76 "Mainstay." Thus far, approximately ten of these planes have entered service. Experts believe the Mainstay may be capable of detecting a low-flying B-1B bomber. Its ability to detect and track cruise missiles, however, is much in doubt. These aircraft mark an important addition to the VPVO's warning and interception system and may greatly increase the effectiveness of fighters.

VPVO Preparedness

How well prepared are the Troops of Air Defense? Evidence is mixed. German teenager Mathias Rust's daring penetration of Soviet airspace on May 28, 1987, flying in a small Cessna aircraft, is seen by some as an indicator of the VPVO's incompetence. Rust's aircraft is reported to have been detected and intercepted; VPVO officers simply concluded that it was a stray civilian aircraft rather than a foreign intruder. The VPVO has therefore laid much of the blame on indecisive commanders rather than on forces or technology.

The Soviet press used the Rust affair as an occasion to excoriate VPVO training and performance. The criticisms focused on what commentators denounced as simplistic and ineffective training, weak interbranch coordination and cooperation, use of primitive training equipment, and reliance on conscripts with poor technical abilities.

Many complaints focus on "formalism," a euphemism for official falsification of exercise results to achieve high marks and promotions. For example, "surprise" VPVO fighter attacks on a SAM unit would be scheduled far in advance so the SAM troops would be prepared to perform well. The SAM unit would then claim to have destroyed all the fighters.

Even though some of the VPVO leadership was replaced in the wake of the Rust incident, training problems apparently persist. The reported deficiencies are of such magnitude that the VPVO probably cannot use its combat equipment fully and effectively.

Air Defense Scenarios

The VPVO faces a variety of threats, from conventional attacks during a theater war to attacks by Chinese nuclear forces to large-scale nuclear assaults by the US strategic bomber force.

Coping with the latter, of course, presents the most important and stressful mission for the air defense system. The VPVO views the force of US bombers and cruise missiles as a formidable adversary that has undergone a rapid expansion in the last decade and now poses a growing first-strike threat.

Western analysts might view the prospect of a first strike with bombers and cruise missiles as fanciful. The VPVO evidently does not. The VPVO's worst-case scenario is of an attack that starts with a no-warning precursor strike by US cruise missiles against important C^3 and air defense targets, the first wave of a counterforce blow.

Acceptance of this as a plausible contingency raises the force and readiness requirements of the VPVO and may be an important VPVO planning scenario, however implausible it is in fact.

At the other extreme is the scenario that is most favorable for the VPVO. In it, the superpower exchange would start with Soviet preemptive counterforce attacks against US strategic forces, aimed at destroying US bombers on the ground and preventing or delaying US air defense suppression attacks by ICBMs and SLBMs. Surviving US bombers then would have to face an alerted and intact Soviet air defense system as they approached their targets.

Even in this scenario, however, the surviving US bomber force could still number 100 aircraft, carrying well over 1,000 warheads and targeted against a number of different areas. To achieve high levels of attrition against such a force, the VPVO would need large numbers of intercepts and engagements. This also drives up force requirements. VPVO effectiveness would be at its highest in this case and might prevent destruction of defended targets.

The VPVO emphasizes the importance of destroying hostile aircraft before they penetrate Soviet airspace. If they are to be destroyed, they must be detected and tracked. While over-the-horizon backscatter (OTH-B) radars can detect aircraft at long ranges and vector AWACS and fighters toward them, they cannot be used in a northerly direction due to effects from the aurora borealis. One OTH-B radar has been deployed to cover Pacific approaches to the USSR.

The VPVO views the force of US bombers and cruise missiles as a formidable adversary.

Due to the limitations of OTH-B radars, the VPVO mounts Il-76 Mainstay patrols from the Kola Peninsula. Together with the Su-27 Flanker and MiG-31 Foxhound long-range interceptors, patrols could be maintained over the Barents Sea to intercept and destroy incoming aircraft.

Holes in the Plan

Soviet forward defense plans, however, are not without weaknesses. First, the Soviets have too few Mainstays to provide twenty-four-hour coverage of large areas over a long time. Keeping the Mainstay on strip alert and launching it on tactical warning makes it vulnerable to surprise attack.

Second, Soviet fighters are not yet equipped for in-flight refueling, which limits their long-range combat air patrol endurance and their interception capabilities. This also threatens their survivability, because US ballistic missile attacks could destroy the fighter bases. Surviving fighters could not remain airborne long enough for the bombers to arrive.

Third, authorities might have to divert Mainstay aircraft to theater defense missions, reducing coverage of bomber approaches and exposing the Mainstay force to attrition.

Finally, changes in US bomber tactics and armament, such as the development of longer-range air-launched cruise missiles (ALCMs) or anti-AWACS capabilities, would cut the effectiveness of forward defenses.

On balance, therefore, it is evident that current VPVO force structure for this particular mission is inadequate, although its capability is increasing as more Mainstay aircraft become available.

If ALCMs or B-1Bs penetrate the VPVO's forward defense, the problem of detection and engagement becomes more difficult. Once over land, the penetrating forces can use low-altitude flight and terrain features to mask their flight paths. In this circumstance, the primary defense against penetrating bombers would consist of SAMs and interceptors directed by ground-based radar. VPVO forces are deployed to allow a mixture of point and area defense, but at present they may not be sufficiently numerous to ensure detection and tracking of low-altitude penetrators.

Despite the VPVO's modernization measures, there is good reason to doubt that its effectiveness against the B-1B or today's ALCMs is very high. The B-1B and the ALCM have low radar cross sections (RCS); when combined with low-altitude, high-speed flight capabilities, they would be elusive targets.

Old SAM systems such as SA-2s, SA-3s, and SA-5s may be circumvented or jammed. The B-1B can use nuclear-armed short-range attack missiles to destroy air defense targets along penetration routes. Problems with the B-1B's electronic countermeasures suite may reduce the plane's effectiveness, but it seems highly probable that it can

penetrate even with reduced ECM capabilities.

VPVO effectiveness against the B-1B may increase as more new systems are deployed, but USAF has estimated that the B-1B should be able to penetrate Soviet airspace for another ten years.

It is likely that VPVO forces would be most effective conducting point defense of critical targets, thereby forcing the US to assign large numbers of bombers or cruise missiles to these targets in order to have high confidence that they will be destroyed. Point defense, however, is feasible only for a small number of targets.

Strong Defense of Mobile Targets

One VPVO mission—the defense of mobile targets—is likely to see Soviet air defenses performing quite well against US forces. Penetrating bombers must conduct mid- to high-altitude searches in order to locate mobile targets. Soviet use of AWACS, fighter patrols, and mobile SAMs against US bombers could result in a high loss rate for B-1Bs if they remain at medium altitude to conduct target searches.

In their efforts to defend cities or industrial areas, VPVO troops will face a far more demanding task. Successful defense of these targets is unlikely, given the size of the area to be defended and the targets' vulnerability. A large number of attacking bombers could penetrate these defenses.

USAF does not publish estimates of probable bomber force penetration. In a 1974 statement, however, Air Force Chief of Staff Gen. George S. Brown observed that Pentagon studies had put bomber attrition rates at twenty to thirty percent. He added that he believed attrition would be much lower. A twenty to thirty percent attrition rate is very high and may reflect worst-case assumptions. The historical average is about two percent, although at times it has been substantially higher.

It is true, however, that the VPVO could cause "virtual attrition" by forcing US bombers to fly low and carry extensive jamming equipment, thereby reducing their effective ranges and weapon loads, and by forcing them to use warheads for defense suppression. The VPVO's ability to inflict real attrition is difficult to judge, but it is unlikely to be very high. The combination of real and virtual attrition may limit damage to the USSR. It is unlikely to prevent massive destruction of economic and military targets.

On the whole, the future appears even bleaker than the present for the VPVO. The B-2 and AGM-129A Advanced Cruise Missile (ACM) may represent a breakthrough in air offense technology, one that could render existing Soviet air defenses obsolete. The B-2's very low RCS is designed to allow it to reconnoiter at medium altitudes in order to locate and attack mobile targets, conduct post-strike reconnaissance, and penetrate to highly defended targets. A low RCS reduces defense effectiveness by creating "gaps" in radar coverage through which penetrators may fly undetected.

Even if the penetrator is detected, the short radar detection range would reduce the time it spends within radar coverage, making it difficult for the Soviets to launch and vector interceptors before losing contact. Airborne intercept radars and SAM seeker heads also suffer from reduced ranges, which reduces chances for successful engagement and destruction of the target. Current VPVO forces are therefore unlikely to be effective against B-2s or ACMs.

How might the Soviets respond to this looming challenge from stealth technology?

One Soviet option would be to undertake a crash program to keep pace and maintain current levels of defense capability against the dramatically increased threat. This would require extensive and costly modernization of all VPVO forces. A first step might be the widespread deployment of dense echelons of modern, high-powered, ground-based radars with improved low-altitude capability. Upgraded AWACS aircraft could also be used for detection and tracking, but they would require advanced computing and software technologies, areas in which the Soviets lag behind the West. Other sensor options, such as space-based radar, ultrawideband radar, multistatic radars, infrared tracking systems, and sound location systems, are possible complements to conventional radar systems. All would require substantial and costly research and development.

A second option is to abandon heavy air defense against a nuclear attack in favor of a limited airspace-sovereignty mission. Surveillance radars and interceptor forces would be concentrated in border areas to challenge peacetime intruders and provide warning of an attack. SAM and fighter deployments in the Soviet interior could be reduced, cutting costs substantially.

Finally, the Soviets could choose to mount a slower, more measured, and incremental response to the stealth threat. This is typical of past Soviet policy. Incremental modernization could be combined with greater emphasis on point defense of a small number of important command and control and military targets.

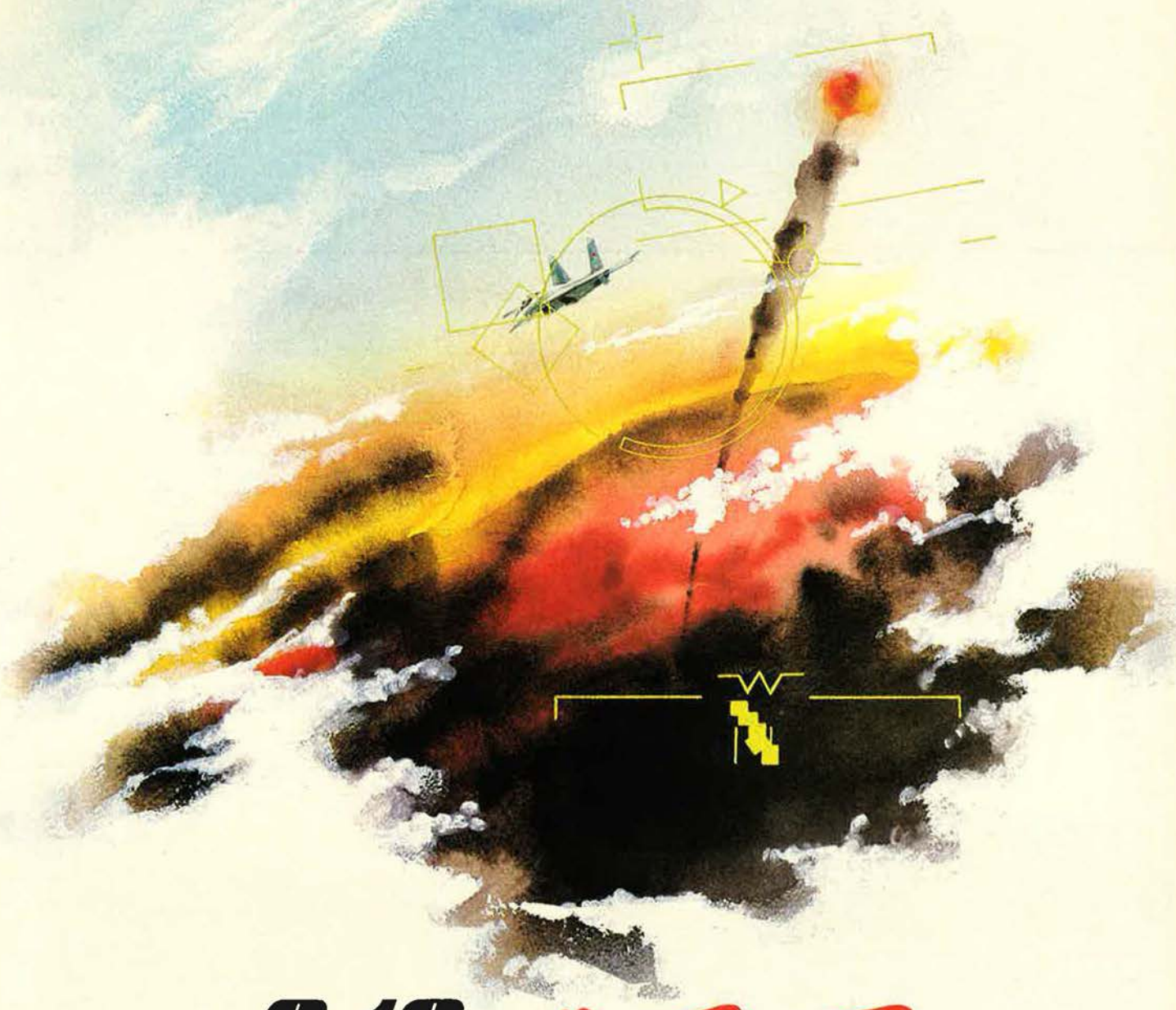
Reductions and Limitations

The prospect of a large-scale Soviet program to counter the B-2 and ACM appears remote. Because of economic and demographic pressures, the VPVO will be slowly reduced in size even as it modernizes. The most appealing and cost-effective option for the Soviets would be to attempt to trade VPVO reductions for limits on the B-2 and ACM, combined with incremental improvements and slow modernization.

The Soviets are likely to try to limit these arms through political means. President Gorbachev has demonstrated a flair for dramatic arms-control offers and could propose reductions in Soviet air defenses in exchange for limits on the B-2. This might be the Soviets' best chance of countering the B-2, if Moscow can convince the US to trade a costly but potentially effective weapon for costly and potentially ineffective Soviet defenses. ■

John W. R. Lepingwell is an Assistant Professor of Political Science at the University of Illinois. He recently conducted extensive research on Soviet air defenses, on which this article, his first for AIR FORCE *Magazine, is based.*

Air National Guard Part Task Trainer



F-16 ACE

The Air National Guard is one-quarter of the nation's total tactical fighter force. Guard pilots need to be ready, and readiness requires effective training.

Training in the Link "F-16 ACE" will lead to *Air Combat Excellence* for Guard pilots.

The "F-16 ACE" provides focused training in use of the radar, HUD, weapons, plus associated aircraft controls during air-to-air intercepts. The expandable design will also permit mission-tailoring for radar warning and self-protection, engine emergency procedures, air-to-ground avionics and other Unit training requirements.

This new ANG-specific trainer is based on air intercept part-task trainers co-developed by Link and the Air Force Human Resources Laboratory, now in use by TAC, the Guard, Air Force Reserve and the Coast Guard.

As the Air Guard upgrades its F-16s, the "ACE" trainer will remain concurrent and ready for training, thanks to Link's exclusive experience as builder and supporter of the F-16 high-fidelity flight simulators for the USAF and allied air forces.

The new "F-16 ACE." The trainer for the Guard's needs at an affordable price from the world's experts in F-16 training devices.

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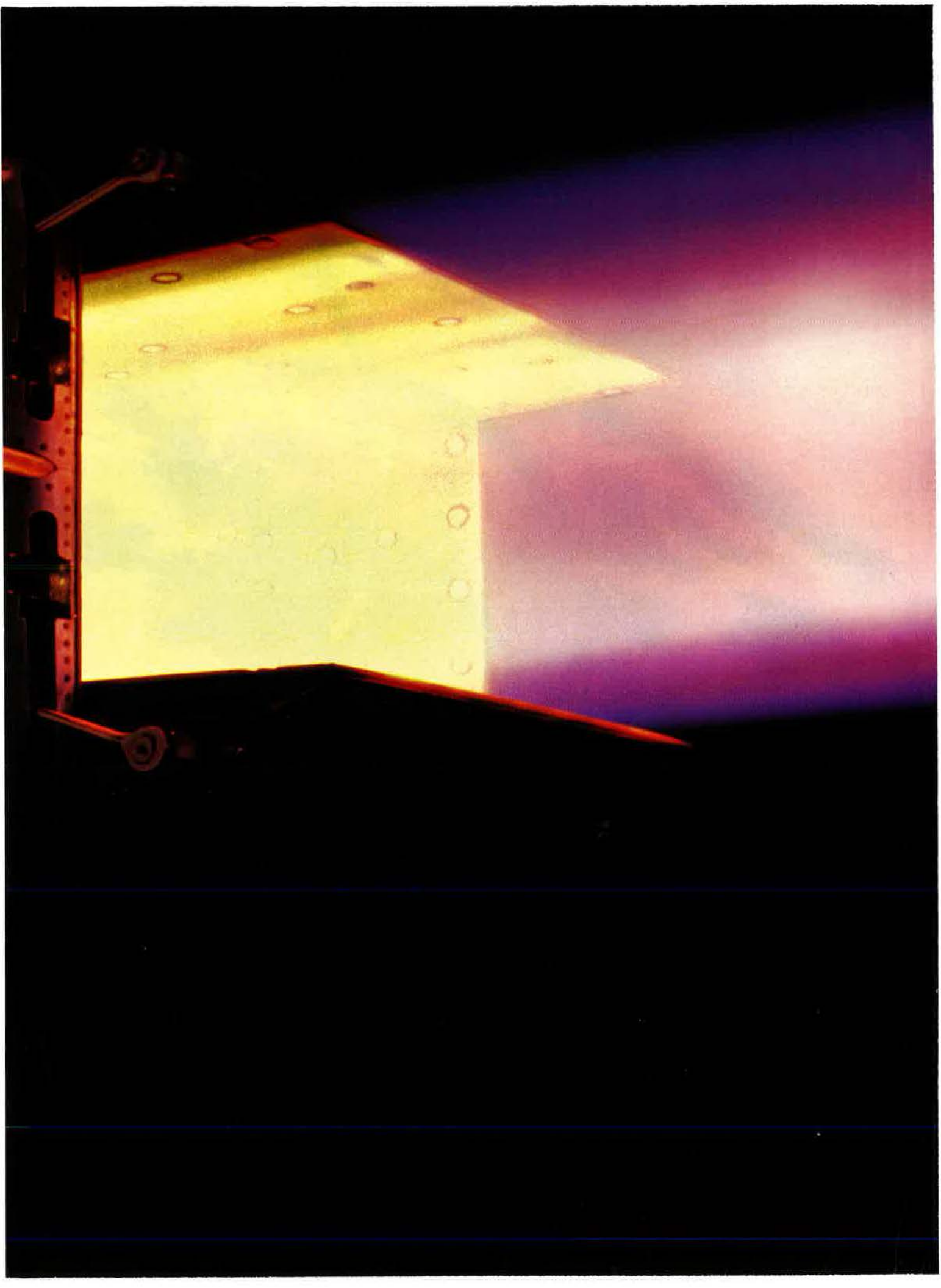
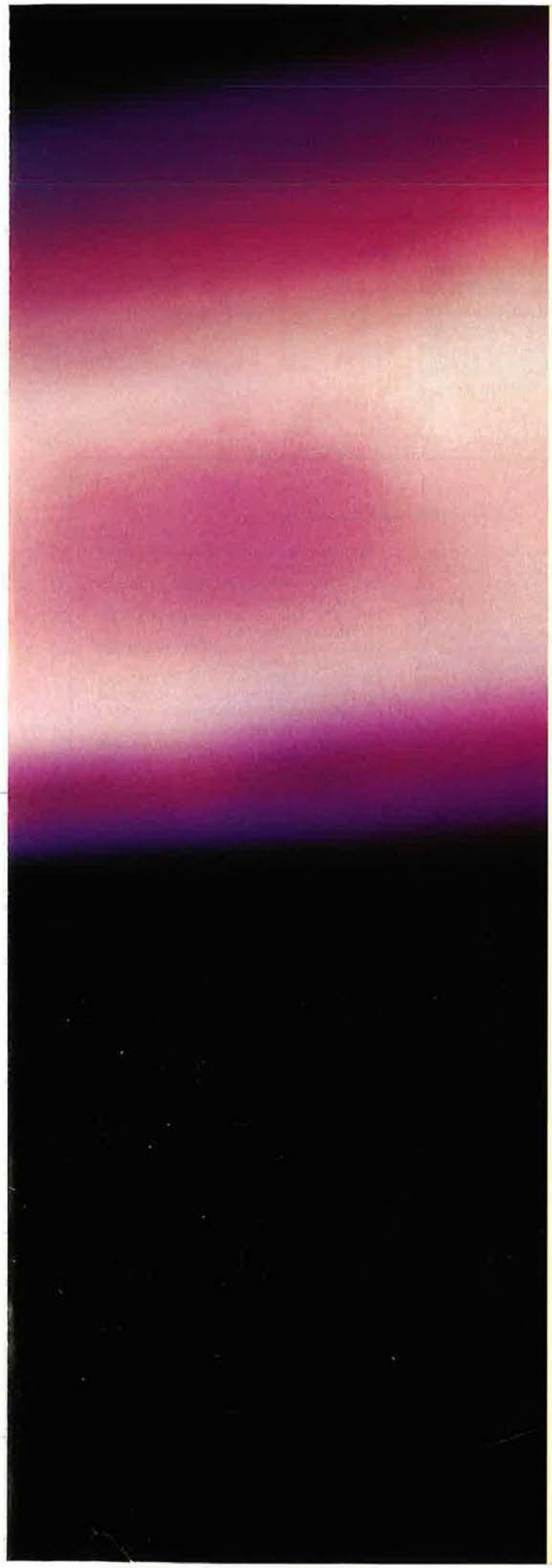




The threat is in for a shock.

Those shock waves are good reason for the threat to think twice. They signal an all-new era in air combat—ushered in by the Advanced Tactical Fighter and the F119 engine. Working with the U.S. Air Force and the U.S. Navy, we created an advanced engine that delivers the thrust you need to cruise supersonically without afterburner. Our nozzle technology can offer new levels of capability. What's more, maintenance and support specialists joined our team right from the drawing board stage. The result: a clean design that makes maintenance fast and easy. We've put the F119 through three years of extensive tests. Now we're proving its rugged reliability in accelerated mission testing. When the next generation of fighters takes to the sky, the F119 will help them carry more firepower deeper into enemy territory. You asked for an engine as advanced as the ATF. We read you loud and clear.

UNITED TECHNOLOGIES PRATT&WHITNEY

Soviet Aerospace Almanac

Edited by Colleen A. Nash, Associate Editor

Information for this Almanac was compiled from a variety of sources. Because the Soviet Union publishes relatively little data about its armed forces, some details are necessarily estimates.

The US Air Force's Directorate of Soviet Affairs, located at Bolling AFB, D. C., provided advice on this project. In addition to reviewing this material and serving as general advisors, William and Harriet Fast Scott prepared several items, including "Organization of the Soviet Armed Forces" and "Top Leaders of the Soviet Armed Forces."

Soviet Aeronautical Milestones

1884—First "hop" by a steam-engine-powered monoplane designed by Alexander Fedorovich Mozhaiski. Short distance and incline-assisted takeoff prevent it from being considered true powered flight.

1904—Nikolai Zhukovski, "Father of Soviet Aviation," founds Europe's first institute of aerodynamics.

1910—Russian Imperial War Ministry establishes flying school at Gatchina.

1913—(May 13) First flight of the world's first four-engine airplane—*The Russian Knight*, affectionately called *Le Grand*, designed by Igor Sikorsky.

1913—(August 20) Staff Capt. Peter Nesterov performs history's first inside loop in a Nieuport IV.

1914—(August 26) First air battle of World War I on the Eastern Front. Staff Capt. Peter Nesterov records first aerial ramming in combat.

1921—The ANT-1 flies, the first of a record number of more than 100 aircraft designed by Andrei N. Tupolev.

1922—The Germans begin construction of a modern aircraft plant at Fili (near Moscow) under the provisions of the Treaty of Rapallo.

1930—The I-5 flies, the first Soviet-designed and -built fighter.

1934—(May 19) First flight of the ANT-20 *Maxim Gorki*, at the time the world's largest aircraft, designed by Andrei Tupolev.

1937—The Soviets set several record endurance flights, including the first polar flight between Europe and North America.

1946—(April 24) First flight of Soviet-designed and -built jet fighter prototypes—the Yak-15 and the MiG-9.

1947—(December 30) First flight of the MiG-15.

1956—The Tu-104 makes its debut as the world's first commercial jetliner.

1968—(December 31) First flight of the Tu-144, the world's first supersonic transport.

1988—(November 30) Rollout of the An-225, the world's largest airplane.

Significant Dates in Soviet Military History

(Dates in New Style Calendar)

1917—February Revolution. Nicholas II abdicates (March 15). October Revolution. Bolsheviks seize power (November 7–8).

1918—Creation of the Red Army of Workers and Peasants (January 23–February 23). Treaty of Brest-Litovsk ends Russia's participation in World War I (March 3). Russian Civil War begins. Fighting lasts until 1920 in western regions of the country and until 1922 in far eastern regions.

1921—Russo-Polish War. A naval mutiny at Kronstadt/Petrograd is put down by the Red Army (March 7–18).

1922—Union of Soviet Socialist Republics is established (December 30).

1936—The Soviets aid the Republicans during the Spanish Civil War (through 1939).

1937—Stalin initiates his Great Purges of the Soviet military. The purges continue through 1938.

1939—Soviet forces battle Japanese forces at Khalkhin Gol in Outer Mongolia (May–August). The Soviets sign a nonaggression pact with Nazi Germany (August 23). Hitler's invasion of Poland begins World War II (September 1). The Soviets join the Germans in the invasion of Poland (September 17). War breaks out between the Soviet Union and Finland on November 30 and lasts into March 1940. The Finns cede 16,000 square miles.

1940—The independent Baltic republics of Lithuania, Latvia, and Estonia are occupied by the Soviets and incorporated into the USSR (July–August).

1941—The Soviets and Japanese conclude a treaty of neutrality (April 13). Germany invades the Soviet Union (June 22). German forces push to the gates of Moscow, but are turned back by the Soviets (September 30–December 5). The US approves Lend-Lease to the USSR (November).

1942—The Battle of Stalingrad is fought (August–February 1943).

1943—The Battle of Kursk is fought (July 5–July 16).

1945—Berlin falls to Soviet troops (May 2). Germany surrenders to the Allies (May 8). The Soviet Union declares war on Japan (August 8). Japan surrenders to the Allies (September 2).

1948—The Soviet Union begins the Berlin Blockade (April 1 through September 1949).

1949—The Soviets explode an atomic bomb (August 29).

1953—The Soviets explode a hydrogen bomb (August 12).

1955—The Warsaw Pact organization is established (May 14).

1956—Soviet forces crush the Hungarian uprising (November 4).

1957—The USSR announces its first successful ICBM test (August 26). The first Sputnik satellite is launched by the Soviets (October 4).

1960—An American U-2 is shot down over the USSR (May 1). A rift begins to develop between the USSR and the People's Republic of China (approximate).

1961—The Soviets begin construction of the Berlin Wall (August 13).

1962—The Cuban Missile Crisis occurs (October 22–November 2).

1968—Soviet forces invade Czechoslovakia (August 20–21).

1969—The USSR clashes with China along the Sino-Soviet border.

1972—The US and the USSR sign the SALT I accord (May 22).

1979—The US and the USSR initial the SALT II accord (June 18). The Soviets invade Afghanistan (December 25).

1983—Soviet fighters down KAL 007, a civilian South Korean airliner that had inadvertently strayed into Soviet airspace (September 1).

1987—The US and USSR sign the INF Treaty (December 8).

1988—The USSR agrees to withdraw its troops from Afghanistan (April 14), and the official withdrawal begins (May 18). President Mikhail Gorbachev announces a unilateral plan to cut total Soviet armed forces by ten percent and, in eastern Europe, to withdraw 50,000 troops and reduce conventional arms (December 7).

1989—Hungary opens its border to the West (May). East German migration to the West begins; US and USSR resume START negotiations in Geneva, discuss reductions in conventional forces in Europe (May–June). Berlin Wall opens (November 9–10). Major political upheavals in Warsaw Pact countries Poland, Hungary, East Germany, Czechoslovakia, and Romania; unrest in several Soviet republics and demonstrations in Baltic States.

Flags of the Armed Forces

The Ground Forces
Sukhoputnyye Voyska (SV)

The Air Forces
Voyenno-Vozdushnyye Sily (VVS)

The Navy
Voyenno-Morskoy Flot (VMF)

The Military Oath

Soviet officers and enlisted members take the same oath. The text printed below is the official Soviet translation.

I, citizen of the Union of Soviet Socialist Republics, joining the ranks of the Armed Forces, take the oath and solemnly pledge to be a conscientious, brave, disciplined and vigilant warrior, strictly to observe military and state secrets, to observe the constitution of the USSR and Soviet laws, unquestioningly to carry out the requirements of all military regulations and orders of commanders and superiors.

I pledge conscientiously to study military science, to preserve in every way military and public property and to remain devoted till my last breath to my people, my Soviet homeland, and the Soviet government.

I am prepared at all times, on orders from the Soviet government, to come out in defense of my homeland, the Union of Soviet Socialist Republics. I pledge to defend it courageously, skilfully, with dignity and honour, without sparing my blood and life in securing complete victory over the enemies.

If I break this solemn vow, may I be severely punished by the Soviet people, universally hated, and despised by the working people.

Col. G. Kobozev described the Soviet military oath thusly in *Soviet Military Review* in 1983: "If you ask [a Soviet] ex-serviceman or serviceman which was the most memorable day in his life, he will, in most cases, say that it was the day when he took the Oath of Allegiance. And that is quite natural, because it is a solemn pledge of loyalty to his Homeland. As soon as a man takes it, he assumes responsibility for the fate of his country and people, he swears he will defend them to his last breath, to the last drop of his blood."

The Military Uniform

Soviet uniforms can vary widely, depending on the rank, service, and position of the wearer as well as the season, occasion, and environment. The following distinctions are applicable to a Soviet equivalent of a USAF officer's Class-A uniform.

- The color of the collar tabs indicates the branch of service. The hatband of the billed cap will be the same color as the collar tabs. Some examples: light blue = aviation and airborne; red = combined arms; black = rocket, artillery, armor, and most technical (chemical, etc.) troops; royal blue = KGB (except Border Guards); and green = KGB Border Guards.
- The branch emblem on the tab indicates the individual's specialty. Some examples: propeller and wings = aviation, parachute = airborne, wreath and star = motorized rifle, crossed barrels = rocket and artillery, and tank = armor.
- Shoulder boards indicate grade *(see accompanying chart)*.
- The right side of the blouse will display qualifications and classification badges, including aviator wings, elite unit designations, and higher military education.

Official and Military Holidays

Official Holidays of the USSR

(Workers are given time off on these days.)

January 1	New Year's Day
March 8	International Women's Day
May 1 & 2	International Worker's Solidarity Days
May 9	Victory Day
October 7	Constitution Day of the USSR
November 7 & 8	Anniversary of the Great October Socialist Revolution

Key Military Days of the USSR

(Time off from work is not normally given, but celebrations are held.)

February 23	Soviet Army and Navy Day
April 12	World Aviation and Cosmonautics Day
Second Sunday of April	Troops of Air Defense Day
May 28	Border Troops Day
First Sunday after July 22	Navy Day
Third Sunday of August	Airfleet Day of the USSR
Second Sunday of September	Tank Forces Day
November 10	Soviet Militia Day
Third Sunday of November	Rocket Troops and Artillery Day

A Typical Day for a Soviet Conscript

0600–0609	Reveille
0610–0630	Exercise (tidying up)
0630–0650	Barracks time
0650–0720	Political information (morning inspection)
0725–0755	Breakfast
0800–1400	Training periods (six fifty-minute periods with ten-minute breaks between)
1400–1440	Dinner
1440–1510	After dinner time
1510–1530	Maintenance: personal, weapon, and equipment
1530–1830	Political education work (Monday and Thursday)
	Equipment maintenance (Tuesday and Friday)
	Sports (Wednesday and Saturday)
1830–1940	Self-preparation or homework
1940–2010	Supper
2010–2040	Personal time
2040–2155	Evening walk and checkup
2200	Taps

Comparative Grades and Insignia

(Bold face indicates equivalent USAF rank.)

Glavnyi Marshal Aviatsii
General of the Air Force

Marshal Aviatsii
General

General-Polkovnik Aviatsii
Lieutenant General

General-Leytenant Aviatsii
Major General

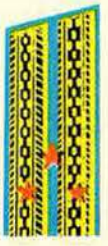
General-Mayor Aviatsii
Brigadier General

Polkovnik
Colonel

Podpolkovnik
Lieutenant Colonel

Mayor
Major

Kapitan
Captain



Starshiy Leytenant
1st Lieutenant

Leytenant
2d Lieutenant

Mladshiy Leytenant
2d Lieutenant

Starshiy Praporshchik
Senior Warrant Officer

Praporshchik
Warrant Officer

Starshina
Chief Master Sergeant

Starshiy Serzhant
Senior Master Sergeant

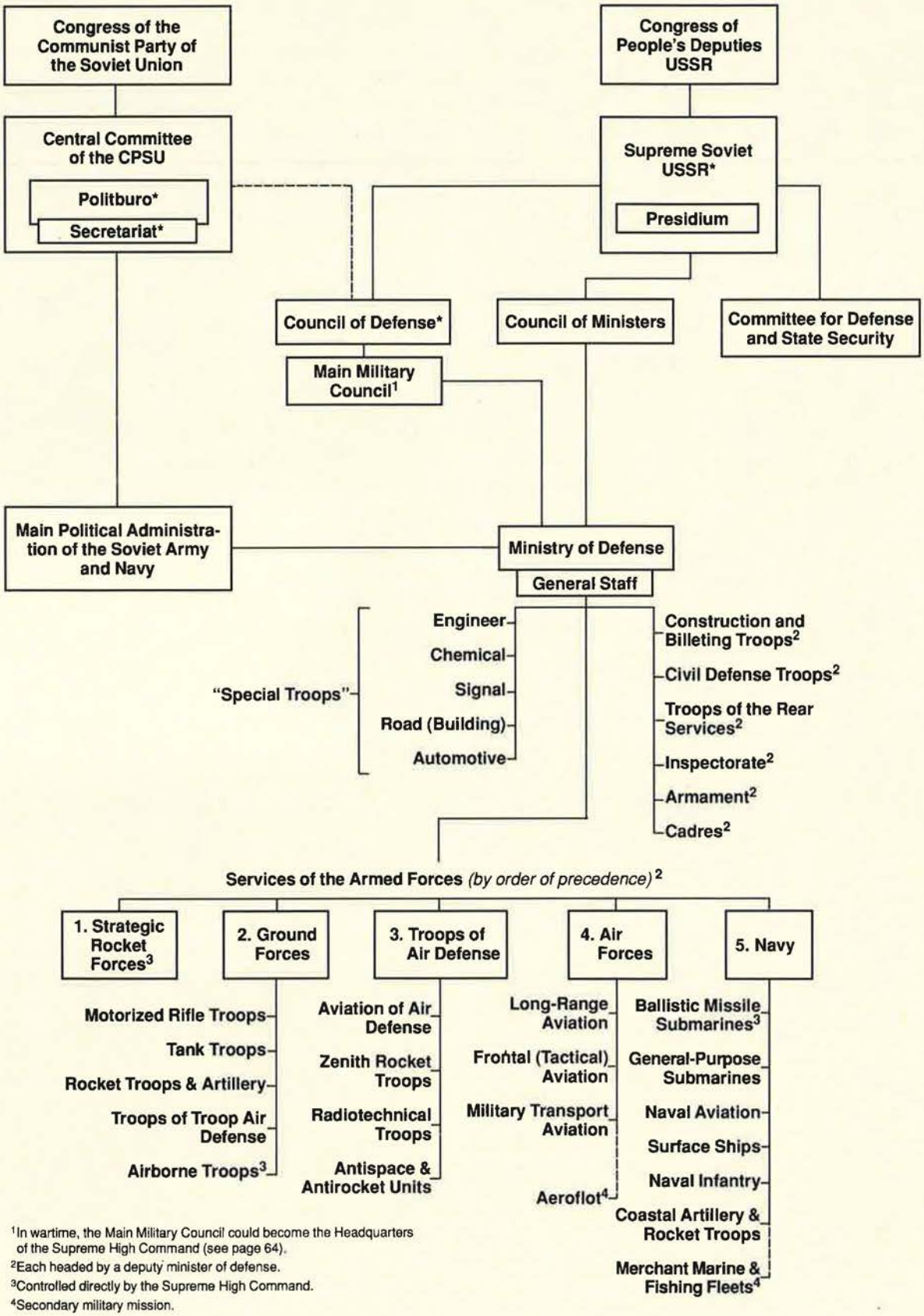
Serzhant
Master Sergeant

Mladshiy Serzhant
Staff Sergeant

Efreytor
Airman First Class

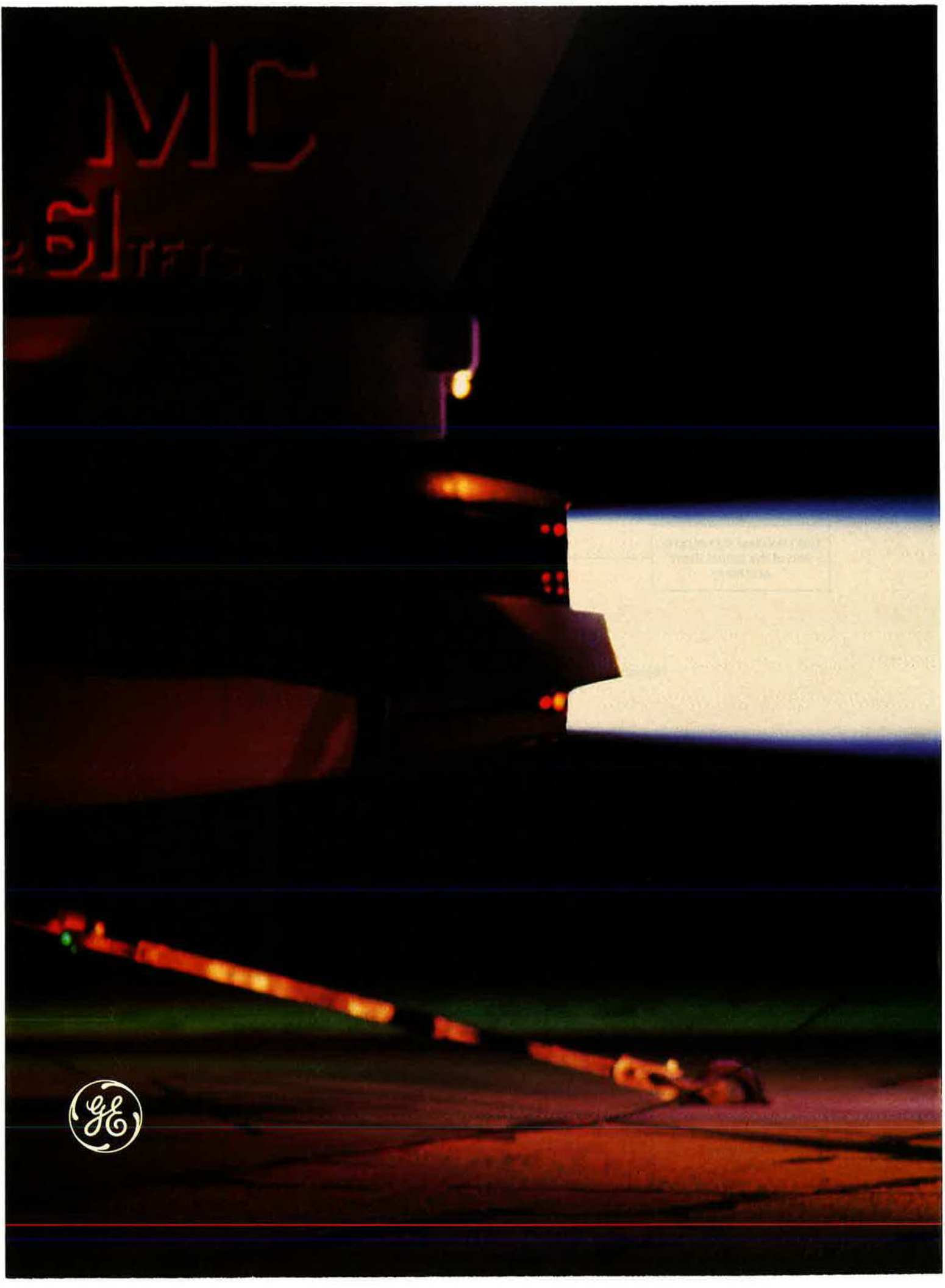
Ryadovoy
Airman Basic

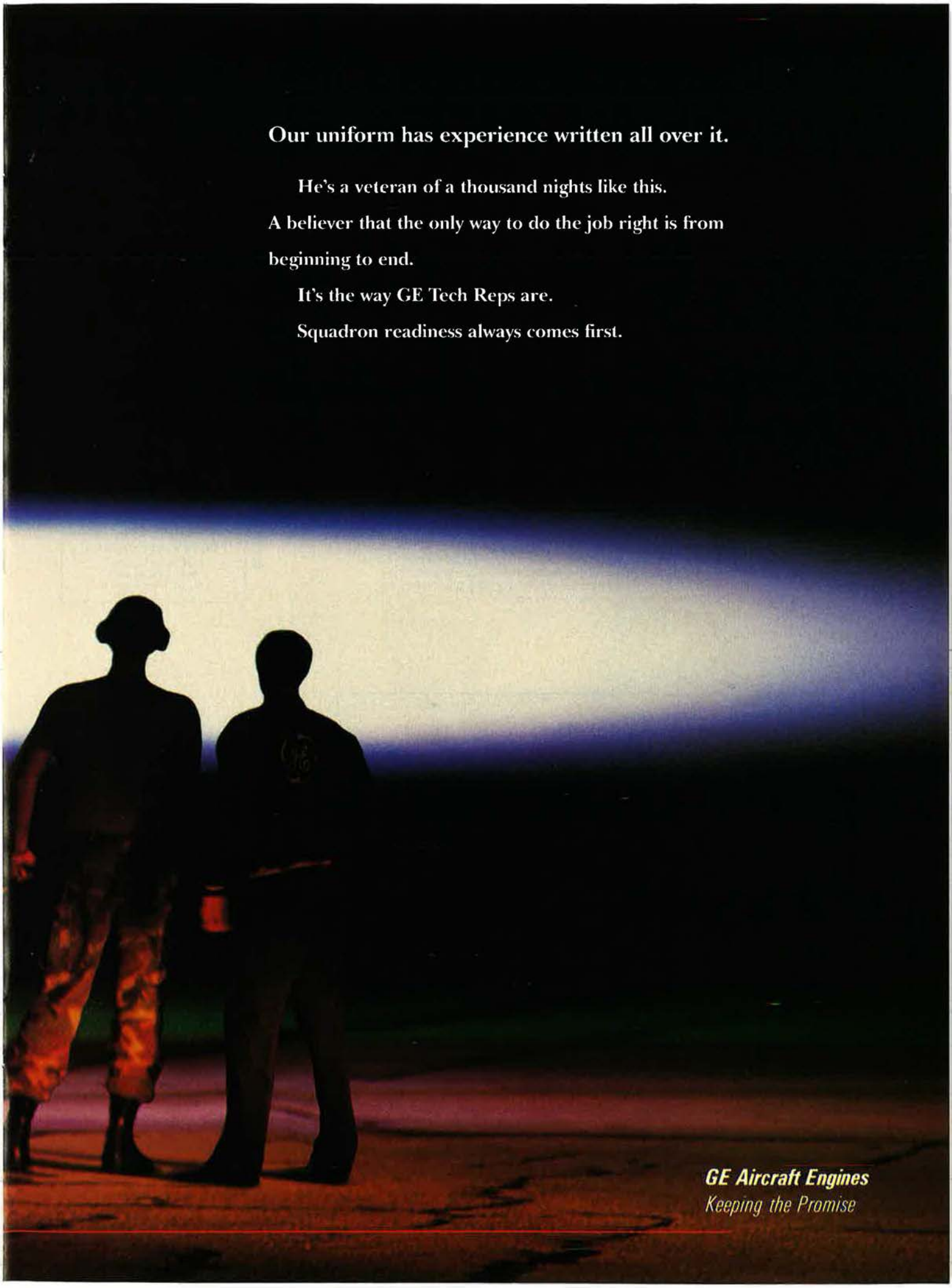
The Soviet Military Establishment



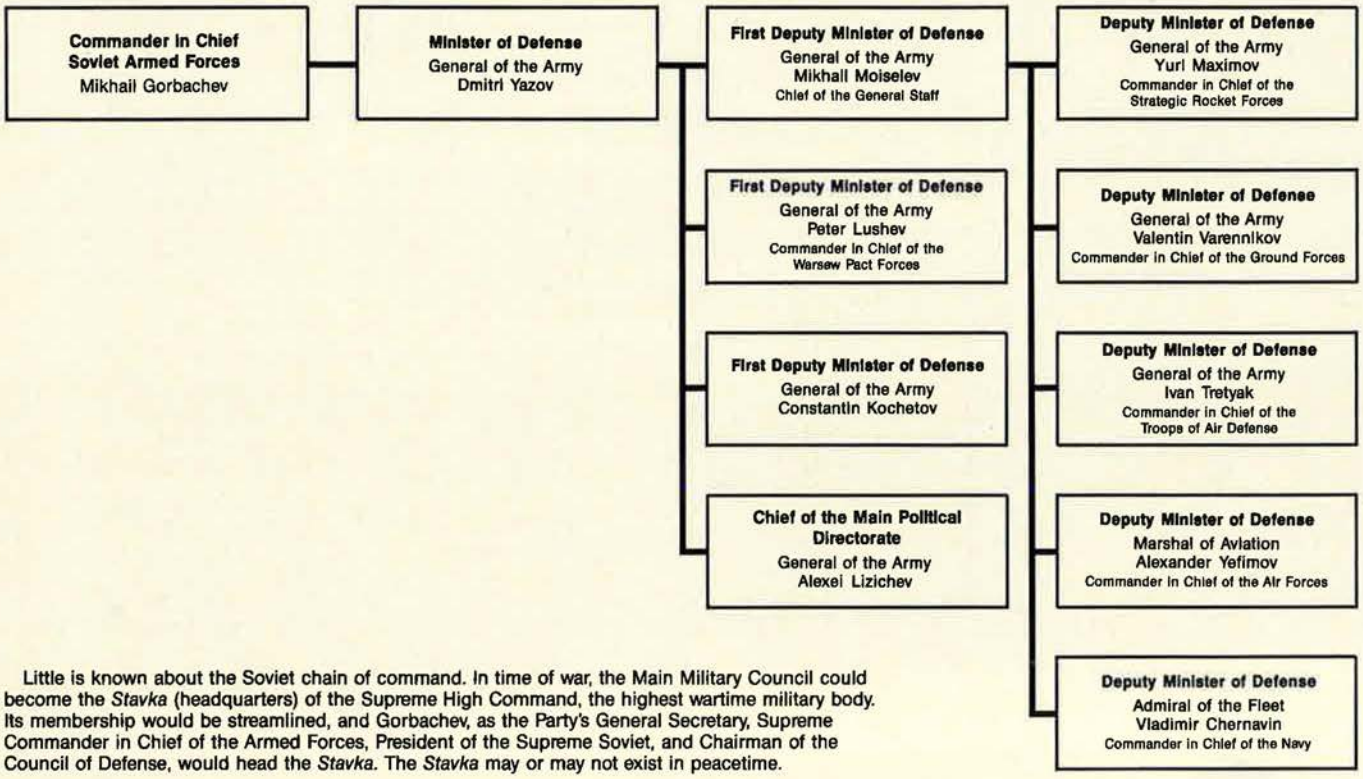
[1] In wartime, the Main Military Council could become the Headquarters of the Supreme High Command (see page 64).
[2] Each headed by a deputy minister of defense.
[3] Controlled directly by the Supreme High Command.
[4] Secondary military mission.

*General Secretary Mikhail Gorbachev is a Member of the Politburo and Secretariat and also President of the Supreme Soviet and Chairman of the Council of Defense.




Our uniform has experience written all over it.
He's a veteran of a thousand nights like this.
A believer that the only way to do the job right is from beginning to end.
It's the way GE Tech Reps are.
Squadron readiness always comes first.
GE Aircraft Engines
Keeping the Promise

The Soviet Supreme High Command



Little is known about the Soviet chain of command. In time of war, the Main Military Council could become the *Stavka* (headquarters) of the Supreme High Command, the highest wartime military body. Its membership would be streamlined, and Gorbachev, as the Party's General Secretary, Supreme Commander in Chief of the Armed Forces, President of the Supreme Soviet, and Chairman of the Council of Defense, would head the *Stavka*. The *Stavka* may or may not exist in peacetime.

The Politburo and Secretariat of the Communist Party of the Soviet Union

Politburo

Full Members

Mikhail Gorbachev
Vladimir Ivashko (December 1989)
Vladimir Kryuchkov (September 1989)
Yegor Ligachev
Yuri Maslyukov (September 1989)
Vadim Medvedev
Nikolai Ryzhkov
Eduard Shevardnadze
Nikolai Slyunkov
Vitaly Vorotnikov
Alexander Yakovlev
Lev Zaykov

Candidate Members

Alexandra Biryukova
Anatoly Lukyanov
Yevgeni Primakov (September 1989)
Boris Pugo (September 1989)
Georgi Razumovski
Alexander Vlasov
Dmitri Yazov

Secretariat

Mikhail Gorbachev
Oleg Baklanov
Constantin Frolov (December 1989)
Andrei Girenko (September 1989)
Yegor Ligachev
Yuri Manayenkov (September 1989)
Vadim Medvedev
Nikolai Slyunkov
Igor Stroyev (September 1989)
Gumer Usmanov (September 1989)
Alexander Yakovlev
Lev Zaykov

All members are Russian, with the exception of Girenko and Ivashko (Ukrainian), Pugo (Latvian), Shevardnadze (Georgian), Slyunkov (Byelorussian), and Usmanov (Tatar).

Top Leaders of the Soviet Armed Forces

General of the Army Dmitri Timofeyevich Yazov. Born 1923. Russian. Minister of Defense since May 1987. Entered service in 1941. From 1942 to 1945, on Volkhov and Leningrad Fronts. From 1956 to 1961 and 1963–65, on the staff of the Leningrad Military District. In Main Directorate of Cadres, army commander, and again Main Directorate of Cadres 1970–76. First Deputy Commander of Far Eastern Military District 1976–79. Commander, Central Group of Forces (Czechoslovakia) 1979–80, Central Asian Military District 1980–84, Far Eastern Military District 1984–87. Deputy Minister of Defense for Cadres January–May 1987. Member of the Central Committee CPSU since 1987 (Candidate 1981–87). Candidate member of the Politburo since June 1987. Deputy of the Supreme Soviet 10th and 11th sessions. Frunze Military Academy (1956) and the Voroshilov Military Academy of the General Staff (1967). Promoted 1984.

General of the Army Mikhail Alexeievich Moiseiev. Born 1939. Russian. Entered service in 1958. First Deputy Minister of Defense and Chief of the General Staff since December 1988. Regimental, divisional, army commander. Chief of Staff (October 1985–87), then Commander of the Far Eastern Military District (January 1987–88). People's Deputy (1989). Frunze Military Academy (1972). Voroshilov Military Academy of the General Staff with a Gold Medal (1982). Promoted to General of the Army in 1989.

General of the Army Peter Georgievich Lushev. Born 1923. Russian. Commander in Chief of United Armed Forces of the Warsaw Pact (1989). Served as First Deputy Minister of Defense since July 1986. Entered service in 1941. Commanded infantry company during war. Commander Kantemirov Tank Division, army commander, First Deputy Commander in Chief, Soviet Forces Germany (1973–75). Commander of the Volga Military District (1975–77), Central Asian Military District (1977–80), Moscow Military District (1980–85). Commander in Chief, Soviet Forces Germany (1985–86). Member of the Central Committee CPSU since 1981. Deputy of the Supreme Soviet 10th and 11th sessions. People's Deputy (1989). Malinovski Tank Academy (1954). Academy of the General Staff (1966). "Hero of the Soviet Union" (1983). Promoted 1981.

General of the Army Constantin Alexeievich Kochetov. Born 1932. Russian. First Deputy Minister of Defense since 1989. Joined the Soviet Army in 1950. Commander of Southern Group of Forces (Hungary) (1982–85), Transcaucasus Military District (1985–88), Moscow Military District (1988–89). Deputy of the Supreme Soviet 11th Session. People's Deputy (1989). Frunze Military Academy. Voroshilov Military Academy of the General Staff. Promoted 1988.

General of the Army Alexei Dmitrievich Lizichev. Born 1928. Russian. Chief of the Main Political Directorate since July 1985. Entered service in 1946. Assistant to Chief of Main Political Directorate for Komsomol Work (1962–65). In Moscow Military District (1965–71), then Soviet Forces Germany as First Deputy Chief of Political Directorate. Chief of Political Directorate of Transbaykal Military District (1975–80). Deputy Chief of the Main Political Directorate (1980–82). Chief of Political Directorate, Soviet Forces Germany (1982–85). Member of Central Committee CPSU (1986). Deputy of the Supreme Soviet 11th session. People's Deputy (1989). Lenin Military-Political Academy (1957), Higher Academic Courses of same (1973). Promoted 1986.

General of the Army Yuri Pavlovich Maximov. Born 1924. Russian. Commander in Chief of Strategic Rocket Forces since June 1985 and Deputy Minister of Defense. 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). Candidate (1981), then Member of the Central Committee CPSU (1986). Deputy of the Supreme Soviet 10th through 11th sessions. People's Deputy (1989). Frunze Military Academy (1950). Academy of the General Staff (1965). "Hero of the Soviet Union" (1982). Promoted 1982.

General of the Army Valentin Ivanovich Varennikov. Born 1923. Russian. Commander in Chief of the Ground Forces since 1989 and Deputy Minister of Defense. Joined Red Army in 1941. First Deputy Commander in Chief of Soviet Forces Germany (1971–73). Commander, Carpathian Military District (1973–79). Headed Ministry of Defense Operational Group in Afghanistan (1979–84). First Deputy Chief of the General Staff (1979–89). Candidate Member of the Central Committee CPSU since 1986. Deputy of the Supreme Soviet 9th and 10th sessions. People's Deputy (1989). Frunze Military Academy (1954). Voroshilov Military Academy of the General Staff (1967). "Hero of the Soviet Union" (1988). Promoted 1978.

General of the Army Ivan Moiseievich Tretyak. Born 1923. Ukrainian. Commander in Chief of Troops of Air Defense (VPVO) since June 1987 and Deputy Minister of Defense. Entered service in 1939 as cadet. Wounded in action on second Baltic Front. Commander of Byelorussian Military District (1967–76), Far Eastern Military District (1976–84), Commander in Chief, Troops of the Far East (1984–86). Inspector General (1986–87). People's Deputy (1989). Frunze Military Academy (1949). Academy of the General Staff (1959), Higher Academic Courses of same (1970). Candidate (1971), then Member of the Central Committee CPSU since 1976. Deputy of the Supreme Soviet 7th through 11th sessions. "Hero of the Soviet Union" (1945), "Hero of Socialist Labor" (1982). Promoted 1976.

Marshal of Aviation Alexander Nikolaievich Yefimov. Born 1923. Russian. Commander in Chief of the Air Forces since December 1984 and Deputy Minister of Defense. Entered service in 1941. Flew 222 sorties in ground attack aircraft. Squadron commander in the 198th Air Attack Regiment of 4th Air Army. First Deputy Commander in Chief of Air Forces (1969–84). Member of the Central Committee CPSU (1986). Deputy of the Supreme Soviet 2d and 9th through 11th sessions. People's Deputy (1989). Military Air Academy (1951). Academy of the General Staff (1957). Twice "Hero of the Soviet Union" (1944, 1945). Distinguished Military Pilot USSR (1970). Candidate of Military Sciences (1968). Promoted 1975.

Admiral of the Fleet Vladimir Nikolaievich Chernavin. Born 1928. Russian. Commander in Chief of the Navy since December 1985 and Deputy Minister of Defense. Joined the Navy in 1947. Commanded one of the first Soviet atomic 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). Deputy of the Supreme Soviet 10th and 11th sessions. People's Deputy (1989). Naval Academy (1965). Academy of the General Staff (1969). "Hero of the Soviet Union" (1981). Promoted 1983.

Organization of the Soviet Armed Forces

MANY changes have taken place within the Soviet Armed Forces within the past year, and more are expected. The basic organization remains as follows: Strategic Rocket Forces, Ground Forces, Troops of Air Defense, Air Forces, and Navy, in that order of precedence. Functions performed by the US Air Force are spread across three of the Soviet services.

The five Soviet services do not include Troops of Civil Defense, Troops of the Tyl (rear services), Construction Troops, or other support organizations, all of which are under the Ministry of Defense. Previously, the Border Guards and Internal Troops, subordinate to the KGB and the Ministry of Internal Affairs (MVD), respectively, were legally part of the Soviet Armed Forces. This is no longer the case, although the troops still exist and the Internal Troops have been expanded.

The Soviets sometimes refer to the Strategic Rocket Forces, Ground Forces, Troops of Air Defense, and Air Forces as the Soviet Army.

The **Ministry of Defense** and the **General Staff** provide centralized command and control. Immediately subordinate to the Minister of Defense, who is roughly comparable in authority to the US Secretary of Defense and the Chairman of the JCS combined, are the Chief of the General Staff, who heads a staff similar to that of prewar Germany, and the Commander in Chief of the Warsaw Pact Forces.

The **Strategic Rocket Forces,** established in 1959, operate the approximately 1,400 land-based ICBMs. IRBMs and MRBMs are being eliminated under the INF Treaty. The SRF remains first among the services.

The **Ground Forces,** numerically the largest of the five services, are divided into motorized rifle and tank troops, airborne troops, rocket troops, and troops of air defense. Some 212 divisions form the basic combat structure. A major reorganization is under way. Corps and brigades, in some cases, may replace divisions and regiments. Ground Forces personnel are equipped to fight in an environment in which weapons of mass destruction are used. These now include chemical, biological, nuclear, laser, electromagnetic, radiation, geophysical, and sonic weapons.

The **Troops of Air Defense** (VPVO) were formed in 1948 as PVO-Strany. In the early 1980s, many of the air defense aircraft were merged with tactical air units, and air defense districts were changed.

Since 1986, the Troops of Air Defense have returned, in general, to the organization that existed in the 1970s. Fixed SAMs, radars, and air defense aircraft are once more under direct control of air defense headquarters in Moscow.

Troops of Air Defense now have approximately 2,000 fighter-interceptors, more than 7,000 SAM launchers, and a massive radar network. Some 150 SA-10 launch units have new phased-array acquisition and guidance radars, which provide a cruise missile detection capability. Anti-space defense (PKO) and antirocket defense (PRO) are being modernized. Work continues on high-energy laser beams.

The **Soviet Air Forces** are divided into three major elements: Strategic Air Armies of the Supreme High Command (VGK), Air Forces of the Military Districts and Groups of Forces, and Military Transport Aviation (VTA).

The Soviets refer to these elements as long-range (strategic) aviation, frontal (tactical) aviation, and military transport aviation. In 1989 a commander of long-range aviation was identified, a position that had been dropped in 1980. Military transport aviation also has a commander; frontal aviation does not.

Long-range aviation has been modernized, and new aircraft and weapon systems are entering the inventory. The Blackjack, the new Soviet intercontinental bomber, is now going into an operational unit. Another new aircraft, the Bear-H, carries an AS-15 ALCM with a standoff range of 3,000 kilometers. This poses a completely new problem to North American air defenses.

The mission of frontal aviation, or Air Forces of Military Districts and Groups of Forces, is to maintain air superiority and to strike targets in the "operational depth" of the enemy. "Army aviation," mostly composed of combat helicopters, is primarily to attack mobile targets at the "tactical depth," providing direct support to Ground Forces units. ("Army aviation" in the Soviet Armed Forces is not the same as "Army Aviation" in the United States.)

Military Transport Aviation includes some 600 fixed-wing aircraft. A small number of the new An-124 Condor transport aircraft are now in service with the VTA. A limited number of the world's largest aircraft, the An-225 Mriya, probably will be constructed. Aeroflot, the Soviet airline, with its more than 1,600 medium- and long-range transports, should also be included as a full-time reserve of VTA.

The **Soviet Navy** places primary emphasis on aircraft and submarines, armed with approximately 1,000 SLBMs. With its aircraft carriers of the *Kiev* class, Soviet Naval Aviation has a mix of carrier-based helicopters and V/STOL aircraft. Naval Aviation also has bombers, fighter-bombers, surveillance aircraft, helicopters, and transport aircraft. Total numbers exceed 1,600.

The unilateral cuts of 500,000 men, 10,000 tanks, 8,500 artillery systems, and 800 combat aircraft, announced by General Secretary Gorbachev in December 1988, currently are under way. Equipment removed has been primarily from obsolete systems. Much deeper cuts of Soviet forces will be required before approximate parity in Warsaw Pact and NATO forces can be achieved. ■

Soviet Combat Organization

Normal peacetime training and housekeeping of Ground and Air Forces (except certain strategic elements) are primarily exercised through the commanders of the fourteen Military Districts (two of sixteen were abolished in 1989) and the four Groups of Soviet Forces in eastern Europe. Administrative support is provided by the individual services. Commanders in Chief of the Strategic Rocket Forces, Troops of Air Defense, and Navy are responsible for their own administrative support and training.

With Commanders in Chief of four Theaters of Military Operations (TVDs) currently identified (Western, Southwestern, Southern, and Far East), it is likely that they now have command and control over designated Ground and Air Forces units, plus certain Navy units. No Commander in Chief of the Northwestern TVD has been identified to date.

A TVD could include several "fronts." In some cases, Military District commanders could become "front" commanders. TVDs could be grouped into continental Theaters of War (TVs). While the Far Eastern and Southern TVs probably correspond to their TVDs, the Western TV most likely includes the Northwestern, Western, and Southwestern TVDs.

TVDs are not carefully defined geographical areas—they are actually directions. However, it is safe to conjecture that the Western TVD would include the Baltic, Byelorussian, and Carpathian Military Districts, while the Northwestern TVD would include the Leningrad Military District, and the Southwestern TVD would include the Kiev and Odessa Military Districts. The Southern TVD would include the Turkestan, North Caucasus, and Transcaucasus Military Districts, and the Far East TVD would include the Siberian, Transbaykal, and Far Eastern Military Districts. The Moscow Military District and Volga/Ural Military District may be a strategic reserve.

Commanders in Chief of TVDs are combined-arms commanders, directing ground and air operations in their areas during conflict and reporting directly to the Soviet Supreme High Command, as would Commanders in Chief of the Troops of Air Defense and Strategic Rocket Forces. Certain Navy units would be directly under the Supreme High Command. Others might be under designated oceanic TVD Commanders in Chief.

The Soviet Union has never published specific information on current TVs or TVDs.

A Variance of Estimates

Four Views of Soviet Forces

	DoD	USSR	IISS	USNI
Total Military Manpower	5,030,000	3,993,000	4,258,000	5,403,500
Combat Aircraft	8,485	8,369	8,909	9,100
Tanks	51,300	63,000	53,000	52,800
ICBMs	1,378	1,398	1,451+	1,360
SLBMs	954	924	960	936
Helicopters	4,285	4,014	4,150	4,140
Submarines	289	260	299	293

The Soviet Union announced on December 15 that it would cut military spending by 8.2 percent in 1990 and promised again that reductions will be made to the Soviet armed forces. Assuming that the promise is valid, from what level would the cuts begin?

Strength totals ascribed to Soviet military forces vary. Here are four versions: the numbers as reported by the US Department of Defense (October 1989), by the Soviet Union (effective January 1990), by the International Institute for Strategic Studies (October 1989), and by the USNI Military Database (January 1990). Some of the divergence in these numbers may be attributable to counting procedures, although every effort has been made to minimize that factor in this presentation.

Soviet Active Military Population

(As of January 1, 1989)

Ground Forces	1,975,000
Air Forces	345,000
Navy	370,000
Strategic Defense Forces	575,000
Strategic Attack (includes Strategic Rocket Forces and strategic elements of the Air Forces and Navy)	315,000
Command/General Support	1,450,000
Total	**5,030,000**

Virtually the entire Soviet male population serves in the Armed Forces at one time or another. Most are called to active duty at age eighteen. Two years later (three years later for sailors), they are "discharged into the reserves." They will remain in the reserves, subject to call-up at any time, until they reach age fifty. Citizens receiving reserve commissions may spend their entire careers as part-time reservists, or they may be called to a period of active duty, particularly if they possess critical skills. The maintenance of a large reserve is the basic element of the Soviet military mobilization plan.

Until recently, the Border Guards of the KGB and Internal Troops of the MVD were legally part of the Soviet Armed Forces. This is no longer the case, although the troops still exist and the Internal Troops have been expanded.

Significant Military Deployments Outside the Soviet Union

(As of June 1989)

Warsaw Pact Countries	635,000
Mongolia	61,000
Latin America (including Cuba)	7,700+
Middle East and North Africa	6,000–7,000
Asia (including Vietnam)[1]	4,000–4,500
Sub-Saharan Africa	4,000+
India	400+
Afghanistan	less than 200

There are an estimated 2,800 Soviet advisors and technicians in Cuba. Cuba itself has significant deployments of its own forces to other Third World countries: 1,000–1,500 in Latin America and 400 in the Middle East and North Africa. In November, Cuba reduced its number of forces in Sub-Saharan Africa to 25,000.

[1]Estimate does not include transient Soviet naval presence.

East and West Weapons Production

1979–88[1]

	US	Other NATO	NATO: Pact Ratio	Other Pact	USSR
Tanks	7,400	3,600	1: 2.85	5,400	26,000
Other Armored Vehicles[2]	8,900	10,200	1: 2.88	5,100	50,000
Artillery, Mortars, and MRLs (>100-mm)	3,600	2,600	1: 4.08	6,300	19,000
Long- and Intermediate-Range Bombers	103	0	1: 3.88	0	400
Fighter/Attack Aircraft	3,600	2,300	1: 1.20	900	6,200
Military Helicopters	2,200	1,700	1: 1.28	800	4,200
Major Surface Warships (>900 tons)	81	94	1: 0.61	23	84
Submarines[3]	40	29	1: 1.14	4	75
ICBMs and SLBMs	600	85	1: 3.94	0	2,700
IRBMs and MRBMs	20	45	1:14.20	0	925
Surface-to-Air Missiles[4]	19,700	39,000	1: 2.07	9,700	112,000

1Military production for a country or alliance's own armed forces, including imports but excluding exports.

2Excludes combat service support vehicles.

3Includes SSBNs, attack, and coastal submarines.

4Includes naval SAMs; excludes portable SAMs.

East and West Aircraft Production

	1986		1987		1988		1986		1987		1988	
Equipment Type	USSR	Other Pact	USSR	Other Pact	USSR	Other Pact	US	Other NATO	US	Other NATO	US	Other NATO
Bombers	50	0	45	0	45	0	26	0	52	0	22	0
Fighters/Fighter-Bombers	650	10	700	15	700	10	375	250	525	200	550	200
Fixed-Wing Antisubmarine Warfare	5	0	5	0	5	0	5	0	10	0	5	0
Helicopters	500	150	450	150	400	125	350	200	375	200	375	200
AWACS	5	0	5	0	5	0	10	0	10	0	5	0

Third World Military Sales

1980–88

	Near East and South Asia	Sub-Saharan Africa	Latin America	East Asia and Pacific	Total
Tanks/Self-Propelled Guns	5,750	985	840	350	7,925
Light Armor	11,075	1,625	750	650	14,100
Artillery	13,050	4,685	1,875	860	20,470
Major Surface Combatants	37	4	5	4	50
Minor Surface Combatants	36	29	66	63	194
Submarines	15	0	2	0	17
Missile Attack Boats	16	9	6	6	37
Supersonic Aircraft	1,740	405	145	330	2,620
Subsonic Aircraft	170	15	0	25	210
Helicopters	1,150	310	155	90	1,705
Other Combat Aircraft	405	110	80	95	690
Surface-to-Air Missiles	22,000	6,110	2,600	1,500	32,210

Lineup of Soviet Military Power

(As of October 1, 1989)

Strategic Nuclear Missiles

1,378* (approx.)—Intercontinental ballistic missiles (ICBM). SS-11: 370. SS-13: 60. SS-17: 90 (with 360 warheads). SS-18: 308 (with 3,080 warheads). SS-19: 320 (with 1,920 warheads). SS-24 (Mod. 1): 20 (with 200 warheads). SS-24 (Mod. 2): 40 (with 400 warheads). SS-25: 170 (with 170 warheads).

**The total ICBM figure does not include ICBMs held in reserve for flight testing.*

954—Submarine-launched ballistic missiles (SLBM). SS-N-5: 24. SS-N-6: 192. SS-N-8: 286. SS-N-17: 12. SS-N-18: 224. SS-N-20: 120. SS-N-23: 96.

435+*—Intermediate/medium-range ballistic missiles (IRBM/MRBM). SS-4: 60. SS-20: 375+.

**Total includes both deployed and nondeployed systems. Designated for elimination under INF Treaty.*

Air Defense

2,190—Interceptors. MiG-23 Flogger: 900. MiG-25 Foxbat: 380. Su-15 Flagon: 420. Su-27 Flanker: 170. MiG-31 Foxhound: 280. MiG-21 Fishbed: 40.

7,050—Strategic surface-to-air missile (SAM) launchers. SA-2: 2,400. SA-3: 1,000. SA-5: 1,950. SA-10: 1,700.

4,960—Tactical SAM launchers. SA-4: 1,350. SA-6: 850. SA-8: 950. SA-9: 430. SA-11: 300. SA-12A: 70. SA-13: 860. SA-15: 20. SA-19: 130.

10—Airborne warning and control aircraft. Il-76 Mainstay: 10.

100—Antiballistic missile launchers. ABM-1B Galosh. (The ABM system is being upgraded to the maximum total of launchers allowed by the ABM Treaty.)

9,000—Warning systems. These include early warning and ground control intercept radars.

Air Forces

150—Long-range strategic bombers. Tu-95 Bear: 140. Blackjack: 10.

470—Medium-range bombers. Tu-22M Backfire: 160 (excludes Backfires with Soviet Naval Aviation). Tu-16 Badger: 190. Tu-22 Blinder: 120.

1,530—Tactical counterair interceptors. MiG-21 Fishbed: 85. MiG-23 Flogger: 700. MiG-29 Fulcrum: 625. Su-27 Flanker: 120.

2,425—Ground attack aircraft. MiG-27 Flogger: 725. Su-7/-17 Fitter: 600. Su-24 Fencer: 800. Su-25 Frogfoot: 300.

75—Tanker aircraft. Mya-4 Bison: 30. Tu-16 Badger: 20. Il-78 Midas: 25.

590—Tactical reconnaissance and electronic countermeasures aircraft. MiG-21 Fishbed: 25. MiG-25 Foxbat: 200. Su-17 Fitter: 130. Su-24 Fencer: 125. Yak-28 Brewer: 110.

150—Strategic reconnaissance and ECM aircraft. Tu-16 Badger: 110. Yak-28 Brewer: 40.

3,000—Transport, liaison, and support helicopters.

1,800—Training aircraft. Includes 900 fixed-wing, of which perhaps 800 are combat capable, and 900 rotary-wing aircraft.

575—Military air transports assigned to Military Transport Aviation (VTA). An-22 Cock: 50. An-12 Cub: 115. Il-76 Candid: 395. An-124 Condor: 15.

1,465—Transports in other elements of the armed forces. An-12 Cub: 325. Others: 1,140.

1,700—Civil aviation aircraft (Aeroflot). An-12 Cub: 150. Il-76 Candid: 75. Other medium- and long-range transports: 1,475.

Ground Forces

51,300—Main battle tanks. T-54/-55: 16,700. T-62: 9,700. T-64: 9,500. T-72: 11,500. T-80: 3,900.

1,465—Surface-to-surface missiles. FROG-3/-5/-7: 585. SS-21 Scarab: 230. SS-1 Scud B: 650.

48,425—Artillery pieces, mortars, and multiple rocket launchers. Artillery pieces: 30,400. Mortars: 11,025. MRLs: 7,000. (Total does not include more than 4,000 antitank artillery pieces.)

59,500—Infantry fighting vehicles and armored personnel carriers.

4,285—Combat and support helicopters.* Mi-2 Hoplite: 550. Mi-4 Hound: 15. Mi-6 Hook: 400. Mi-8 Hip: 1,850. Mi-24 Hind: 1,400. Mi-26 Halo: 55. Mi-10 Harke: 15. Mi-28 Havoc and Hokum are still in development.

**Total includes 1,200 Hip-E and Hind-D and -E gunship helicopters. Figures include only assets subordinate to Army Aviation.*

Naval Forces

70—Ballistic missile submarines. Delta: 42. Hotel: 1. Yankee: 13. Typhoon: 6. Golf: 8.

144—Nuclear-powered general-purpose submarines. Cruise missile attack: 50. Attack: 80. Other: 14.

130—Diesel- and electric-powered general-purpose submarines. Cruise missile attack: 16. Attack: 110. Training: 4.

15—Auxiliary submarines. Includes both nuclear-powered and nonnuclear-powered boats.

4—Guided missile V/STOL aircraft carriers (*Kiev* class).

2—Guided missile aviation cruisers (*Moskva* class).

34—Cruisers. *Kirov*-class nuclear-powered guided missile: 3. *Sverdlov*-class light: 3. Guided missile: 28.

42—Destroyers. Includes 37 guided missile destroyers.

157—Frigates and corvettes. Includes 32 *Krivak*-class guided missile frigates.

970—Small surface-ship combatants. Patrol: 200. Coastal patrol and river/roadstead: 400. Mine warfare: 370.

185—Amphibious warfare ships and craft.

809—Auxiliary ships. Material support: 70. Underway replenishment: 89. Fleet support: 150. Other: 500.

Naval Aviation

290—Strike and bomber aircraft. Tu-22M Backfire: 130. Tu-16 Badger: 135. Tu-22 Blinder: 25.

185—Fighter and fighter-bomber aircraft. Su-17 Fitter: 95. Yak-38 Forger-A: 80. MiG-23 Flogger: 10.

45—Tankers (Tu-16 Badger).

185—Reconnaissance and electronic warfare aircraft. Tu-16 Badger: 130. Tu-95 Bear-D: 40. Tu-22 Blinder: 5. Su-24 Fencer-E: 10.

470—Antisubmarine aircraft. Tu-142 Bear-F: 55. Mi-14 Haze-A: 95. Ka-27 Helix: 95. Ka-25 Hormone-A: 90. Be-12 Mail: 90. Il-38 May: 45.

580—Transport, miscellaneous, and training aircraft.

Totals for air defense interceptors, strategic bombers, and tactical aircraft include aircraft in operational units only.

Alliances and Treaties

Prior to the 1970s, the Soviet Union maintained very few alliances or treaties with other nations. The Warsaw Pact, initiated by the Soviets in 1955 as a response to NATO, remains the only multinational defense alliance to which it is a signatory.

Known bilateral treaties of military significance are listed. Others may exist, but, if so, they have been kept secret by the signatories. The USSR also maintains bilateral arrangements with each of the other Warsaw Pact countries.

Multinational Alliances

- Warsaw Pact Organization. Members include Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the USSR. Albania was an original signatory, but was excluded from the Pact in 1962. Pact Headquarters is in Moscow; the Pact's Commander in Chief is General of the Army Peter Lushev.

Bilateral Treaties

- Afghanistan: Friendship, Cooperation, and Mutual Assistance (1978).
- Angola: Friendship and Cooperation (1976); Military Cooperation Agreement (1983).
- Congo: Friendship and Cooperation (1981).
- Cuba: Peace, Friendship, and Cooperation (1989).
- Ethiopia: Friendship and Cooperation (1978).
- Finland: Mutual Assistance (1948).
- India: Friendship, Cooperation, and Mutual Assistance (1971).
- Iran: Provisions of a treaty dating from 1921 between what was then Persia and the USSR were abrogated by Iran in 1979. These provisions permitted Soviet intervention in Iran if a third party should attempt an attack against the USSR from Iranian soil. The Soviets have not recognized this unilateral abrogation.
- Iraq: Friendship, Cooperation, and Mutual Assistance (1972, 1978).
- Mongolia: alliance (1921); defense treaty (1966).
- Mozambique: Friendship and Cooperation (1977).
- North Korea: Friendship, Cooperation, and Mutual Assistance (1961).
- North Yemen: Friendship (1984).
- South Yemen: Friendship, Cooperation, and Mutual Assistance (1980); Agreement of Joint Cooperation (1983).
- Syria: Friendship, Cooperation and Mutual Assistance (1980).
- Turkey: Nonaggression Pact (1978).
- Vietnam: Friendship, Cooperation, and Mutual Assistance (1978).

Soviet Aircraft Designations

The several parts of a Soviet aircraft designation have distinct meanings. Take the designation "MiG-21MF Fishbed-J" as an example.

MiG is an abbreviation of the design bureau responsible for the aircraft—Mikoyan and Gurevich (the bureau's originators) in this case. Other examples are Su for Sukhoi (or Sukhoy), Tu for Tupolev, and Yak for Yakovlev.

The numeral 21 is the model number of the production aircraft. Odd numerals are assigned to fighters; bombers and transports are generally assigned even numbers.

The letter arrangement MF is the progressive development suffix. M stands for modified or modified for export, F for boosted. Other examples are A for aerodynamic refinement, B for attack or bomber version, *bis* for a reinitialized suffix, P for interceptor version, S for boundary layer blowing, and U for Uti for trainer.

Fishbed is the identifying code name assigned to this MiG series by NATO. All important Soviet aircraft are named as they are identified by photographs from a man-operated camera. The first letter of the name identifies the aircraft type—F for fighter, B for bomber, C for cargo or transport, H for helicopter, and M for miscellaneous. A code name of one syllable means the aircraft is propeller-powered; a code name of two syllables means it is jet-powered.

The letter following the name—J in this example—indicates the point in the letter sequence at which this version was identified by NATO.

Soviet Space Shots by Program

(1957–1989)

Photo Reconnaissance	806
Communications	318
Electronic Intelligence (ELINT)	182
Related to Manned Spaceflight (manned: 66; unmanned: 110)	176
Minor Military (radar calibration, etc.)	153
Navigation/Geodetic	154
Scientific/Developmental (including rocket tests)	116
Weather/Natural Resources	85
Early Warning	62
Venus or Mars Missions	42
ASAT-Related	38
Lunar Missions	30
Fractional Orbital Bombardment System (FOBS)	18
Unknown	1
Total	**2,181**

—Courtesy Teledyne Brown Engineering

Soviet Space Firsts

October 1957	Sputnik 1	First artificial earth satellite
November 1957	Sputnik 2	First satellite to collect biological data
September 1959	Luna 2	First lunar probe to hit the moon
October 1959	Luna 3	First photographs of the moon's far side
April 1961	Vostok 1	First manned orbital flight (Cosmonaut Yuri Gagarin)
June 1963	Vostok 6	First woman in space (Cosmonaut Valentina Tereshkova)
October 1964	Voskhod 1	First multiple crew member spaceflight (Cosmonauts Komarov, Yegorov, Feoktistov)
March 1965	Voskhod 2	First space walk (Cosmonaut Alexei Leonov)
January 1966	Luna 9	First soft landing of a probe on the moon
April 1966	Luna 10	First artificial satellite of the moon
October 1967	Kosmos 186/188	First automatic docking of satellites
November 1968	Kosmos 252	First successful ASAT test
January 1969	Soyuz 4/5	First linkup of manned vehicles and in-orbit crew exchange
October 1969	Soyuz 6/7/8	First triple launch and rendezvous of manned ships
November 1970	Luna 17	First robot vehicle on the moon
April 1971	Salyut 1	First launch of a prototype manned space station
June 1975	Venera 9	First pictures of the surface of Venus
July 1975	Apollo/Soyuz Test Project	First international rendezvous and docking in space
January 1978	Soyuz 27	First manned double docking in space
October 1984	Soyuz T-10/11	Record of 237 days living in space
March 1986	Vega 1	First close rendezvous with a comet
May 1986	Soyuz T-15	First transfer between operational space stations
December 1987	Soyuz TM-3	Record of 326 days living in space
December 1987	Mir	First permanent manned space station
November 1988	Buran	First space shuttle brought back to earth via ground control
December 1988	Soyuz TM-6	Record of 366 days living in space

Soviet Space Launches to Orbit or Beyond

(As of December 31, 1989)

1957	2
1958	1
1959	3
1960	3
1961	6
1962	20
1963	17
1964	30
1965	48
1966	44
1967	66
1968	74
1969	70
1970	81
1971	83
1972	74
1973	86
1974	81
1975	89
1976	99
1977	98
1978	88
1979	87
1980	89
1981	98
1982	101
1983	98
1984	97
1985	98
1986	91
1987	95
1988	90
1989	74

—Courtesy Teledyne Brown Engineering

Gallery of Soviet Aerospace Weapons

By John W. R. Taylor

Bombers and Maritime

Beriev A-40 Albatross

This elegant sweptwing amphibian was first spotted more than two years ago, on photographs taken 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, Rear Adm. William O. Studeman, US director of naval intelligence, referred to it as a possible ASW/surveillance/minelaying aircraft with the provisional Western designation Tag-D. The prototype made an unexpected 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, with the Soviet designation A-40 Albatross. It was credited to a design team led by A. Konstantinov.

A feature in *Red Star* stated that the A-40 will be confined to SAR missions near the coast, and that the next task confronting its designers is to produce a similar aircraft capable of operating anywhere in the Pacific. Equipment was said to include extensive radio, radar, electro-optical sensors, and searchlights to detect shipwreck survivors by day or night. A rescue team with power boats, life-rafts, and other specialized equipment can be carried, and there is room for up to 60 survivors, who enter the aircraft via hatches in the side of the hull with the aid of mechanized ramps. Onboard equipment to combat hypothermia is available, together with resuscitation and surgical equipment and medicines. Loss of life in accidents to Soviet nuclear submarines at sea, has emphasized the value of aircraft of this type. However, a 20 ft stores bay in the bottom of the hull aft of the step, the large nose radar, unidentified dielectric hemispheres at the rear of the large pods that house the main landing gear under the wingroots, cylindrical containers (possibly ESM) above the wingtip floats, an in-flight refueling noseprobe, and other features indicate that Admiral Studeman's role assessment could also be correct. *(The following data are provisional.)*

Power Plant: two podded turbofans, possibly 51,650 lb st Lotarev D-18Ts, on pylons above rear of hull.
Dimensions: span 137 ft, length excl noseprobe 141 ft, depth of hull forward of wing 13 ft 2 in.

Beriev A-40 Albatross (Quadrant/Flight)

Beriev M-12 Tchaika (NATO 'Mail')

More than 90 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 shore bases of the Soviet Northern and Black Sea Fleets.

Power Plant: two Ivchenko AI-20D 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.

Beriev M-12 Tchaika (NATO 'Mail') (Swedish Air Force via FlygvapenNytt)

Ilyushin Il-38 (NATO 'May')

The airframe of this intermediate-range shore-based antisubmarine/maritime patrol aircraft was developed from that of the Il-18 airliner in the same way that the US Navy's P-3 Orion was based on the Lockheed Electra. Standard equipment includes a large radome under the forward fuselage and a MAD tail-sting, with two internal weapons/stores bays forward and aft of the wing carry-through structure.

Il-38s of the Soviet Naval Air Force are encountered frequently over the Baltic and North Atlantic. A Soviet Treaty of Friendship and Cooperation, signed with the People's Democratic Republic of Yemen in October 1979, permits patrols over the Red Sea, Gulf of Aden, Arabian Sea, and Indian Ocean from a base in that country. Periodically, deployments are made to Libya and Syria. About 59 Il-38s are in service with Soviet naval units. Three others equip No. 315 Squadron of the Indian Navy, based at Dabolim, Goa.

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, max range 4,473 miles, patrol endurance 12 hr.
Accommodation: crew of twelve.
Armament and Operational Equipment: variety of attack weapons and sonobuoys in weapons bays.

Ilyushin Il-38 (NATO 'May')

Tupolev Tu-16 (NATO 'Badger')

Thirty-eight years after the first flight of the prototype of this medium bomber, about 220 Tu-16s are estimated to remain operational in the strike role, mostly with the Smolensk and Irkutsk air armies. Replacement with Tu-26 'Backfires' has been under way since the mid-1970s, with one further Tu-16 regiment re-equipped in 1988. Many of the redundant bombers have been modified to serve with the force of 20 Tu-16 in-flight refueling tankers and 135 Tu-16s equipped for reconnaissance and ECM missions in support of the attack units, there being no variant of 'Backfire' configured for such tasks. Soviet Naval Aviation still has around 100 Tu-16 attack aircraft, plus 70 tankers and up to 80 reconnaissance and ECM variants. The attack aircraft carry antiship cruise missiles with standoff ranges varying from 55 to more than 185 km and are often supplemented by air army Tu-16s in naval exercises. Sixteen strike, tanker, and ECM variants were deployed to a base at Cam Ranh Bay, Vietnam, with a potential combat radius encompassing Thailand, the Philippines, Guam, most of Indonesia, and southern China; eight were withdrawn last December. Current versions of the Tu-16 are as follows:

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, using a unique wingtip-to-wingtip transfer technique to

Tupolev Tu-16 (NATO 'Badger-D') escorted by Sea Harrier (Royal Navy)

refuel other 'Badgers' or a probe-and-drogue system to refuel 'Blinders.' About 120 operational with Chinese Air Force and Navy (still being built in China as Xian H-6).

Badger-C. Antishipping version, first shown in 1961 Aviation Day flypast. 'Kipper' winged missile carried in recess under fuselage ('Badger-C Mod' carries 'Kingfish' missiles underwing). Wide nose radome, in place of glazing and nose gun of 'Badger-A'. No provision for free-fall bombs. Operational with Soviet Northern, Baltic, Black Sea, and Pacific Fleets.

Badger-D. Maritime/electronic reconnaissance version. Nose like that of 'Badger-C'. Larger undernose radome. Three radomes in tandem under weapons bay.

Badger-E. Photographic and electronic reconnaissance version. Similar to 'Badger-A', but with cameras in bomb bay and two additional radomes under fuselage, larger one aft.

Badger-F. Basically similar to 'Badger-E', but with electronic intelligence pod on pylon under each wing. No radomes under center-fuselage.

Badger-G. Converted from 'Badger-B'. Generally similar to 'Badger-A', but with underwing pylons for two rocket-powered air-to-surface missiles (NATO 'Kelt') that can be carried to a range greater than 2,000 miles. Free-fall bombing capability retained. Majority serve with antishipping squadrons of the Soviet Naval Air Force. Some passed on to Iraq.

A Soviet Navy Tu-16, probably a 'Badger-G', has been illustrated with an ECM nose thimble of the kind seen beneath the in-flight refueling probe of 'Bear-G'. It can be assumed that it also carries further pods like those of 'Bear-G' on its center or rear fuselage.

Badger-G modified. Specially equipped to carry '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. Operational with Soviet Northern, Black Sea, and Pacific Fleets.

Badger-H. Standoff or escort ECM aircraft to protect missile-carrying strike force, with primary function of chaff dispensing. The dispensers (max capacity 20,000 lb) are located in the weapons bay area. Hatch aft of weapons bay. Two teardrop radomes, fore and aft of weapons bay. Two blade antennae aft of weapons bay. Glazed nose and chin radome.

Badger-J. Specialized ECM jamming/elint aircraft to protect strike force, with some equipment located in a canoe-shape radome protruding from inside 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 antennae at wingtips.

Badger-K. Electronic reconnaissance variant with nose like 'Badger-A'. Two teardrop radomes, inside and forward of weapons bay; four small pods on centerline in front of rear radome. *(Data for 'Badger-G' follow.)*

Power Plant: two Mikulin RD-3M (AM-3M) turbojets; each 20,950 lb st. Internal fuel capacity approx 12,000 gallons.

Dimensions: span 108 ft 0½ in, length 118 ft 11¼ in, height 45 ft 11¼ in, wing area 1,772.3 sq ft.

Weights: empty 82,000 lb, normal gross 165,350 lb.

Performance: max speed 616 mph at 19,700 ft, service ceiling 40,350 ft, range with 8,360 lb bomb load 3,680 miles, max unrefueled combat radius 1,955 miles.

Accommodation: crew of six.

Armament: seven 23 mm NR-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')

Tu-22s were the first Soviet operational bombers with supersonic dash capability. About 75 remain operational alongside Tu-16s in medium-range units of the air armies, mostly in such support roles as ECM jamming and reconnaissance. The Soviet Navy has about 30 bombers and 20 equipped for maritime reconnaissance and ECM duties, based mainly in the southern Ukraine and Estonia to protect sea approaches to the USSR. Versions identified by NATO reporting names are as follows:

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 air-to-surface missile (NATO 'Kitchen') 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. New dielectric panels, modifications to nosecone, etc., on some aircraft indicate ECM and electronic intelligence roles. 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. Used by Soviet and Libyan air forces.

Power Plant: two Kolliesov VD-7 turbojets in pods above rear fuselage, on each side of tail-fin; each 30,900 lb st with afterburning. Lip of each intake is extended forward for takeoff, creating annular slot through which additional air is ingested.

Dimensions: span 78 ft 0 in, length 132 ft 11½ in, height 35 ft 0 in.

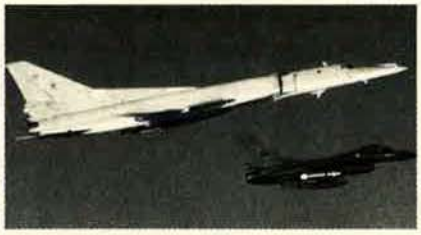
Weight: gross 185,000 lb.

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-22 (NATO 'Blinder-A') (Swedish Air Force via FlygvapenNytt)



Tupolev Tu-26 (Tu-22M) (NATO 'Backfire-B')

Tupolev Tu-142 (NATO 'Bear-H') (UK Ministry of Defence)

Tupolev Tu-142 (NATO 'Bear-J') (US Air Force)

Tupolev Tu-26 (Tu-22M) (NATO 'Backfire')

The Soviet press continues to refer to this supersonic swingwing medium bomber as the Tu-22M, but its current service designation is believed to be Tu-26. More than 350 are operational in Soviet air armies and with Soviet Naval Aviation, with production continuing at the rate of 30 aircraft a year. There are two operational versions:

Backfire-B. Initial series production version. Slightly inclined lateral engine air intakes, with large splitter plates. Two twin-barrel guns in tail mounting. Above-nose fairing for optional in-flight refueling probe.

Backfire-C. Advanced production version with wedge-type air intakes. Upturned nosecone with small pod at tip. No visible in-flight refueling probe. 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 Soviet bombers. It is deployed primarily against NATO in Europe and over the Atlantic, with about one-third of the force in the far east of the Soviet Union. Demonstrated in-flight refueling capability would enable it to be used against the continental US if sufficient tankers were available. Although 'Backfire' has been used for development launches of new-generation cruise missiles, it is unlikely to become a designated AS-15 carrier. With the 1988 assignment of Backfire-Cs to the Northern Fleet Air Force, the four Soviet fleets are now equipped with a total of 160 Tu-26s. *(Data for 'Backfire-B' follow.)*

Power Plant: two unidentified engines, reported to be uprated versions of the 44,090 lb st Kuznetsov NK-144 afterburning turbofans developed for the Tu-144 supersonic transport. Can be refueled in flight.

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, max unrefueled combat radius 2,485 miles.

Armament: primary armament of two '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 bombs sometimes fitted under the air intake trunks. Alternative weapon loads include up to 26,450 lb of conventional bombs, or mines. Soviet 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-95 and Tu-142 (NATO 'Bear')

Now in its 36th year of continuous production, this remarkable propeller-driven aircraft remains a formidable spearhead of Soviet strategic nuclear attack and maritime air power. Of 160 'Bears' now flying with the Soviet air armies, most are of the upgraded 'Bear-G' or new-production 'Bear-H' missile-carrying versions. In *Soviet Military Power,* DoD warns that 'Bear-H' and the new 'Blackjack' give the Soviets the capability to attack the US with hundreds of difficult-to-detect, hard-target-kill AS-15 'Kent' cruise missiles. Similarly, most of the 80 Soviet Naval Aviation 'Bears' are of the 'F' model, which differs so greatly from earlier versions that its designation was changed from Tu-95 to Tu-142. Versions identified by unclassified NATO reporting names are as follows:

Bear-A. Basic Tu-95 long-range strategic bomber. Chin radome. Internal stowage for two nuclear or a variety of conventional free-fall weapons. Defensive armament of six 23 mm guns in pairs in remotely controlled rear dorsal and ventral turrets and manned tail turret.

Bear-B. As 'Bear-A', but able to carry large air-to-surface winged missile (NATO 'Kangaroo') under fuselage, with associated radar in wide undernose radome replacing glazed nose. Defensive armament retained. A few 'Bs' operate in maritime reconnaissance role, with flight refueling nose probe and, sometimes, an elint blister fairing on the starboard side of the rear fuselage.

Bear-C. Third Tu-95 strike version, with ability to carry 'Kangaroo', first observed near NATO ships in 1964. Differs from 'Bear-B' in having an elint blister fairing on each side of its rear fuselage. Has been seen with a faired tailcone as mentioned under 'Bear-D' entry. Refueling probe standard.

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 like 'Bear-A', with undernose radome and superimposed refueling probe. Rear fuselage elint fairings as on 'Bear-C'. Added fairing at each tailplane tip. I band tail-warning radar in enlarged fairing at base of rudder. 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'.

Bear-E. Reconnaissance version of Tu-95. Generally as 'Bear-A', but with rear fuselage elint fairings and refueling probe as on 'Bear-C'. Seven camera windows in bomb-bay doors. 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 the Soviet Naval Air Force in 1970, since when several variants have been seen. Re-entered production in the mid-1980s. Originally, 'Bear-F' had enlarged and lengthened fairings aft of its inboard engine nacelles, and undernose radar. The main underfuselage J band radar housing is considerably farther 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 nuclear 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. The variants of 'Bear-F' are identified as follows:

Mod 1: As original 'Bear-F', but reverted to standard-size nacelles. 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 made less wide.

Mod 4: Chin radar reinstated. ECM thimble radome on nose, plus other fairings.

Most of approximately 65 'Bear-Fs' in service are now to Mod 3 or Mod 4 standard.

Bear-G. Tu-95, generally similar to 'Bear-B/C', but reconfigured for elint missions and to carry two AS-4 ('Kitchen') air-to-surface missiles instead of one AS-3 ('Kangaroo'), on a large pylon under each wingroot. Other features include 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'. More than 45 operational with the Irkutsk air army.

Bear-H. New production version, based on the Tu-142 type airframe of 'Bear-F' but with a shorter fuselage of the same length as 'Bear-B/C'. Equipped to carry long-range cruise missiles, including the AS-15 (NATO 'Kent') and, probably, the new AS-19 in the early 1990s. Aircraft observed up to mid-1988 had only an internal (rotary?) launcher for six AS-15 ALCMs, but pylon mountings for four more can be attached under each wingroot. 'Bear-H' achieved initial operational capability in 1984, and more than 70 were deployed by summer 1988. 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 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 Soviet Northern and Pacific Fleets, it appears to use a modified Tu-142 'Bear-F' airframe.

Duties of the 'Bears' include regular deployments to staging bases in Cuba and Angola, and a few are stationed at Cam Ranh in Vietnam. 'Bears' are encountered off the US east coast during transits between Murmansk and Cuba and during elint missions from Cuba. 'Bear-Hs' from Dolon air base in the central USSR carry out simulated attack and training missions against the US and Canada. Other 'Bears', including missile-armed 'Gs', have been reassigned to a theater role, and conduct regular combat training exercises against naval and land targets in the northern Pacific region. The Indian Navy has five Tu-142M 'Bear-Fs' for maritime reconnaissance. *(Data for 'Bear-F' 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.

Weight: gross 414,470 lb.

Performance: max speed 575 mph at 25,000 ft, over-target speed 518 mph at 41,000 ft, unrefueled combat radius 5,150 miles.

Tupolev Tu-160 (NATO 'Blackjack')

'Blackjack's' Soviet designation of Tu-160 was confirmed when a single example was flown at low altitude over Tushino airport during the August 1989 Aviation Day flypast. More than 15 had been delivered by that time, and the first operational squadron, at Dolon air base in the central USSR, had been in existence for more than a year. It is expected that at least 100 will be built in a complex that has been added to the huge Kazan airframe plant.

Comparison with USAF's latest strategic bomber, the 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 the world's most 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 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.

Tupolev Tu-160 (NATO 'Blackjack') (Jane's/Paul Beaver)

'Blackjack' is confirmed as being 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 unidentified afterburning turbofans, each probably smaller and with lower rating than those of 'Backfire'. Provision for in-flight refueling presumed.

Dimensions: span 182 ft 9 in spread, 110 ft swept; length 177 ft; height 42 ft.

Weight: gross 590,000 lb.

Performance: max speed Mach 2.3 at high altitude, max unrefueled combat radius 4,535 miles.

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

Armament: 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 SRAMs or six ALCMs, currently AS-15 'Kents', to be superseded by supersonic AS-19s in the early 1990s.

MiG-21MF (NATO 'Fishbed-J') of the Polish Air Force (Lech Zielaskowski)

MiG-23MF (NATO 'Flogger-B') of the Polish Air Force (Lech Zielaskowski)

Fighters

MiG-21 (NATO 'Fishbed')

The number of MiG-21s still serving in first-line units of the Soviet tactical air forces is fewer than 500, of which about 60 are reconnaissance MiG-21R/RFs. Early MiG-21F/PF/PFM variants (NATO 'Fishbed-C/D/F') continue to be flown by various Warsaw Pact and Soviet-supplied air forces worldwide, but the versions operated by Soviet air forces of the military districts (MDs) and groups of forces are as follows:

MIG-21PFMA ('Fishbed-J'). Multirole development of PFM, with Tumansky R-11-300 turbojet, rated at 13,668 lb st, improved radar (NATO 'Jay Bird'; search range 12 miles), and four underwing pylons instead of two. Deepened dorsal spine fairing above fuselage contains some tankage, but internal fuel totals only 687 gallons. Two additional pylons carry either 130-gallon fuel tanks or radar-homing AA-2C 'Atoll' missiles to supplement infrared AA-2/2Ds (K-13As) on inboard pylons and GSh-23 twin-barrel 23 mm gun. Zero-speed, zero-altitude ejection seat.

MIG-21MF ('Fishbed-J'). Differs from PFMA in having lighter-weight, higher-rated Tumansky R-13-300 turbojet. Entered service in 1969.

MIG-21SMB ('Fishbed-K'). As MiG-21MF, but deep dorsal spine extends rearward as far as parachute brake housing to provide maximum fuel tankage and optimum aerodynamic form. Deliveries believed to have started in 1971.

MIG-21*bis* ('Fishbed-L'). Third-generation multirole air combat fighter/ground attack version, with Tumansky R-25-300 turbojet, rated at 16,535 lb st with afterburning, wider and deeper dorsal fairing, updated avionics, and generally improved construction standards. Internal fuel capacity increased to 766 gallons.

MIG-21*bis* ('Fishbed-N'). Advanced version of 'Fishbed-L' with further improved avionics. Rate of climb at T-O weight of 15,000 lb, with 50 percent fuel and two 'Atoll' missiles, is 58,000 ft/min. Armament uprated to two radar-homing AA-2C 'Atolls' and two 'Aphids', or four 'Aphids'. *(Data for MiG-21MF follow.)*

Power Plant: one Tumansky R-13-300 turbojet; 14,550 lb st with afterburning. Internal fuel capacity 687 gallons. Provision for three external tanks with maximum capacity of 471 gallons and for two JATO rockets.

Dimensions: span 23 ft 5½ in, length 51 ft 8½ in, height 14 ft 9 in, wing area 247 sq ft.

Weights: empty 12,882 lb, gross 21,605 lb.

Performance: max speed Mach 2.05 above 36,000 ft, Mach 1.06 at low altitude; practical ceiling about 50,000 ft; range 683 miles on internal fuel, 1,118 miles with three external tanks.

Accommodation: pilot only.

Armament: one twin-barrel 23 mm GSh-23 gun, with 200 rounds. Typical underwing loads for interceptor role include two AA-2/2D (K-13A) and two AA-2C air-to-air missiles; two K-13As and two UV-16-57 (sixteen 57 mm) rocket pods; two drop tanks and two missiles. Typical ground attack loads are four UV-16-57 rocket packs; two 1,100 lb and two 550 lb bombs; or four S-24 240 mm rockets.

MiG-23 (NATO 'Flogger')

Replacement of early-model MiG-23MF ('Flogger-B') air combat fighters with MiG-29s and Su-27s continues, but 'Floggers' remain more numerous than any other

type equipping Soviet tactical air forces and VPVO home defense interceptor units. They are expected to serve in sizable numbers through the mid-1990s and are flown by all the Warsaw Pact air forces plus at least 12 other air forces. Current variants identified by unclassified NATO reporting names are as follows:

MiG-23M ('Flogger-B'). First series production version. Single-seat air combat fighter with Tumansky R-27 turbojet, rated at 22,485 lb st with afterburning, and considerably modified airframe compared with Lyulka-engined prototype and preproduction models. Deliveries began in 1972.

MiG-23MF ('Flogger-B'). Generally similar to MiG-23M, but with more powerful R-29 turbojet and uprated equipment, including J band radar (NATO 'High Lark'; search range 53 miles, tracking range 34 miles) in nose, Sirena-3 radar warning system, 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 for Soviet air forces from about 1975 and for other Warsaw Pact air forces from 1978.

MiG-23UM ('Flogger-C'). Tandem two-seater for both operational training and combat use. Identical to MiG-23M (with R-27 engine), except for slightly raised second cockpit to rear, with retractable periscopic sight for occupant, and modified fairing aft of canopy.

MiG-23MS ('Flogger-E'). Export version of MiG-23M 'Flogger-B', equipped to lower standard. Smaller radar (NATO 'Jay Bird'; search range 18 miles, tracking range 12 miles) in shorter nose radome. No infrared sensor or Doppler. Armed with 'Atoll' missiles and GSh-23 gun.

MiG-23BN ('Flogger-F'). Export counterpart of Soviet air forces' MiG-27 ('Flogger-D') ground attack/interdictor. Has the nose shape, laser rangefinder, raised seat, cockpit external armor plate, and larger, low-pressure tires of the MiG-27, but retains the power plant, variable-geometry intakes, and GSh-23 twin-barrel gun of the MiG-23MF. Provision for AS-7 'Kerry' missiles.

MiG-23ML ('Flogger-G'). Basically similar to MiG-23MF, but with much smaller dorsal fin, lighter-weight radar, and, on some aircraft, an undernose sensor pod of new design.

MiG-23BN ('Flogger-H'). As 'Flogger-F', but with small fairing for radar warning receiver added on each side at bottom of fuselage, immediately forward of nosewheel doors.

MiG-23 ('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.

It is estimated that about 900 'Flogger-B/G/Ks' serve with the Soviet strategic air defense force and a further 900 in tactical air force regiments. On all versions, wing sweep is variable manually, in flight or on the ground, to 16°, 45°, or 72°. *(Data for 'Flogger-G' follow.)*

Power Plant: one Tumansky R-29B turbojet, rated at 27,500 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 9 in spread, 25 ft 6 in swept; length excl probe 52 ft 1¼ in; height 15 ft 9¾ in; wing area 336.9 sq ft spread, 372.4 sq ft swept.

Weights: empty 22,485 lb, max external weapons 6,615 lb, gross 35,495-41,670 lb.

Performance: max speed Mach 2.35 at height, Mach 1.2 at S/L, service ceiling 59,055 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-23 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 (NATO 'Aphid') missiles, in addition to two AA-7 (NATO 'Apex') on underwing pylons.

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

The threat of USAF's XB-70 Mach 3 strategic bomber, which the MiG-25 was designed to counter, failed to materialize in production form. However, as they had developed what was to prove the fastest combat aircraft ever put into first-line service, the Soviets ordered a limited number of basic MiG-25 interceptors and a further batch of reconnaissance MiG-25Rs. The airframes were manufactured primarily of arc-welded nickel steel, with titanium in areas subject to extreme heating, such as the wing leading-edges. Emphasis was placed on high-speed, high-altitude capability and, in the interceptor, a radar/missile fit that would permit attack over a considerable range. Maneuverability was less important, and the end product was strictly a 'straight and level' aircraft that even pilots of Third World air forces now fly routinely. Thirty years after the design was finalized, about 400 MiG-25s continue to equip the Soviet strategic interceptor force; a further 50 interceptors and 120 reconnaissance MiG-25s serve with the tactical air forces. Others fly in the national markings of Algeria, India, Iraq, Libya, and Syria. Six versions have been identified:

MiG-25 ('Foxbat-A'). Basic interceptor designed to attack high-flying targets. Slightly reduced wing sweep toward tips, which carry antiflutter bodies housing ECM and CW target-illuminating radar. Most operational aircraft in the USSR, and some in Libyan service, have been uprated to 'Foxbat-E' standard.

MiG-25R ('Foxbat-B'). Reconnaissance version. Described separately in *Reconnaissance, ECM, and EW Aircraft* section.

MiG-25U ('Foxbat-C'). Trainer with redesigned nose section, containing separate cockpit with individual canopy, forward of standard cockpit and at a lower level. No search radar or reconnaissance sensors in nose.

MiG-25R ('Foxbat-D'). Reconnaissance version. Described separately.

MiG-25M ('Foxbat-E'). Converted 'Foxbat-A' with changes to radar and equipment to provide limited look-down/shoot-down capability comparable with that of 'Flogger-B'. Undernose sensor pod. Engines uprated to 30,865 lb st. Developed via aircraft known as Ye-266M, which recaptured two time-to-height records from the

MiG-25M (NATO 'Foxbat-E') Interceptor with AA-6 (NATO 'Acrid') Air-to-Air Missiles

MiG-29 (NATO 'Fulcrum-A') (P. J. Cooper)

F-15 *Streak Eagle* in 1975 and subsequently set the current absolute height record of 123,524 ft.

MiG-25 ('Foxbat-F'). First illustrated in Soviet press in 1986, this 'Wild Weasel' type of defense suppression aircraft carries AS-11 (NATO 'Kilter') antiradiation missiles to attack surface-to-air missile sites over long standoff ranges. Airframe generally similar to 'Foxbat' interceptors, but with dielectric panel aft of radome on port side (possibly both sides) of front fuselage. Entered service in 1988. *(Data for 'Foxbat-A' follow.)*

Power Plant: two Tumansky R-31 (R-266) turbojets, each 27,010 lb st with afterburning. Internal fuel capacity approx 4,600 gallons. Electronically controlled variable ramps in intakes.

Dimensions: span 45 ft 9 in, length 78 ft 1¾ in, height 20 ft 0¼ in, wing area 611.7 sq ft.

Weights: basic operating 44,100 lb, gross 82,500 lb.

Performance: never-exceed combat speed, with missiles, Mach 2.83, max speed at low altitude, with missiles, Mach 0.85, service ceiling 80,000 ft, max combat radius 900 miles.

Armament: air-to-air missiles. These may comprise one infrared and one radar homing example of the AA-6 (NATO 'Acrid') under each wing. Alternatively, one AA-7 ('Apex') and a pair of AA-11s ('Archers') or AA-8s ('Aphids') can be carried under each wing.

MiG-29 (NATO 'Fulcrum')

Operational in its basic single-seat landbased form since early 1985, the MIG-29 is a twin-engine combat aircraft comparable in size to the US Navy's F/A-18 Hornet. Comparison of its general configuration with that of the much larger Su-27 shows that the two designs are strikingly similar in most respects; even in such detail as current tail fin location, the manner in which the mainwheels retract into the wingroots, and the use of hinged doors that shield the engine air intakes against foreign object ingestion during takeoff and landing. In the MiG, engine air is then taken in through louvers in the upper surface of the wingroot extensions. Its large pulse-Doppler look-down/shoot-down radar is limited to search-while-scan rather than track-while-scan, but is supplemented by a laser rangefinder and an infrared search/track sensor in front of the windscreen. Operating in conjunction with a helmet-mounted aiming device, these enable the MiG to avoid emission of detectable radar signals when approaching targets. Sustained turn rate is much improved over earlier Soviet fighters, and thrust-to-weight ratio is better than 1. Supermaneuverability and post-stall behavior were tested during development, and simulated combats have since been carried out in the post-stall region. Following early modifications, the MiG-29 will not enter a flat spin, is reluctant to enter a normal spin, and will recover as soon as the controls have been released. Its controls are hydraulically actuated.

Although operated primarily as a single-seat counter-air fighter, the MiG-29 has a full dual-role air combat/attack capability. Academician Rostislav A. Belyakov, general designer of the Mikoyan OKB, has referred to its 'substantial growth potential'. A combat-capable two-seat version has been in production and service for several years. Modified carrier-based and fly-by-wire versions have flown, and the full list of MiG-29 variants identified to date is as follows:

Fulcrum-A. Basic landbased single-seater, seen in three models:

The original single-seat production version, with two ventral tail fins similar to those of the Sukhoi Su-27.

First version displayed in public, when a detachment of six from Kubinka air base made a goodwill visit to Finland on July 1, 1986. Instead of ventral fins, this variant has its dorsal fins extended forward as what appear to be simple overwing aerodynamic fences but are packed with countermeasures flares.

Differs from second variant in having extended-chord rudders.

Fulcrum-B (MiG-29UB). Combat trainer with second seat in front of the normal cockpit, under a continuous canopy. Nose radar replaced by radar rangefinder. Periscope above canopy. Underwing stores pylons retained.

Fulcrum-C. Generally similar to the latest variant of 'Fulcrum-A', but with more deeply curved top to fuselage aft of the cockpit, containing extensive equipment. This may have been transferred from inside the lower fuselage to provide room for extra fuel.

Maritime Fulcrum. Used for ski-jump takeoff and deck landing trials on board the new Soviet Navy carrier *Tbilisi* in late 1989. Basically similar to 'Fulcrum-A' with original short-chord rudders. Upward folding outer wing panels, with bulged tips, probably for electronic support measures equipment. No intake FOD doors required for carrier operation, permitting deletion of overwing louvers and internal ducting in center-section, which now provides much increased integral fuel tankage. No APU airscoop on rear fuselage or flare dispenser 'fences' forward of dorsal fins. Different IRST. Expected to form standard close-range air defense/attack force on *Tbilisi* and its sister ships.

FBW Fulcrum. An experimental MiG-29, with fly-by-wire controls, was flown for the first time by Mikoyan chief test pilot Valery Menitsky in late 1989. Features include a different tailplane, a slightly changed wing position, and modifications to change the center of gravity. Claimed to be more comfortable to fly, with increased permissible angle of attack, better maneuverability, and improved cruise efficiency.

A 'glass' cockpit, with CRTs, will be installed in future MiG-29s. Mr. Belyakov has stated that his OKB plans to design a STOL aircraft and is evaluating the worth of stealth technology.

More than 500 MiG-29s have replaced MiG-21s, Su-15s, and some MiG-23s in Soviet units stationed in East Germany, Hungary, and in the USSR west of the Urals. Deliveries have also been made to the air forces of Cuba, Czechoslovakia, East Germany, India, Iraq, North Korea, Poland, Syria, and Yugoslavia. Manufacture is centered at a factory in Moscow. *(Data for 'Fulcrum-A' follow.)*

Power Plant: two Isotov RD-33 turbofans, each 18,300 lb st with afterburning. Internal fuel capacity 1,153 gallons. Provision for two external tanks underwing and one under fuselage.

Dimensions: span 37 ft 3¼ in, length 56 ft 10 in, height 15 ft 6¼ in, wing area 378.9 sq ft.

Weights: empty 18,025 lb, gross 33,065–39,700 lb.

Performance: max speed at height Mach 2.3, at S/L Mach 1.06, service ceiling 56,000 ft, combat radius 650 miles.

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

Armament: six medium-range radar homing AA-10

(NATO 'Alamo-A') 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 in attack role. One 30 mm gun in port wingroot leading-edge extension.

MiG-31 (NATO 'Foxhound')

First Soviet interceptor to offer true look-down/shoot-down and multiple-target engagement capability, the MiG-31 inherits its configuration from 'Foxbat' and appears to have a generally similar arc-welded nickel steel structure to speed development and production. It is, however, a very different aircraft, with a crew of two and reduced emphasis on highest attainable speed. The large pulse-Doppler radar is said to embody technology found in the Hughes AN/APG-65 digital radar of the Navy's F/A-18 Hornet; its search range is said to be 190 miles and tracking range 167 miles. Other equipment includes an infrared search/track sensor, radar warning receivers, and active infrared and electronic countermeasures. Offset tandem twin-wheel main landing gear units for operation from rough ground and gravel.

Deployment of MiG-31s with VPVO air defense regiments had begun by early 1983, and more than 160 are operational, at bases from the Arkhangelsk area near the USSR's western borders to Dolinsk on Sakhalin Island, north of Japan. Production is centered at the Gorki airframe plant.

Power Plant: two Tumansky turbojets; each 30,865 lb st with afterburning. Fuel capacity probably similar to MiG-25.
Dimensions: span 45 ft 11¼ in, length of fuselage (nosecone tip to end of jetpipes) 70 ft 6½ in.
Weights: empty 48,115 lb, gross 90,725 lb.
Performance: max speed Mach 2.4 at height, combat radius 1,305 miles.
Accommodation: crew of two, in tandem.
Armament: aircraft seen to date each had four AA-9 (NATO 'Amos') radar homing long-range air-to-air missiles in pairs under fuselage, and twin mounts for AA-8 ('Aphid') air-to-air missiles on one large pylon under each wing. These pylons, and outer underwing pylons not yet observed, can probably increase the number of AA-9s to eight.

Sukhoi Su-15 (NATO 'Flagon')

The number of Su-15s in home defense units is believed to be around 400, 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 afterburning turbojets, reported to be Tumansky R-13F2-300s; each 15,875 lb st.
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 (NATO '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')

Undoubted star of the 1989 Paris Air Show, the Su-27 was designed specifically for air-to-air combat and was the first Soviet fighter to have fly-by-wire flight controls as standard. These give it outstanding agility and a very tight turning circle; but development was not easy, and two pilots lost their lives before major airframe redesign provided the production configuration. There are no ailerons. Instead, 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 amount of titanium is used in the airframe. The current 1970s-style cockpit instruments will be superseded by CRTs in the near future. Already, the integrated fire-control system enables the coherent pulse-Doppler radar, IRST sensor, and laser rangefinder to be slaved to the pilot's helmet-mounted aiming device and displayed on the wide-angle HUD. A range of more than 2,500 miles on internal fuel removed the need for external tanks, but an in-flight refueling capability is now under development. Refueled from an Il-78 and Su-24 buddy tanker, one test Su-27 flew nonstop 8,700 miles from Moscow to the Pacific coast of the USSR and back.

Maritime MiG-29 (NATO 'Fulcrum') on carrier* Tbilisi, *with wings folded

MiG-31 (NATO 'Foxhound') (DoD)

Four versions have been identified by NATO reporting names, as follows:

Flanker-A. Prototypes, the first of which flew, as Model T-10, on May 20, 1977. Followed by many preseries aircraft, all with curved wingtips, and tail fins mounted centrally above engine housings.

Flanker-B. Single-seat landbased production version, with square wingtips carrying launchers for air-to-air missiles, tail fins located outboard of engine housings, extended tailcone, and other changes. First flown April 20, 1981.

Flanker-B variant 2. Version for ramp-assisted operation from Soviet Navy carriers, first mentioned by Rear Adm. William O. Studeman, USN, in the spring of 1988. Basically similar to landbased 'Flanker-B' but with movable foreplanes, first tested on experimental Su-27 designated Model 1024. Folding outer wing panels, twin-wheel nose landing gear, added arrester hook. Long tailcone of landbased version deleted, to prevent tail-scrapes during takeoff and landing.

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

Series production of the Su-27 is centered in a plant at Komsomolsk, Khabarovsk Territory. More than 100 are in service with Soviet strategic air defense forces, including units based in the Kola Peninsula and in the far east of the USSR, as replacements for older types such as the Yak-28P, Su-15, and Tu-28P/128. Operating in conjunction with the AEW&C 'Mainstay', they have been particularly active in simulated interceptions of NATO aircraft over the Barents Sea. All fighter components of the Leg-

Sukhoi Su-27 (NATO 'Flanker-B') (Ivo Sturzenegger)

nica and Vinnitsa air armies are reequipping with Su-27s, which have sufficient range to escort Su-24 'Fencer' deep-penetration strike missions against the UK and western Europe. Look-down/shoot-down weapon systems and beyond-visual-range air-to-air missiles provide formidable potential against low-flying aircraft and cruise missiles. Fine-grille hinged screens in the engine air intakes guard against FOD during takeoff and landing.

A specially prepared Su-27, known as the P-42, holds four time-to-height records, including a climb to 12,000 m (39,370 ft) in 55.5 seconds. *(Data for standard 'Flanker-B' follow.)*
Power Plant: two 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 gun, with 149 rds, in starboard wingroot extension. Up to ten air-to-air missiles, including pairs of AA-10A/B/C (NATO 'Alamo-A/B/C'), or AA-9 'Amos', and four AA-11 ('Archer') or AA-8 ('Aphid').

Tupolev Tu-28P/Tu-128 (NATO 'Fiddler')

Largest purpose-designed interceptor yet put into service, 'Fiddler' is usually designated Tu-28P in the press, but DoD prefers Tu-128. Fewer than 50 'Fiddler-Bs' remain operational with the VPVO home defense fighter force.
Power Plant: two unidentified afterburning turbojets; each estimated at 27,000 lb st.
Dimensions: span 59 ft 4½ in, length 89 ft 3 in.
Weight: gross 100,000 lb.
Performance: max speed Mach 1.65 at 36,000 ft, ceiling 65,600 ft, combat radius with max internal fuel 930 miles.
Accommodation: crew of two in tandem.
Armament: four AA-5 air-to-air missiles (NATO 'Ash') under wings, two radar homing, two infrared homing.

Yakovlev Yak-28P (NATO 'Firebar')

About 60 veteran Yak-28P all-weather interceptors are thought to remain operational in the VPVO fighter force.
Power Plant: two turbojets, related to the Tumansky R-11 fitted in some MiG-21s; each 13,120 lb st with afterburning.
Dimensions: span 42 ft 6 in, length 75 ft 5½ in, height 12 ft 11½ in.
Weight: gross 44,000 lb.
Performance: max speed Mach 1.88 at 35,000 ft, service ceiling 55,000 ft, combat radius 575 miles.
Accommodation: crew of two in tandem.
Armament: two AA-3 air-to-air missiles (NATO 'Anab') under outer wings, with alternative infrared or semi-active radar homing heads.

Yakovlev Yak-38 (NATO 'Forger')

The Yak-38 remains the only operational jet combat aircraft that shares the Harrier's V/STOL capability, but requires three engines, rather than one, to make this possible. When first observed on board the carrier/cruiser *Kiev*, in 1976, it 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. But payload/range capability is limited, and Western pilots might not enthuse over an electronic system that 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 appear to be operational on each of the four Soviet carrier/cruisers, in addition to 'Forger-Bs' and about 19 Kamov Ka-25 or Ka-27 helicopters. 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 Lyulka AL-21 turbojet, without afterburner, exhausting through two vectored-thrust nozzles that can turn up to 10° forward of vertical for VTOL; 17,985 lb st. Two Koliesov liftjets in tandem aft of cockpit, inclined forward at 13° from vertical; each 7,875 lb st.

Dimensions: span 24 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, and auxiliary fuel tanks.

Yakovlev Yak-41

The existence of this second-generation Yakovlev V/STOL fighter/attack aircraft was revealed by Rear Adm. William O. Studeman, USN, in the spring of 1988. Its general configuration is shown in the DoD artist's impression of a Yak-41 on the deck of the Soviet Navy carrier *Tbilisi*, shown above right. In fact, this aircraft has not yet carried out ship trials, and there is no certainty that it will be based on the new class of 65,000-ton carriers. More likely is that it will supersede Yak-38s on the smaller carrier/cruisers of the *Kiev* class.

The artist's impression is based on initial overhead satellite photography, and gives no suggestion of the engine configuration. A report in a usually well-informed French aviation magazine has suggested that the Yak-41 is powered by a single vectored-thrust turbofan, designed under the leadership of Eng Khachaturov, on the lines of the Harrier's Rolls-Royce Pegasus. However, a liftjet/vectored-thrust multiengine power plant similar to that of the Yak-38 seems more likely. Evolutionary changes by comparison with the Yak-38 include a refined airframe configuration with the now conventional twin tail fins, a nose radar, and supersonic capability.

Yakovlev Yak-38 (NATO 'Forger-A') (US Navy)

Artist's impression of Yak-41 on carrier Tbilisi (DoD)

Attack Aircraft

MiG-27 (NATO 'Flogger')

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. Two versions are operational in Soviet tactical air force regiments:

Flogger-D. Initial version, with forward portion of fuselage completely redesigned by comparison with interceptor versions of MiG-23. Instead of having an ogival radome, 'Flogger-D' 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 Gatling-type underbelly gun replaces GSh-23 of interceptor. Bomb/JATO rack under each side of rear fuselage, in addition to five pylons for external stores, including tactical nuclear weapons and the air-to-surface missiles known to NATO as AS-7 'Kerry', AS-10 'Karen', AS-12 'Kegler', and AS-14 'Kedge'. Bullet-shape antenna above each glove pylon, associated with missile guidance. Radar warning receiver blister on each side of front fuselage, ahead of nosewheel bay.

Flogger-J. Identified in 1981. Modified nose, with lip at top and blister fairing below. Enhanced electro-optical sensors, probably with rearward laser designation capability for laser-guided bomb delivery. Bullet-shape antennae above wingroot glove pylons and external armor on sides of cockpit deleted. Wingroot leading-edge extensions on some aircraft. Armament includes two gun pods on underwing pylons, with gun barrels that can be depressed for attacking ground targets.

About 830 'Flogger-Ds' and 'Js' are deployed with Soviet tactical air forces (with which they operated in Afghanistan), plus at least one squadron with the East German Air Force. The somewhat similar aircraft known to NATO as 'Flogger-F' and 'H' are MiG-23s. Both have been operated by Soviet units, but are basically export counterparts of the MiG-27, equipped to lower standards. *(Data for 'Flogger-D' follow.)*

Power Plant: generally similar to MiG-23MF, but R-29-300 engine rated at 25,350 lb st with afterburning.

Dimensions: span as MiG-23, length 52 ft 6 in.

Weights: max external load 9,920 lb, gross 44,313 lb.

Performance: max speed Mach 1.7 at height, Mach 1.1 at S/L, service ceiling 52,500 ft, combat radius (lo-lo-lo, with underbelly tank, four 1,100 lb bombs, and two 'Atoll' missiles) 240 miles, max ferry range (3 external tanks) 1,550 miles.

Armament: described above.

Sukhoi Su-17, Su-20, and Su-22 (NATO 'Fitter-C, D, E, F, G, H, J, and K')

The original prototype of this family of single-seat attack fighters was no more than a simple variable-geometry modification of the old Su-7 'Fitter-A'. Progressive development has made the latest versions so capable that more than 1,000 of them constitute one-third of the Soviet tactical ground attack force. In addition, Soviet Naval Aviation has about 75 at land bases of the Baltic Fleet for antishipping strike and amphibious support roles and has formed a further Su-17 unit in the Pacific. Variants in Soviet service are as follows:

Su-17 ('Fitter-C'). Basic single-seat attack aircraft for Soviet air forces, with Lyulka AL-21F-3 turbojet. Manual wing sweep control. Curved dorsal fin between tail fin and dorsal spine fairing. 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. Serves also with Soviet Navy and, with reduced equipment standard, with air forces of Algeria, Czechoslovakia, Egypt, Iraq, and Poland.

MiG-27 (NATO 'Flogger-D')

Su-17M ('Fitter-D'). Generally similar to 'Fitter-C', but forward fuselage lengthened by about 10 in. Added undernose electronics pod for Doppler navigation radar. Laser rangefinder in intake centerbody.

Su-17UM ('Fitter-E'). Tandem two-seat trainer for Soviet air forces. Generally similar to 'Fitter-D', without electronics pod, but entire fuselage forward of wing drooped slightly to improve pilot's view. Deepened dorsal spine fairing, almost certainly providing additional fuel tankage. Port wingroot gun deleted.

Su-17 ('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-17 ('Fitter-H'). Improved single-seater for Soviet air forces. Basically as 'Fitter-D', but with wide and deep dorsal fairing aft of canopy, like 'Fitter E/G'. Doppler navigation radar fitted internally in deepened undersurface of nose. Taller fin like 'Fitter-G'. Removable ventral fin. Retains both wingroot guns. About 165 'Fitter-H/K' are equipped for tactical reconnaissance duties, carrying a centerline sensor pod.

Su-17 ('Fitter-K'). Latest single-seat version, identified in 1984. Dorsal fin embodies small cooling air intake at front.

The later versions exported to Angola, Libya, Peru, Syria, Vietnam, and North and South Yemen were seen to have a more bulged rear fuselage, now known to house a Tumansky R-29BS-300 turbojet, as fitted in the MiG-27, with rearranged external air ducts and a shorter plain metal shroud terminating the rear fuselage. This change of power plant, together with variations in equipment standard, is covered by the following changes to the Soviet type designation:

Su-22 ('Fitter-F'). Export counterpart of 'Fitter-D', with modified undernose electronics pod. Tumansky R-29B turbojet, rated at 25,350 lb st with afterburning. Gun in each wingroot. Weapons include AA-2 'Atoll' air-to-air missiles. Aircraft supplied to Peru had Sirena-2 limited-coverage radar warning receiver, virtually no navigation aids, and IFF incompatible with that nation's SA-3 (NATO 'Goa') surface-to-air missiles. Some basic US-supplied avionics fitted subsequently.

Su-22 ('Fitter-G'). Export counterpart of Su-17 'Fitter-G', with R-29B engine.

Su-22 ('Fitter-J'). Generally similar to 'Fitter-H', but with Tumansky engine. Internal fuel capacity 1,656 gallons. More angular dorsal fin. 'Atoll' air-to-air missiles. Supplied to Libya and Peru.

Su-22M-4 ('Fitter-K'). Similar to Soviet Air Force 'Fitter-K', for Czechoslovakia, East Germany, and Poland. *(Data for Su-17 'Fitter-C' follow.)*

Power Plant: one 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.

Weights: empty 22,046 lb, takeoff clean 30,865 lb, gross 39,020 lb.

Performance: max speed Mach 2.09 at height, Mach 1.05 at sea level, ceiling 59,050 ft, combat radius with 4,410 lb external stores (lo-lo-lo) 275 miles, (hi-lo-hi) 425 miles.

Accommodation: pilot only.

Armament: two 30 mm NR-30 guns in wingroots; eight pylons under fuselage and wings for more than 7,000 lb of bombs, including nuclear weapons, rocket pods, and such guided missiles as the air-to-surface AS-7 (NATO 'Kerry').

Sukhoi Su-24 (NATO 'Fencer')

More than 500 'Fencers' are now assigned to strategic missions in four of the five Soviet continental TVDs (theaters of military operations). By consolidating all of the USSR-based 'Fencers' into VGK-subordinate air armies in this way, their responsiveness and ability to meet theater requirements are both enhanced. The strike components of the Legnica and Vinnitsa air armies already consist almost exclusively of Su-24s. About 300 other 'Fencers' equip tactical deep-interdiction units of the air forces of military districts and groups of forces, and at least one squadron serves with the Baltic Fleet air force for maritime reconnaissance, making a total of more than 800 in Soviet service. In addition, 15 have been supplied to Libya, and 12 have been ordered by Syria. Each has twice the combat radius of the Su-17 while carrying a comparable weapon load. The ability to deliver a wide range of air-to-surface missiles provides de-

fense 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.

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 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. Five versions may be identified by NATO reporting names:

Fencer-A. Identifiable by rectangular rear fuselage box enclosing jet nozzles.

Fencer-B. Rear fuselage box around jet nozzles has deeply dished bottom skin between nozzles. Larger brake parachute housing.

Fencer-C. Introduced in 1981. Important equipment changes. Multiple fitting on nose instead of former simple probe. Triangular fairing forward of each fixed wingroot, on side of air intake (presumably housing RWR equipment of the kind seen on the fuselage sides, forward of the nosewheel doors, of ground attack MiG-23/27 'Floggers') and also on each side of fin, near tip.

Fencer-D. Introduced in 1983, with added in-flight refueling capability. Slightly longer nose (approx 2 ft 6 in); chord of lower part of tail fin extended, giving kinked leading-edge; large overwing fences integral with extended wingroot glove pylons, probably for AS-14 (NATO 'Kedge') missiles; undernose antennae deleted; blister, probably for electro-optical sensor, added aft of nosewheel bay; and single long noseprobe.

Fencer-E. Reconnaissance variant of 'Fencer-D' used by tactical and naval air forces. Ability to carry air-to-surface missiles retained. About 65 in service.

An electronic warfare version, to replace the 'Brewer-E' model of the Yak-28, was undergoing systems development in 1988. *(Data for 'Fencer-C' follow.)*

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

Dimensions: span 57 ft 5 in spread, 33 ft 5½ in swept; length excl probe 69 ft 10 in; height 19 ft 8¼ in.

Weights: empty, equipped 41,885 lb, gross 87,080 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 six-barrel 30 mm Gatling-type gun on starboard side of belly; eight pylons under fuselage, wingroot gloves, and outer wings for 24,250 lb of guided and unguided air-to-surface weapons, including nuclear weapons, and such missiles as AS-7 (NATO 'Kerry'), AS-10 ('Karen'), AS-11 ('Kilter'), AS-12 ('Kegler'), AS-13 ('Kingbolt'), and AS-14 ('Kedge').

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

Information made available officially at the 1989 Paris Air Show, where examples were displayed, confirms earlier assessment of the effectiveness of this modern counterpart of the Soviets' Ilyushin Il-2 *Shturmovik* close support aircraft of World War II. 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 fire protection. A total of 256 flares is packed into containers above the engine nacelles and tailcone for protection 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.

More than 300 Su-25s have been delivered from the Tbilisi airframe plant to Soviet tactical units and the air forces of Bulgaria, Czechoslovakia, Hungary, and Iraq. Versions identified to date are as follows:

Su-25K ('Frogfoot-A'). Basic single-seat close support version.

Su-25UB ('Frogfoot-B'). Tandem two-seat operational conversion and weapons training version. Raised rear cockpit. Gun and weapons pylons retained. With arrester hook under rear fuselage, has been used for deck landing training on dummy flight deck marked out on runway at Saki naval airfield, and on deck of carrier *Tbilisi*.

Su-25UT ('Frogfoot-B'). Generally similar to Su-25UB but without arrester hook. In production as advanced trainer for DOSAAF.

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

Power Plant: two nonafterburning 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.

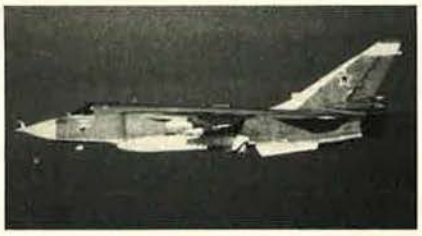
Weights: empty 20,950 lb, gross 32,187–38,800 lb.

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. 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 (NATO 'Atoll') or AA-8 ('Aphid') air-to-air missiles.

Sukhoi Su-22M-4 (NATO 'Fitter-K'), Polish Air Force (Ryszard Jaxa-Malachowski)



Sukhoi Su-24 (NATO 'Fencer-C') (DoD)

Reconnaissance, ECM, and Early Warning Aircraft

New Reconnaissance Aircraft (NATO 'Mystic')

Among Soviet aircraft observed at Ramenskoye flight test center in 1982 is a high-altitude reconnaissance vehicle in the class of USAF's Lockheed TR-1. It is known by the NATO reporting name 'Mystic' and is probably under continuing development. It is a high-wing monoplane with glider-like wings, twin tailbooms, and a long-span tailplane, mounted on the tips of the tail fins and extending beyond them. The single engine of the example illustrated has fuselage-side intakes, and exhausts from the rear of the fuselage pod, at the wing trailing-edge.

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 antennae on front fuselage, aft of flight deck, and other changes.

Cub-B. Conversion of 'Cub' transport for elint missions. Examples photographed over international waters by the crews of Norwegian and Swedish combat aircraft each had two additional radomes under the forward- and center-fuselage, plus other antennae. About 10 produced for Soviet Naval Air Force.

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 ECM dispensers. Glazed nose and undernose radar of transport retained. An ogival 'solid'

New Soviet Reconnaissance Aircraft (NATO 'Mystic')

fuselage tailcone, housing electronic equipment, is fitted in place of the usual gun position.

Cub-D. This further variant of the An-12 reflects the huge efforts being made by the Soviet Union to ensure effective handling of every conceivable ECM task. Equipment differs from that of 'Cub-C' to perform different active countermeasures duties. About 20 'Cub-C and D' aircraft are believed to serve with the Soviet Navy.

Antonov An-74 AEW&C Variant
(NATO 'Madcap')

A photograph taken during Mr. Gorbachev's visit to the Antonov design bureau shows, in the background, the much modified tail of an An-74 bearing the serial number SSSR-780151. This has a large, sweptforward fin and rudder, at the top of which is mounted an AEW&C (airborne early warning and control) rotodome. It can be assumed that this aircraft bears the same relationship to the Ilyushin 'Mainstay' as does the Grumman E-2C Hawkeye to the Boeing E-3 Sentry, with similar potential for export to selected customers. Production is likely to be at an early stage, with a few aircraft completed and considerable effort still required to perfect the avionics.

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

This electronic intelligence (elint)/reconnaissance aircraft appears to be 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 antennae 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 basic Il-18 airframe that has been put to good use by the Soviet armed forces. All that can yet be published is that it is an airborne command post, operational in substantial numbers. It would be logical to expect a variety of external fairings and antennae, as on USAF EC-135s.

Ilyushin Il-76 AEW&C Variant
(NATO 'Mainstay')

Deployment of this AEW&C version of the Il-76 has been slower than anticipated. About 12 currently operate with MiG-29, MiG-31, and Su-27 counterair fighters of the VPVO home defense force and Soviet tactical air forces, mainly in the Soviet 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. In *Soviet Military Power,* DoD stated that 'Mainstay' improves substantially Soviet capabilities for early warning and air combat command and control compared with the earlier Tu-126. It provides the Soviet forces with the capability to 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 European and Asian battlefields as well as to enhance air surveillance and defense of the USSR. Its Soviet designation is reported to be A-50.

MiG-21 (NATO 'Fishbed-H')

Two versions of this single-seat fighter are operated by the Soviet air forces and their allies as specialized tactical reconnaissance aircraft:

MiG-21R ('Fishbed-H'). Basically similar to MiG-21-PFMA, but with a pod housing forward-facing or oblique cameras, or elint sensors, on the fuselage centerline pylon. Suppressed ECM antenna at midpoint on dorsal spine and optional radar warning receivers in wingtip fairings.

MiG-21RF ('Fishbed-H'). Generally similar to MiG-21R, but based on MiG-21MF. Total of 60 'Fishbed-Hs' of both models estimated in service with Soviet tactical air forces.

MiG-25 (NATO 'Foxbat-B and D')

Generally similar to the basic MiG-25 interceptor, the reconnaissance variants have a modified wing and, carrying no external weapons, are not limited to Mach 2.8, although engine life is brief at speeds above Mach 3. Two versions have been identified in service, as follows:

MiG-25R ('Foxbat-B'). Basic reconnaissance version, with five camera windows and various flush dielectric panels aft of very small dielectric nosecap for radar. Equipment believed to include Doppler navigation system and side-looking airborne radar (SLAR). No armament. Slightly reduced span. Wing leading-edge sweep constant from root to tip. Total of about 120 'Foxbat-Bs and Ds' estimated in service with the Soviet tactical air forces. 'Foxbat-B' also operational in Algeria, India, Libya, and Syria.

MiG-25R ('Foxbat-D'). Similar to 'Foxbat-B', but with larger SLAR dielectric panel, farther aft on side of nose, and no cameras. Supplied also to Libya.

Ilyushin Il-76 AEW&C Variant (NATO 'Mainstay')

Mil Mi-8 (NATO 'Hip-K')

The MiG-25 'Foxbat-F', a 'Wild Weasel' type of defense suppression aircraft, is listed under the main MiG-25 entry in the *Fighters* section.

Dimension: span 44 ft 0 in.

Weights ('Foxbat-B'): basic operating 43,200 lb, gross 73,635 lb.

Performance: max speed Mach 3.2 at height, service ceiling 88,580 ft, operational radius 560 miles.

Mil Mi-8 (NATO 'Hip-D, G, 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 antennae.

Hip-G. Airborne communications version. Rearward inclined antennae projecting from rear of cabin and from undersurface of tailboom, aft of box for Doppler radar.

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 large antenna array on each side of cabin. No Doppler radar box under tailboom.

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

About 165 of the Su-17 ('Fitter-H/K') fighters serving with Soviet 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')

Reconnaissance/attack 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, and K')

Details of these maritime, photographic, and electronic reconnaissance versions of the Tu-16, and ECM chaff-dispensing and jamming versions, can be found under the main Tu-16 entry in the *Bombers and Maritime* section.

Tupolev Tu-22 (NATO 'Blinder')

See main Tu-22 entry in *Bombers and Maritime* section.

Tupolev Tu-95 (NATO 'Bear')

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

Tupolev Tu-126 (NATO 'Moss')

About six Tu-126 first-generation airborne early warning and control aircraft remain operational, with airframe and power plant based on those of the long-retired Tu-114 turboprop airliner rather than the smaller-fuselage Tu-95 bomber. The 36 ft diameter rotating radar 'saucer' (NATO 'Flap Jack') above the fuselage is 6 ft larger than that of the E-3; however, the Tu-126 is believed to have only limited effectiveness in the warning role over water and to be ineffective over land. Replacement with the Il-76-derived 'Mainstay' is nearing completion.

Power Plant: four Kuznetsov NK-12MV turboprops; each 14,795 ehp. Internal fuel capacity 20,075 gallons. In-flight refueling probe standard.

Dimensions: span 168 ft 0 in, length 181 ft 1 in, height 52 ft 8 in, wing area 3,349 sq ft.

Weight: gross 374,785 lb.

Performance: max speed 528 mph, normal operating speed 404 mph, max range without flight refueling 7,800 miles.

Accommodation: crew of twelve.

Armament: none.

Yakovlev Yak-28 (NATO 'Brewer')

Versions of this two-seat tactical aircraft still operational in support roles are as follows:

Brewer-D. Reconnaissance aircraft, carrying cameras or other sensors, including side-looking airborne radar, instead of weapons in its internal bomb-bay. Blister radome under fuselage forward of wings.

Brewer-E. Deployed in 1970 as the first Soviet operational ECM escort aircraft, with an active ECM pack built into its bomb bay, from which the pack projects in cylindrical form. No radome under front fuselage, but many additional antennae and fairings. A rocket pod, chaff dispenser, or antiradiation missile can be carried under each outer wing, between the external fuel tank and balancer wheel housing.

Approximately 125 'Brewer-Ds and Es' remain in service for tactical reconnaissance and ECM and 40 for strategic ECM.

Dimensions, weight, and performance should be in the same order as those of the Yak-28P ('Firebar') interceptor (which see).

Transports and Tankers

Antonov An-12BP (NATO 'Cub')

Unlike its Western counterparts, the Soviet Military Transport Aviation force (VTA) uses its 600 aircraft primarily to carry equipment and cargo. The 1,600 long- and medium-range aircraft of the national airline, Aeroflot, with their crews, provide immediately available troop transport capability, as well as supplementing VTA's freight-carrying fleet. During the past decade, VTA has modernized 75 percent of its inventory, and An-12BPs have been replaced by far more efficient Il-76s. Fewer than 150 remain, mostly in units located along the southern and far eastern periphery of the USSR. Another 200 serve with the Soviet air armies and air forces of military districts and groups of forces, together with 300 short-range transports.

The medium-range An-12BP entered service 31 years ago. Its 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.

An-12s serve with ten other air forces, and developed versions are in production in China under the designation Y-8 for both transport and maritime patrol duties. The Soviet 'Cub-A, B, C, and D' elint and ECM versions are described separately.

Power Plant: four Ivchenko AI-20K turboprops; each 4,000 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 'Condor' 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 55 An-22s are now available to VTA. Each has a max payload of 176,350 lb.

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')

Developed from the popular An-24 twin-turboprop airliner, the An-26 freighter 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 Soviet Military Transport Aviation force; others are flown by about 27 foreign air forces. Those operated by some nations, including Angola and Mozambique, have a rack on each side of the fuselage below the wing for bombing missions. A derivative known as the Y-14 is under development in China.
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 version has rollgangs and mechanical handling system, enabling two men to load and unload three 8 ft long standard freight pallets in 30 minutes.
Armament: none on Soviet air forces' An-26s.

Antonov An-32 (NATO 'Cline')

This specialized 'hot and high' short/medium-range transport is being produced currently in Kiev at the rate of at least 40 a year, many for Soviet air forces service. India ordered 118, Peru has 15, some have gone to Afghanistan, and at least four other customers have been reported. 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 specified as 14,770 lb, but an An-32 lifted 15,996 lb to 2,000 m while setting 14 official records for height, sustained height, and payload to height.

In addition to the basic transport version, the An-32 is available with equipment for a variety of duties, including fisheries surveillance, firefighting, and air ambulance complete with operating theater.
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: normally none, but Peruvian aircraft have two racks for bombs on each side of the fuselage below the wing.

Antonov An-70

In December 1988, *Izvestia* reported that a new transport aircraft designated An-70 is being developed to replace some of VTA's remaining An-12BPs. Production, intended originally to begin that year, has been deferred until 1995.

Antonov An-72 and An-74 (NATO 'Coaler')

The An-72/74 series is expected to develop into a 'family' of aircraft at least as diverse as the earlier An-24/26/30/32. Initially, 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

Antonov An-32 (NATO 'Cline') (Aviation Magazine Int'l/Jacques Marmain)

Antonov An-72A (NATO 'Coaler-C') (Aviation Magazine Int'l/Jacques Marmain)

operation, using the so-called 'Coanda effect.' Two prototypes were built, of which the first 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 wing span, 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 will be superseded eventually by 16,550 lb st Lotarev 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 that does not follow curve of fuselage undersurface. Production of about 100 anticipated.

Examples of 'Coaler' have been seen in military camouflage. In addition, an AEW&C variant is flying and has received the NATO reporting name 'Madcap' *(see Reconnaissance, ECM, and Early Warning Aircraft section).*
Power Plant: two Lotarev D-36 high bypass ratio turbofans; each 14,330 lb st.
Dimensions: span 104 ft 7½ in, length 92 ft 1¼ in, height 28 ft 4½ in, wing area 1,062 sq ft.
Weights: max payload 22,045 lb. gross 76,060 lb.
Performance (at TO weight of 72,750 lb): 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 (An-72) or five (An-74); main cabin designed primarily for freight, but An-72 has 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.

Ilyushin Il-78 tanker (NATO 'Midas') (Royal Norwegian Air Force)

Antonov An-124 (NATO 'Condor')

The An-124 is the Soviet counterpart to the USAF/Lockheed C-5 Galaxy, with a slightly larger wing span and higher gross weight. The first of two prototypes flew on December 26, 1982, and about 18 production aircraft had followed from the Kiev plant by the beginning of 1989. Deliveries to VTA, the Soviet Military Transport Aviation force, began during 1987, to replace the turboprop An-22.

No major changes were made when progressing from prototypes to production. Except for having a low-mounted tailplane, the An-124's 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. Payloads range from the largest Soviet battle tanks to complete missile systems, Siberian oil well equipment, and earth movers.

Of particular significance is that the Soviet Union now has turbofan engines comparable in power with those fitted in the latest Western transport aircraft. They enabled an An-124 to set 21 official records by lifting a payload of 377,473 lb to a height of 35,269 ft on July 26, 1985, 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 Soviet Union.
Power Plant: four 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.
Performance: max cruising speed 537 mph, 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.

Antonov An-225 Mriya

There is no evidence yet that the An-225, the world's largest airplane and the first with a gross weight exceeding one million pounds, has any planned military use. It lacks a rear door and ramp for 'straight-through' loading, and will be used initially to carry Soviet space shuttle orbiters, components of the Energiya launch rocket, and similar giant loads, externally on mounts above its fuselage, as a replacement for the converted M-4 'Bison' used to date. But there could well be occasions when an aircraft with a maximum internal or external payload of 250 metric tons would form a useful supplement to VTA's An-124s in ferrying major military loads over long distances.

Known by its design bureau as the Mriya (Dream), the An-225 was conceived as a scale-up of the An-124, with six turbofan engines instead of four, and a similar 50 percent increase in gross weight and payload. Standard An-124 wings were attached outboard of a new center-section, and the fuselage was lengthened, without altering the cross-section of the freight hold. Twin tail fins were installed on the new rear fuselage, to preserve optimum control with external loads in place. Each main landing gear was given seven pairs of wheels in tandem, compared with five pairs on the An-124, to retain the latter's ability to turn on narrow runways. The rear four pairs on each side are steerable.

Despite its size, the prototype An-225 was completely unknown in the West until it was unveiled at Kiev on November 30, 1988. It made a 75-minute first flight only three weeks later, on December 21, taking off from what the TASS news agency described as 'a 1,000 m (3,280 ft) runway.' In service, it is intended to operate from airfields with an 11,500 ft runway. After three months of testing, the An-225 set a total of 106 records by taking off at a weight of 1,120,370 lb, with a payload of 344,576 lb, flying around a 2,000 km closed circuit in 3½ hours, and reaching a height of more than 39,000 ft en route. The first flight with the Soviet shuttle *Buran* mounted on its roof beams was made on May 13, 1989, and the An-225 was flown to the Paris Air Show in this form one month later. At that time, only the prototype had been completed. One more has been funded, and further An-225s will be built as required. Antonov's General Designer, Pyotr Bal-

Antonov An-225 Mriya, carrying space shuttle orbiter* Buran *(Air Portraits)

abuyev, claims that everyday cargoes could be hauled by the An-225 at a ton/mile cost 30 percent lower than that offered by the An-124. The 141 ft long cabin could accommodate sixteen large freight containers, or up to 80 Lada automobiles.

Power Plant: six Lotarev D-18T turbofans; each 51,590 lb st.

Dimensions: span 290 ft 0 in, length 275 ft 7 in, height 59 ft 4¾ in.

Weights: nominal payload 551,150 lb, gross 1,322,750 lb.

Performance: cruising speed 435–528 mph, range with 440,900 lb internal payload 2,800 miles.

Accommodation; crew of six; internal or external freight.

Armament: none on prototype.

Ilyushin Il-76 (NATO 'Candid-B')

In the same class as USAF's C-141 StarLifters, nearly 450 Il-76s constitute around 70 percent of the current VTA inventory, with deliveries continuing at the rate of 50 a year. The Ilyushin OKB was given the task of producing a replacement for the An-12BP medium-range transport, able to haul 40 metric tons of freight over a distance of 3,100 miles (5,000 km) in under six hours in the harsh operating conditions of Siberia. The prototype flew for the first time on March 25, 1971. By July 1975, Il-76s were able to set 25 official records, including a payload of more than 70 metric tons lifted to a height of 38,960 ft and a speed of 532.923 mph around a 1,000 km circuit with the same load.

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 unarmed Il-76/76T/76TD versions are known to NATO as 'Candid-A'. Deliveries to a development squadron of military Il-76Ms ('Candid-B'), with rear guns and small ECM fairings, began in 1974. Current operators include the air forces of India, Iraq, Czechoslovakia, and Poland, as well as the VTA, which can also draw on the Il-76Ts and Ms of Aeroflot as necessary. Packs of ninety-six 50 mm infrared countermeasures flares can be carried in the landing gear fairings and/or on the sides of the rear fuselage of Soviet aircraft operating into combat areas.

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 105,820 lb, and additional fuel to extend max range by 745 miles.

Power Plant: four 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 pasengers.

Armament: two 23 mm twin-barrel GSh-23L guns in tail turret.

Ilyushin Il-78 Tanker (NATO 'Midas')

When the Soviets allowed former US Defense Secretary Frank C. Carlucci to inspect a 'Blackjack' strategic bomber, on August 2, 1988, it was parked alongside an Il-78 (NATO 'Midas') in-flight refueling tanker. Development of 'Midas' had begun in the mid-1970s, to replace modified Myasishchev M-4 ('Bison') aircraft which have supported the 'Bear/Bison' strategic attack force for many years. According to the 1988 edition of DoD's *Soviet Military Power,* the first unit of 'Midas' tankers entered operational service during 1987. 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. *(Data generally as for Il-76.)*

Myasishchev M-4 Tanker (NATO 'Bison')

During the past year, photographs published in the Soviet press have shown redundant M-4 strategic bombers with their tails sawn off. However, the 40 'Bisons' that were modified into probe-and-drogue in-flight refueling tankers will remain in service until the Il-78 'Midas' fleet has grown large enough to take their place entirely. One other retired bomber, known as VM-T (registered SSSR-01502), has been modified to carry on its back the *Buran* space shuttle orbiter and large components of the Energiya rocket launch vehicle. This necessitated substitution of a new tail unit, with two large rectangular fin-and-rudder assemblies. Maximum payload is 40 metric tons, requiring the removal of *Buran's* orbital maneuvering system engines, tail fin, and other components before it could be transported. *(Data for tanker follow.)*

Power Plant: four Mikulin AM-3D turbojets; each 19,180 lb st.

Dimensions: span 165 ft 7½ in, length 154 ft 10 in.

Weight: gross 350,000 lb.

Performance (as bomber): max speed 620 mph at 36,000 ft, service ceiling 45,000 ft, max unrefueled operational radius 3,480 miles.

Myasishchev VM-T conversion of M-4 bomber (NATO 'Bison') carrying component of Energiya launch vehicle (Quadrant/Flight)

Yakovlev Yak-52

Trainers

Aero L-29 Delfin (NATO 'Maya')

About 3,600 L-29 two-seat basic and advanced jet trainers were manufactured in Czechoslovakia between 1963 and 1974 for standardized use by the air forces of all Warsaw Pact nations except Poland, which preferred its own TS-11 Iskra, and for export. Replacement with another Czech-designed trainer, the L-39, began in 1974, but L-29s remain in large-scale service in the Soviet Union.

Power Plant: one M701c500 turbojet; 1,960 lb st..

Dimensions: span 33 ft 9 in, length 35 ft 5½ in, height 10 ft 3 in.

Weights: empty 5,027 lb, gross 7,804 lb.

Performance: max speed 407 mph at 16,400 ft, service ceiling 36,100 ft, range 555 miles with external tanks.

Accommodation: crew of two, in tandem.

Armament: provision for two bombs of up to 220 lb, eight air-to-ground rockets, or two 7.62 mm machine-gun pods under wings.

Aero L-39 Albatros

The first prototype of the L-39 flew on November 4, 1968, and series production began in 1972. The initial production L-39C two-seat basic and advanced flying trainer supplements, and will eventually replace, the L-29 at the DOSAAF schools from which the Soviet air forces receive most of their recruits. Other versions are used by Warsaw Pact and foreign air forces for weapons training, light ground attack, reconnaissance, and target towing. The L-39MS, first flown in 1986, is a new advanced training version with a more powerful (4,850 lb st) Soviet/Czechoslovak DV-2 turbofan, zero/zero ejection seats, and upgraded equipment, but is not yet in production. More than 2,500 L-39s of all types have been delivered, with production continuing at a rate of 200 a year. *(Data for L-39C follow.)*

Power Plant: one Ivchenko AI-25-TL turbofan; 3,792 lb st. Internal fuel capacity 332 gallons. Provision for two 92.5 gallon underwing drop-tanks.

Dimensions: span 31 ft 0½ in, length 39 ft 9½ in, height 15 ft 7¾ in, wing area 202.36 sq ft.

Weights: empty 7,617 lb, gross 10,362 lb.

Performance: max speed 466 mph at 16,400 ft, service ceiling 36,100 ft, range 683 miles on internal fuel, 1,087 miles with external tanks.

Accommodation: crew of two, in tandem.

Armament: none.

MiG-21U (NATO 'Mongol')

Nearly twenty of the air forces equipped with MiG-21 single-seat fighters also fly this two-seat training version of the same type. The basic **MiG-21U** (NATO 'Mongol-A') is generally similar to the MiG-21F, with 12,675 lb st R-11F turbojet, but has two cockpits in tandem under a sideways-hinged double canopy, larger mainwheels and tires, a one-piece forward airbrake, and repositioned pitot boom, above the air intake. It carries no guns. Later production models ('Mongol-B') have a wide-chord fin and deeper dorsal spine fairing. A third variant is the **MiG-21US**, which adds SPS flap-blowing and a retractable periscope for the instructor. The **MiG-21UM** is a trainer counterpart of the MiG-21MF, with 14,550 lb st R-13 turbojet and four underwing stores pylons.

MiG-23UM (NATO 'Flogger-C')
(See page 74.)

MiG-25U (NATO 'Foxbat-C')
(See page 74.)

MiG-29UB (NATO 'Fulcrum-B')
(See page 74.)

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

Among the many military duties for which the Soviet Union utilizes Mi-2 light helicopters *(see page 84)* is primary training of helicopter pilots.

Mil Mi-24 (NATO 'Hind-C')
(See page 84.)

Sukhoi Su-15 (NATO 'Flagon-G')
(See page 75.)

Sukhoi Su-17 (NATO 'Fitter-E and G')
(See page 76.)

Sukhoi Su-25 and Su-28 (NATO 'Frogfoot-B')
(See page 77.)

Sukhoi Su-27UB (NATO 'Flanker-C')
(See page 75.)

Tupolev Tu-22U (NATO 'Blinder-D')
(See page 72.)

Yakovlev Yak-28U (NATO 'Maestro')
Although the operational Yak-28P ('Firebar') is a tandem two-seater, it was not possible to adapt the existing rear cockpit in order to produce a dual-control training version. Instead, the Yakovlev Bureau had to design a completely new front fuselage for the Yak-28U. This has two individual single-seat cockpits in tandem, each with its own blister canopy. The front canopy is sideways hinged, to starboard. The higher rear canopy is rearward-sliding. A very large conical probe projects forward of the nosecone.

Yakovlev Yak-38 (NATO 'Forger-B')
(See page 76.)

Yakovlev Yak-52
This tandem two-seat primary trainer was designed to replace the veteran Yak-18s on which pilots of the Warsaw Pact air forces had received their initial training, at civilian or paramilitary schools, such as the Soviet DOSAAF centers, since the mid-1940s. Large-scale production was entrusted to the Intreprinderea de Avioane Bacau works in Romania, which delivered the 1,000th Yak-52 in 1987, with production continuing.

Externally, this trainer resembles closely the final Yak-18 designs, but has a more powerful engine, reduced span with no wing center-section, a semi-monocoque rear fuselage instead of the Yak-18's fabric-covered steel-tube structure, and a tricycle landing gear that leaves all three wheels fully exposed when retracted to reduce damage in a wheels-up landing.

Power Plant: one Vedeneyev M-14P piston engine; 360 hp. Fuel capacity 32 gallons.
Dimensions: span 30 ft 6¼ in, length 25 ft 5 in, height 8 ft 10¼ in, wing area 161.5 sq ft.
Weights: empty 2,205 lb, gross 2,844 lb.
Performance: max speed at 1,650 ft 186 mph, econ cruising speed 118 mph, service ceiling 19,685 ft, max range 341 miles.
Armament: none.

Yakovlev Yak-53
The Yak-53 is a single-seat fully aerobatic version of the Yak-52. It retains the latter's power plant and semi-retractable landing gear, but lacks its spring-loaded controls and is stripped of nonessential equipment, such as a radio compass and direction finder, to enhance its agility.

Power Plant: one Vedeneyev M-14P piston engine; 360 hp. Fuel capacity 34 gallons.
Dimensions: span 31 ft 2 in, length 25 ft 2¼ in, height 9 ft 8¼ in, wing area 161.5 sq ft.
Weights: empty 1,985 lb, gross 2,337 lb.
Performance: max speed 186 mph, cruising speed 143 mph, max endurance 50 min.
Armament: none.

Helicopters

Kamov Ka-25 (NATO 'Hormone')
About 100 Ka-25s continue in Soviet Navy service; others are operated by India, Syria, Vietnam, and Yugoslavia. Built in 1966–75, they can be seen in three forms:

Hormone-A. Basic ship-based ASW version, with flat-bottomed housing for undernose search radar, and racks for small stores, including sonobuoys, on the starboard side of the fuselage. 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. The legs are pivoted, so that the wheels can be moved into a position where they offer least interference to signals from the nose radar. 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. 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 (NATO 'Shaddock') missiles launched from *Kresta I* cruisers, SS-N-12 ('Sandbox') missiles from *Kiev*-class carrier/cruisers and *Slava*-class cruisers, SS-N-19 missiles from the battle cruisers *Kirov* and *Frunze*, and SS-N-22 missiles from *Sovremennyy*-class destroyers. *Kiev*- and *Kirov*-class ships each carry three 'Hormone-Bs', the others one. Larger undernose radome with more spherical undersurface. Cylindrical radome under rear of cabin. Data link equipment.

Hormone-C. Utility and search and rescue model, generally similar to 'Hormone-A', but with nonessential operational equipment and weapons removed. *(Data for 'Hormone-A' follow.)*

Kamov Ka-25 (NATO 'Hormone-A') in Yugoslav Service

Kamov Ka-29TB (NATO 'Helix-B') (Jane's/Paul Beaver)

Artist's impression of Kamov Ka-? (NATO 'Hokum') (DoD)

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.
Armament: ASW torpedoes, nuclear depth charges, and other stores in underfuselage weapons bay, when installed.

Kamov Ka-27, Ka-28, and Ka-29 (NATO 'Helix')
Design of the Ka-27 was started in 1969, with the aim of producing a helicopter that could be stowed in much the same space as the Ka-25 with its rotors folded, despite much greater power and capability, and that could be operated independently of ground support equipment. Titanium and composite materials are used extensively throughout the airframe, with special emphasis on resistance to corrosion at sea. The twin turboshaft engines are similar to those used in the Mi-24 'Hind' gunship, enabling flight to be maintained on one engine at max takeoff weight. Ease of handling, with a single pilot, is ensured by such features as a 'mix' in the collective control system that maintains constant total rotor thrust during turns to reduce the pilot's work load when landing on a pitching deck and to simplify transition into hover and landing. The autopilot is capable of providing automatic approach and hover on a preselected course, using Doppler.

The basic ASW version of the Ka-27 was first observed on the stern platform of the Soviet 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. Versions identified to date are as follows:

Ka-27 ('Helix-A'). Basic ASW helicopter, with probable crew of three. Equipment includes undernose 360° search radar, ventral weapons bay for torpedoes and other stores, sonobuoys, IFF, radar warning antennae 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, pod for twin gyro compasses under tailboom. More than 90 operational. Eighteen ordered for Indian Navy.

Ka-27B ('Helix-B'). Ship-based combat version to replace Ka-25 'Hormone-B', photographed on board the *Ivan Rogov* in the Mediterranean in 1987. Primary functions are delivery of precision-guided weapons and target designation. Stub wings with four pylons for weapons, including rocket pods. About 30 in service.

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-28 ('Helix-A'). Export version of ASW Ka-27, operational in Yugoslavia. TV3-117VK turboshafts each rated at 2,170 shp. 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.

Ka-29TB ('Helix-B'). Combat transport version of 'Helix-B' shown at 1989 Aviation Day display. Undernose sensor pod for missile guidance instead of radar. Large flat nose radome and other sensors. Pylon-mounted weapons can include AT-6 (NATO 'Spiral') air-to-surface missiles and 57 mm or 80 mm rocket pods. Gun in nose. IR jamming pod at rear of power plant pylon fairing. Two-part upward/downward-opening cabin door instead of sliding type.

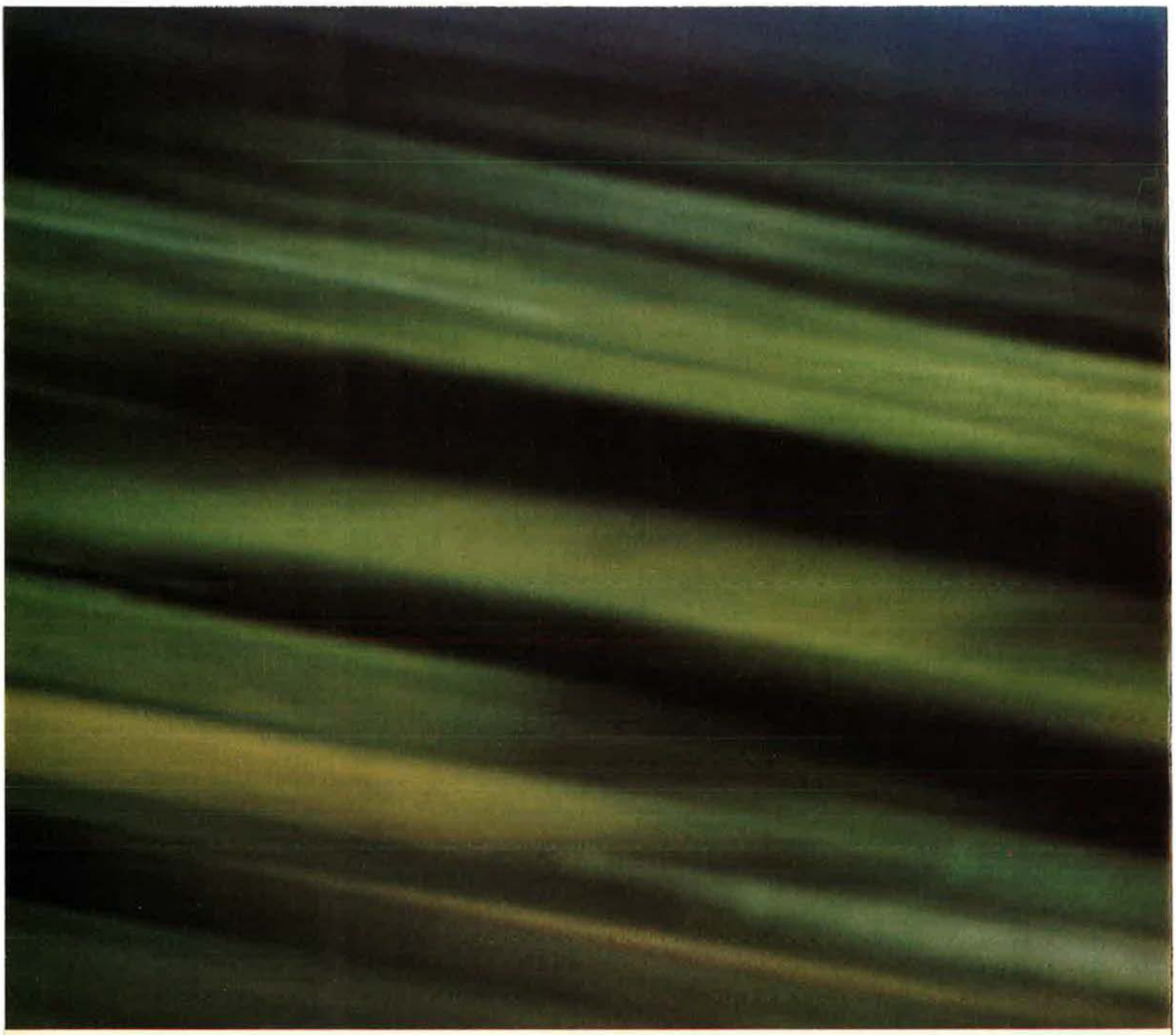
Ka-32 ('Helix-C'). Civil transport and flying crane versions, with folding seats for 16 passengers as alternative to mission equipment, litters, or freight. *(Data for Ka-29TB follow.)*

Power Plant: two Isotov TV3-117VK turboshafts; each 2,205 shp.
Dimensions: rotor diameter (each) 52 ft 2 in, length of fuselage 37 ft 1 in, height 17 ft 8½ in.
Weight: gross 26,455 lb.
Performance: max speed at S/L 165 mph, service ceiling 11,500 ft, range 310 miles.
Accommodation: flight crew of two, with seat for third person; up to 12 combat-ready troops as alternative to mission equipment.
Armament: see above.

Kamov Ka-? (NATO 'Hokum')
Although the combat helicopter known to NATO as 'Hokum' has been undergoing flight testing since 1984, few facts about it are known for certain. A Soviet designation of Ka-41 has been quoted widely, but senior members of the Kamov OKB have denied the existence of a 'Ka-41 Hokum'. This suggests that other references to an original OKB designation of Ka-136 and current Ka-34 may be nearer the mark. DoD's *Soviet Military Power* suggests a conventional tandem two-seat configuration, with raised rear cockpit under a continuous glazed canopy, but the fuselage appears wide enough for side-by-side seating in the only published photograph, and this is shown clearly in the DoD artist's impression at left. Even 'Hokum's' primary mission is uncertain. DoD still believes that mission to be battlefield air defense against opposing antitank helicopters and lower-performance fixed-wing ground attack aircraft. This would give it a unique and valuable new helicopter capability. However, the 1989 edition of *Soviet Military Power* hedges its bets by adding that 'Hokum, like other army aviation elements, can be used in a variety of roles, including countering enemy attacks, preparing for and executing counteroffensives, and supporting combined-arms offensives into an opponent's territory'. European observers are happier with this likely role, which is supported by the undernose Gatling-type gun and underwing rocket pods on the artist's impression, with air-to-air missiles for secondary armament.

Bearing in mind that the previous Kamov military helicopters have been produced mainly for naval use, It is possible that 'Hokum' is also envisaged as an escort for 'Helix-Bs' on the Soviet Navy's carriers. It has the usual Kamov coaxial contrarotating and widely separated three-blade rotors, with swept blade tips; a streamlined fuselage with a tapered nose like that of a jet attack aircraft, with pitot, transducer to provide data for a fire control computer, and undernose sensor pack; and a retractable landing gear. Survivability is enhanced by use of infrared suppressors, infrared decoy dispensers, and armor. In 1989, 'Hokum' appeared to be still under development, with only prototypes involved in flight and structural testing. DoD expects it to enter service in the near future.

Power Plant: probably two Isotov TV3-117VK turboshafts; each 2,205 shp.
Dimensions: rotor diameter 45 ft 10 in, length excl nose probe and gun 44 ft 3½ in, height 17 ft 8 in.
Weight: gross 16,500 lb.
Performance: max speed 217 mph, combat radius 155 miles.



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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 5,080 have been delivered for military and commercial service, with the air forces of Bulgaria, Czechoslovakia, East Germany, Hungary, Iraq, North Korea, Libya, Poland, Syria, and the Soviet Union among known operators. The USSR has received well over 2,000, and production is continuing.

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 one 12.7 mm gun in cabin; alternatively, one 14.5 mm gun on port side 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 Soviet production helicopter 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 latter currently with the air forces of Algeria, Iraq, Peru, the Soviet Union (about 450), and Vietnam. The task of these helicopters is to haul guns, armor, vehicles, supplies, freight, or troops in combat areas.

Power Plant: two Soloviev D-25V turboshafts; each 5,500 shp.
Dimensions: rotor diameter 114 ft 10 in, length of fuselage 108 ft 10½ in, height 32 ft 4 in.
Weights: empty 60,055 lb, gross 93,700 lb.
Performance: max speed 186 mph, 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')

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 support Soviet armies in the field. Many others are operated by Soviet air forces, and military Mi-8s have been supplied to at least 39 other air forces. At Soviet army level alone, there are now some 20 helicopter attack regiments, each with up to 60 Mi-8/17s and Mi-24s. More than half of them are deployed opposite NATO forces. 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 currently deployed are as follows:

Hip-C. Standard equipment of Soviet army support forces. 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 in service. Some uprated to Mi-17 standard, as Mi-8T and Mi-8TB.

Hip-D. For airborne communications role; see page 78.

Hip-E. Improved development of 'Hip-C'. 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 Soviet ground forces. Some uprated to Mi-17 standard, as Mi-8TBK.

Hip-F. Export counterpart of 'Hip-E'. Missile armament changed to six 'Saggers'.

Hip-G. For airborne communications duties; see page 78.

Hip-H. See entry on Mi-17.

Hip-J and K. ECM versions; see page 78.

Power Plant: two 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 14,760 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 (V-14) (NATO 'Haze')

The Mi-14 shore-based amphibious helicopter flew for the first time in 1973. Overall dimensions, power plant, and dynamic components are generally similar to those of the Mi-17, reflecting parallel development from the Mi-8 airframe. New features to suit the Mi-14 for its primary role as an antisubmarine aircraft 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, to confer a degree of amphibious capability. The landing gear is fully retractable. Operational antisubmarine equipment can be seen to include 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 and depth charges carried in a weapons bay in the bottom of the hull.

Three versions of the Mi-14 are identified by NATO reporting names:

Haze-A (Mi-14PL). Basic ASW version, with crew of four or five, as described above.

Haze-B (Mi-14BT). Mine countermeasures version, identified by fuselage strake and pod on starboard side of cabin and deletion of MAD. Two additional equipment boxes under the tailboom, to each side of the Doppler container. In service with Soviet, East German, and Polish navies.

Haze-C (Mi-14PS). Search and rescue version in service in Soviet Union and Poland. Double-width sliding door at front of cabin on port side, with retractable rescue hoist. Searchlight on each side of nose.

Of at least 230 built, ten have been exported to Bulgaria, 14 to Cuba, 12 to Libya, at least five to Poland, six to Romania, eight to East Germany, 12 to Syria, and unknown quantities to North Korea and Yugoslavia. Production continues.

Power Plant: two Isotov TV3-117 turboshafts; each 2,200 shp.
Dimensions: rotor diameter 69 ft 10¼ in, length overall incl rotors 83 ft 0 in, height 22 ft 7¾ in.
Weight: gross 30,865 lb.
Performance: max speed 143 mph, range 575 miles.
Accommodation: crew of four or five in 'Haze-A'.

Mil Mi-17 (NATO 'Hip-H')

First seen at the 1981 Paris Air Show, the Mi-17 has an airframe basically identical to that of the Mi-8, but with more powerful TV3 engines in shorter nacelles, with the intakes positioned above the midpoint of the sliding cabin door. The tail rotor is repositioned on the port side of the vertical stabilizer, and the engine air intakes are fitted with deflectors to prevent the ingestion of sand, dust, or foreign particles at unprepared landing sites. 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 and with combat units in Central America. 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. Export deliveries include 16 to Cuba in 1983 and others subsequently to Angola, India, North Korea, and Peru. 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, first shown at the 1989 Paris Air Show, is the Mi-17-IVA, with 2,225 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 Isotov TV3-117MT turboshafts; each 1,900 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-35P (NATO 'Hind-F')
(Paul Jackson)

Mil Mi-26 (NATO 'Halo')

Mil Mi-24, Mi-25, and Mi-35 (NATO 'Hind')

More than 2,300 of these formidable gunship helicopters have been delivered from plants in Arsenyev and Rostov. In addition to the Soviet armed forces, they are operated by the air forces of Afghanistan, Algeria, Angola, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, India, Iraq, Libya, Mozambique, Nicaragua, North Korea, Peru, Poland, Vietnam, and South Yemen. Used operationally in Chad, Nicaragua, Sri Lanka, Angola, and Afghanistan, and in the Gulf War (where at least one Iranian F-4 Phantom fell victim to a 'Spiral' antitank missile fired from a 'Hind'), they have accumulated unrivaled combat experience but had not been displayed openly in the West until an export model appeared at the Helitech trade show in the UK in September 1989. By then, production was reducing from a peak rate of more than 15 a month.

Most of the 1,250 'Hinds' deployed with Soviet armies equip approximately 20 helicopter attack regiments, more than half of which confront NATO forces in Europe. The fact that the Mi-24 was designed originally as a heavily armed assault transport for a squad of troops (a capability that is retained in all versions) means that it lacks the slim silhouette that is optimum for a gunship; but progressive changes to the airframe, power plant, operational equipment, and weapons, and the addition of infrared jammers, exhaust suppressors, and flare dispensers as a result of combat experience, plus increased armor, have maintained the aircraft's effectiveness through a succession of variants, as follows:

Hind A. Initial series production version, observed in service in East Germany in spring 1974. Assault transport, with large flight deck for crew of three, and places for up to eight fully equipped troops in main cabin. Dynamic components and TV2-117 engines of Mi-8 fitted initially. Fully retractable landing gear. Auxiliary wings of this version have considerable anhedral. One 12.7 mm machine-gun in nose, slaved to undernose sighting system; four hardpoints under stubwings for 32-round packs of 57 mm rockets, 20-round packs of 80 mm rockets, UPK-23 pods each containing twin 23 mm guns, up to 3,300 lb of chemical or conventional bombs, PFM-1 mine dispensers, or other stores; four AT-2 (NATO 'Swatter') antitank missiles on wingtip launchers. Provisions for firing AK-47 guns from cabin windows. Antitorque rotor, originally on starboard side of offset tail pylon, repositioned to port side when TV2 engines were replaced by TV3s on later and converted aircraft.

Hind-B. Similar to 'Hind-A' except that auxiliary wings have neither anhedral nor dihedral and carry only the two inboard weapons stations on each side. This version preceded 'Hind-A' and was not built in quantity.

Hind-C. Training version. Generally similar to late-model 'Hind-A', but without nose gun and undernose blister fairing, and no missile rails at wingtips.

Hind-D. First observed in 1977. Basically similar to late-model 'Hind-A', with TV3-117 engines and tail rotor on port side, but with front fuselage completely redesigned and heavily armored for primary gunship role, although transport capability retained. 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, providing air-to-air as well as air-to-surface capability. Undernose packs for electro-optics and RF missile guidance. Wing armament of 'Hind-A' retained. Many small antennae and blisters, including 'Odd Rods' IFF and radar warning antennae. 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. Export models, including those for

Cuba, India, and Afghanistan, are designated **Mi-25.**

Hind-E. As 'Hind-D', but with modified wingtip launchers and four underwing pylons for a total of up to twelve AT-6 (NATO 'Spiral') radio guided tube-launched antitank missiles in pairs, and enlarged undernose guidance pod on port side. AA-8 (NATO 'Aphid') air-to-air missiles can be carried on the underwing pylons. Export models are designated **Mi-35.**

Hind-F (Mi-24P = *pushka*, cannon). First shown in service with Soviet forces in 1982 photographs. Generally similar to 'Hind-E', but nose gun turret replaced by a twin-barrel 30 mm GSh-30-2 gun on starboard side of front fuselage. Bottom of nose smoothly faired above and forward of sensors. Export models are designated **Mi-35P.**

Hind-G. First identified at Chernobyl, after the 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-shape housing with cylindrical insert under the port side of the cabin, a bubble window on the starboard side, and a plate of triangular shape mounted in the tailskid. Small numbers of 'Hind-Gs' are deployed individually throughout the Soviet ground forces. *(Data for Mi-24P follow.)*

Power Plant: two 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 280 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 weathers. 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 Soviet air forces in early 1983, and was fully operational by 1985. About 40 have since been built for military and civil use, and the first export deliveries, of ten for India, began in June 1986. 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.

In the course of establishing five world helicopter payload-to-height records, in 1982, an Mi-26 lifted a total mass of 125,154 lb to a height of 2,000 m, including a payload of 25,000 kg (55,115 lb).

Power Plant: two 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, max payload, internal or external, 44,090 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; max seating for about 85 combat-equipped troops. Other loads include two airborne infantry combat vehicles.

Mil Mi-28 (NATO 'Havoc')

Because of its origins as an assault transport, the Mi-24 'Hind' offers a large target for ground fire. When designing the Mi-28, the Mil Bureau was able to begin with a clean sheet of paper and produce a two-man attack helicopter with heavy armament but altogether slimmer and less vulnerable, particularly against the threat of NATO weapons using thermal imaging systems. The result is an aircraft truly in the class of the US Army's AH-64A Apache, as Western observers were able to confirm when the third prototype was demonstrated at the 1989 Paris Air Show. 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 general configuration is similar to that of the slightly smaller Apache. Its 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 50 ft/second 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 persons in a combat rescue situation.

The 30 mm 2A42 gun currently fitted is identical with that on many Soviet Army ground vehicles, and uses the same ammunition. 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, which are expected to enter service in 1991–92.

Power Plant: two Isotov TV3-117 turboshafts; each 2,205 shp. Internal fuel capacity approx 500 gallons. Provision for four underwing tanks.

Dimensions: rotor diameter 56 ft 5 in, length excl rotors 55 ft 3½ in.

Weight: gross 25,130 lb.

Performance: max speed 189 mph, 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 (NATO 'Spiral') antitank missiles. Missile guidance equipment in thimble radome on nose.

Strategic Missiles

SS-4 (Soviet designation **R-12**; NATO 'Sandal')

Remembered as the missile that precipitated the Cuba crisis in 1962, the SS-4 MRBM was based on German wartime V-2 technology. About 30 remained in service in June 1989, all located in the western USSR, opposite European NATO. They will be destroyed under the terms of the INF Treaty.

Power Plant: one four-chamber RD-214 liquid-propellant (nitric acid/kerosene) sustainer; 163,142 lb thrust in vacuo.

Guidance: inertial, offering CEP of 2.0 km (1.25 miles).

Warhead: single RV; alternative nuclear (1 megaton) or high-explosive.

Dimensions: length 68 ft 0 in, diameter 5 ft 3 in.

Launching weight: 60,000 lb.

Performance: max speed Mach 6–7, max range 1,250 miles.

SS-11 (NATO 'Sego')

Two versions of this 'light' ICBM remain operational. Although they are considerably less capable than later generations of Soviet strategic weapons, and housed in less survivable silos, DoD states that 'their destructive potential against softer area targets in the US and Eurasia is significant'. Following replacement of a proportion of the original force with SS-17s and SS-25s, a total of 380 SS-11 Mod 2/3s remained in 1989. Differences are as follows:

SS-11 Mod 2. Single reentry vehicle (1 megaton), with added penetration aids. Deployment began 1973.

SS-11 Mod 3. First operational Soviet missile with MRVs (three 100–300 kiloton). CEP 1.1 km (0.7 miles). Deployment began 1975.

Power Plant: two-stage storable liquid-propellant.

Guidance: inertial.

Warhead: single nuclear (Mod 2); three MRVs (Mod 3).

Dimension: length 66 ft 0 in.

Performance: max range 8,075 miles (Mod 2), 6,585 miles (Mod 3).

SS-13 (NATO 'Savage')

In the Minuteman category; only 60 SS-13 ICBMs were deployed, in Mod 2 configuration, beginning in 1968.

Power Plant: three-stage solid-propellant.

Guidance: inertial, offering CEP of 1.8 km (1.1 miles).

Warhead: single RV; nuclear (600 kilotons).

Dimensions: length 66 ft 0 in, max diameter 6 ft 6 in (first-stage skirt).

Performance: range 5,840 miles.

SS-17 (Soviet designation **RS-16**; NATO 'Spanker')

Known in the Soviet Union as the RS-16, this 'light' ICBM is designed for cold launch. This means that it is 'popped' out of its silo by a gas generator before the main booster motors are fired. As a result, the silo is not heavily damaged and could be reloaded, although this would be a slow process. A total of 110 SS-17 missiles, all upgraded to Mod 3 standard with four MIRVs, were deployed in modified SS-11 silos, but are now being withdrawn following introduction of SS-24s and SS-25s.

Power Plant: two-stage storable liquid-propellant.

Guidance: inertial, offering CEP of 1,300 ft.

Warhead: four MIRVs (each 500 kilotons).

Dimensions: length 68 ft 0 in, max diameter 8 ft 6 in.

Performance: max range 6,200 miles.

SS-18 (Soviet designation **RS-20**; NATO 'Satan')

There are 308 of these cold-launched 'heavy' missiles in the Soviet ICBM force, in converted SS-9 silos. Most were upgraded from 1982 to Mod 4 standard, with ten MIRVs, each with more than 20 times the destructive power of the nuclear bombs dropped on Hiroshima and Nagasaki in 1945. They are now being replaced by a Mod 5 version, offering further improved throw-weight and accuracy. DoD believes that the SS-18 force, by itself, has the capability to destroy 65 percent to 80 percent of US ICBM silos and command facilities, using two nuclear warheads against each silo. After doing so, 1,000 SS-18 warheads would still be available for further attacks on US targets. A CEP of under 1,000 ft has been quoted.

Power Plant: two-stage liquid-propellant.

Guidance: inertial.

Warhead: ten or more MIRVs (each 500 kilotons).

Dimensions: length 104 ft 0 in, max diameter 10 ft 0 in.

Performance: max range 6,835 miles.

SS-19 (Soviet designation **RS-18**; NATO 'Stiletto')

Comparable in size to USAF's Peacekeeper, the Soviet Union's 320 SS-19 Mod 3 missiles are classified as light ICBMs, but have the flexibility of being able to attack targets in Eurasia as well as in the US. The hot-launched Mod 3 carries six MIRVs and, although less accurate than the SS-18, has significant capability against all but hardened silos. Replacement with the silo-based SS-24 Mod 2 has begun.

Power Plant: two-stage liquid-propellant.

Guidance: inertial.

Warhead: six MIRVs (each 550 kilotons).

Dimensions: length 75 ft 0 in, max diameter 9 ft 0 in.

Performance: max range 6,200 miles.

SS-20 (Soviet name **RSD-10 Pioneer**; NATO 'Saber')

A total of 405 SS-20 IRBM launchers had been deployed at 48 bases by the time the INF Treaty was signed, of which 270 confronted NATO, with the others targeted against China and Japan. Each missile, in Mod 2 form, is carried on a wheeled launcher and can be fired either from sliding-roof garages at regimental bases or from field-deployed sites, rendering its detection and counter-targeting difficult. Furthermore,the launcher has the capability of being reloaded, and refire rounds were known to be stockpiled. A CEP of about 1,300 ft is estimated when the SS-20 is fired from a presurveyed site. Deactivation of the entire force began in 1988, as scheduled under the Treaty, and only 262 were still deployed by mid-1989.

Power Plant: two-stage solid-propellant.

Guidance: inertial.

Warhead: three MIRVs (each 150 kilotons).

Dimension: length 54 ft 0 in.

Performance: max range 3,100 miles.

SS-24 (NATO 'Scalpel')

Following construction of an extensive network of rail support facilities for the Mod 1 rail-mobile version of the SS-24, deployment began in 1987, and about 18 of these ICBMs were operational by the end of 1989, together with 40 silo-based Mod 2 SS-24s. The fifth-generation SS-24 is similar in size to the US Peacekeeper and, like all modern Soviet ICBMs except the SS-19, is cold-launched. Accuracy is believed to be better than that of the SS-18 and SS-19, together with a greater hard-target kill capacity. The rail-mobile version also offers improved survivability.

Power Plant: three-stage solid-propellant.

Guidance: inertial; CEP estimated at 655 ft.

Warhead: up to ten MIRVs (each 100 kilotons).

Dimension: length 69 ft 0 in.

Performance: max range 6,200 miles.

SS-25 (NATO 'Sickle')

By the fall of 1989, the Soviet Union was estimated to have deployed about 170 launchers for this fifth-generation Minuteman-sized ICBM at several operational bases. Each base consists of a number of launcher ga-

rages with sliding roofs to house the system's massive off-road wheeled transporter-erector-launch vehicles, together with other buildings to shelter the mobile support equipment. Advances claimed for the SS-25 include a greater throw-weight and nine times the accuracy of the SS-13, the USSR's first solid-propellant ICBM, as well as greater survivability, because of its road-mobile configuration, and an inherent refire capability. SS-11 silos are being dismantled in compensation for SS-25 deployments.
Power Plant: three-stage solid-propellant.
Guidance: inertial; CEP estimated at 655 ft.
Warhead: single RV (550 kilotons).
Dimension: length 59 ft 0 in.
Performance: range 6,525 miles.

AS-4 (NATO 'Kitchen')
Although 'Kitchen' was first seen on a Tu-22 ('Blinder') bomber nearly 29 years ago, it remains a highly important Soviet standoff weapon, carried by 'Blinder', the Tu-26 'Backfire', and the Tu-95 'Bear-G'. It has an airplane configuration, with stubby delta wings and cruciform tail surfaces, and is powered by a liquid-propellant rocket motor. Several versions have been identified, including a strategic 'Kitchen' with inertial guidance and a 350-kiloton nuclear warhead, needing no terminal homing; an antishipping version with a 2,200 lb high-explosive warhead or a nuclear warhead plus active radar terminal homing; and a defense suppression version with passive radar homing.
Dimensions: span 9 ft 10 in, length 37 ft 0 in.
Weight: 13,000 lb.
Performance: max speed Mach 4.6, range 185 miles at low altitude, 285 miles at high altitude.

AS-6 (NATO 'Kingfish')
This air-to-surface missile is standard armament of modified 'Badger-Gs', which carry a 'Kingfish' under each wing. Propulsion is by solid-propellant rocket motor, with inertial midcourse guidance and active radar terminal homing, giving exceptional accuracy. The warhead can be either nuclear (350 kiloton) or 2,200 lb high explosive. An antiradiation version, with passive radar homing and a high-explosive warhead, may also exist.
Dimensions: span 8 ft 2½ in, length 36 ft 0 in.
Weight: 12,125 lb.
Performance: max speed Mach 3, range 250 miles.

AS-15 (NATO 'Kent')
The Soviet Union began deployment of 'Kent' long-range air-launched cruise missiles on 'Bear-H' strategic bombers in 1984. 'Kent' also arms the new supersonic 'Blackjack' bomber, providing the Soviet strategic attack force with greatly improved capabilities for low-level and standoff attack in both theater and international operations. Configuration of 'Kent' is similar to that of the much smaller General Dynamics Tomahawk cruise missile. A submarine-launched version is known as the SS-NX-21. Both missiles have a terrain-comparison/inertial guidance system similar to the US Tercom, making possible a CEP of about 500 ft, and a 200 kiloton nuclear warhead. Propulsion is believed to be by turbofan.
Dimensions: span 10 ft 8 in, length 23 ft 3½ in.
Weight: 3,750 lb.
Performance: speed subsonic, range 1,850 miles.

AS-16
The AS-16 is a short-range attack missile, assumed to be in the same class as USAF's SRAM II and probably with a similar configuration. Twelve are carried as an alternative to six AS-15 ALCMs on each of the Tu-160 'Blackjack's' rotary launchers.

AS-19
This supersonic cruise missile, with a reported range of 2,000 miles, is being developed as an alternative weapon for 'Bear-H', and might also be carried by the Tu-160 'Blackjack'. It is expected to enter service in the early 1990s.

Airborne Tactical Missiles

AS-2 (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-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 warhead is standard.
Well over 1,000 AS-5s had been delivered by the spring of 1976. 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 (NATO 'Kerry')
Carried by the MiG-23BN 'Flogger', MiG-27 'Flogger', Su-17 'Fitter', Su-24 'Fencer', and Yak-38 'Forger', this first-generation tactical air-to-surface missile is said to have a single-stage solid-propellant rocket motor, radio command guidance system, and 242 lb hollow-charge high-explosive warhead.
Dimensions: span 2 ft 11½ in, length 11 ft 6 in.
Weight: 650 lb.
Performance: max speed transonic, range 3 miles.

AS-9 (NATO 'Kyle')
This is a liquid-propellant antiradiation missile, with a configuration similar to that of the much larger AS-4 'Kitchen' and a 330–440 lb warhead for defense suppression. It is said to arm MiG-25, MiG-27, Su-17, Su-24, Tu-16, and Tu-26 aircraft.
Dimensions: span 6 ft 6½ in, length 19 ft 9½ in.
Weight: 1,650 lb.
Performance: max speed supersonic, range 56 miles.

AS-10 (NATO 'Karen')
The laser homing 'Karen' is a solid-propellant rocket-powered air-to-surface missile resembling 'Kerry', from which it may have been developed. It caries a 220 lb high-explosive warhead and is operational on MiG-27, Su-17, Su-24, and Su-25 attack aircraft.
Dimensions: span 3 ft 2½ in, length 11 ft 6 in.
Weight: 660 lb.
Performance: max speed transonic, max range 6.2 miles.

AS-11 (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, as expected, an antiradiation missile of conventional cruciform clipped-delta wing/tail fin 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 Su-24.

AS-11 missile (NATO 'Kilter')
(Jane's/Paul Beaver)

AS-14 missile (NATO 'Kedge')

Dimensions: span 3 ft 11¼ in, length 14 ft 1¼ in.
Weight: estimated at 925 lb.
Performance: range approx 30 miles.

AS-12 (NATO 'Kegler')
'Kegler' is described as a lightweight successor to the AS-9 with a different seeker and improved performance. It is carried by the Su-24, Su-25, and Tu-26.
Dimensions: span 2 ft 11½ in, length 12 ft 7½ in.
Weight: 770 lb.
Performance: range 21 miles.

AS-13 (NATO 'Kingbolt')
Nothing is known about this tactical air-to-surface missile except that it is carried by the Su-24.

AS-14 (NATO 'Kedge')
This Maverick-type tactical solid-propellant air-to-surface missile is carried on the extended wingroot glove pylons of the 'Fencer-D' version of the Su-24, and probably by the Su-25. When carried by the MiG-27 'Flogger', it is accompanied by an underfuselage data link pod for guidance of the AS-14, which employs laser terminal homing. The warhead could be a 551 lb GP bomb.
Dimensions: span 4 ft 5½ in, length 12 ft 6 in.
Weight: 1,375 lb.
Performance: range 7.5 miles.

AT-2 (NATO 'Swatter')
This standard Soviet 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 semiautomatic command to line-of-sight (SACLOS) guidance via elevons on the trailing-edges of its rear-mounted cruciform wings and two small movable 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-3 (NATO 'Sagger')
In conformity with the Soviet practice of not supplying advanced equipment on its export aircraft, the manually commanded to line-of-sight (MACLOS) wire-guided 'Sagger' replaces 'Swatter' on the 'Hip-F' version of the Mi-8, as well as arming the Polish-built Mi-2 and Gazelles of the Yugoslav services.
Dimensions: span 1 ft 3 in, length 2 ft 10 in.
Weight: 25 lb.
Performance: speed 265 mph, range 1.85 miles.

AT-6 (NATO 'Spiral')
Unlike previous Soviet helicopter-launched antitank missiles, 'Spiral' does not appear to have a surface-launched application. It is a solid-propellant missile, with a warhead weighing about 22 lb. Tube-launched and radio command guided, possibly with semiactive laser terminal homing, it equips the 'Hind-E and F' versions of the Mi-24 and the Mi-28 'Havoc'.
Dimensions: span 1 ft 0 in, length 5 ft 10 in.
Weight: 55 lb.
Performance: range 3 miles.

AA-2 and AA-2D (NATO 'Atoll')
Designated K-13A in the USSR, the basic AA-2 'Atoll' is the Soviet counterpart to the American Sidewinder 1A (AIM-9B), to which it is almost identical in size, configuration, and infrared guidance. It was followed by the AA-2D, with improved seeker, that has long been standard armament on home and export versions of the MiG-21 and is carried by the Su-25 as well as export models of the MiG-23 and Sukhoi Su-22. A solid-propellant rocket motor and 24 lb fragmentation warhead are fitted. *(Data for AA-2D follow.)*
Dimensions: length 9 ft 3½ in, body diameter 5.12 in, fin span 1 ft 8¾ in.
Weight: 165 lb.
Performance: cruising speed Mach 2.5, range 1.85 miles.

AA-2C (NATO 'Advanced Atoll')
The multirole versions of the MiG-21 (NATO 'Fishbed-J, K, L, and N') can carry a radar homing version of 'Atoll' on the outer stores pylon under each wing, in addition to an infrared homing 'Atoll' on the inboard pylon. The radar version is known as AA-2C 'Advanced Atoll'. Length is increased to 11 ft 6 in, and weight to 205 lb. Range of the AA-2C is 5 miles.

AA-3 (NATO 'Anab')
This solid-propellant air-to-air missile arms Yak-28P and Sukhoi 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 11 in, wing span 4 ft 3 in.
Weight: 575 lb (IR), 595 lb (SAR).
Performance: range 1.85 miles (IR), 6.2 miles (SAR).

AA-5 (NATO 'Ash')
Several thousand of these large air-to-air missiles were produced as armament for Tu-28P interceptors. The version with infrared homing head is normally carried on the inboard pylon under each wing of the Tu-28P, with an I/J band semiactive radar homing version on each outboard pylon.
Dimensions: length 17 ft 0 in (IR) or 17 ft 4½ in (SAR), body diameter 12 in, wing span 4 ft 3 in.
Weight: 980 lb (IR), 992 lb (SAR).
Performance: range 3 miles (IR), 12 miles (SAR).

AA-6 (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 is normally carried on each inboard underwing pylon, with a radar homing version on each outer pylon. The wingtip fairings on the fighter are thought to house continuous-wave target illuminating equipment for the radar homing missiles.
Dimensions: length 20 ft 7½ in (radar version), 19 ft 0 in (IR version).
Weight: 1,015 lb.
Performance: cruising speed Mach 2.2, range 18.5 miles.

AA-7 (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. 'Apex' has a solid-propellant rocket motor and was developed in infrared and semiactive radar homing versions (Soviet designations R-23T and R-23R, respectively). Only the radar version appears to be operational. Warhead weight is 66 lb.
Dimensions: length 14 ft 1¼ in, body diameter 8.25 in, wing span 3 ft 7¼ in.
Weight: 606 lb.
Performance: range 12.5 miles.

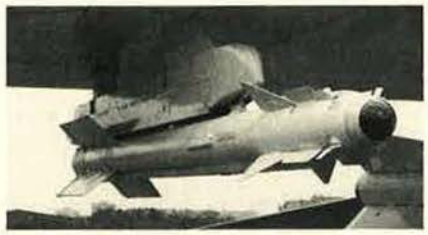
AA-8 (NATO 'Aphid')
Standard close-range air-to-air missile carried by late-model MiG-21s, MiG-23s, MiG-25s, MiG-29s, MiG-31s, Su-15s, Su-25s, and Yak-38s, 'Aphid' is a highly maneuverable solid-propellant weapon with infrared homing guidance and a 13.2 lb warhead. Its Soviet designation is R-60.
Dimensions: length 6 ft 10½ in, body diameter 5.12 in, wing span 1 ft 5¾ in.
Weight: 143 lb.
Performance: range under 1,650 ft min, 3 miles max.

AA-9 (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-25M interceptor. It is standard armament on the MiG-31 and is regarded as being in the same class as the USN AIM-54 Phoenix. 'Amos' is believed to have a solid-propellant rocket motor, and to combine semiactive radar/inertial midcourse guidance with active radar terminal homing. A passive radar homing version has been reported, for use against AWACS aircraft.
Dimensions: length 13 ft 1½ in, body diameter 15.75 in, wing span 3 ft 3½ in.
Weight: 990 lb.
Performance: range 45 to 93 miles.

AA-10 (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. Three versions have been identified on the Sukhoi Su-27 counterair fighter:
Alamo-A. Short-burn semiactive radar homing version, for use over medium ranges. Also standard armament of MiG-29.
Alamo-B. Short-burn infrared homing version.
Alamo-C. Long-burn semiactive radar homing version, for use over longer ranges.
Dimensions: length 10 ft 6 in (B), 13 ft 1½ in (C), body diameter 7.3 in; wing span 2 ft 3½ in.
Weight: 342 lb (B), 440 lb (C).
Performance: range 5 miles (B), 18.5 miles (C).

AA-11 (NATO 'Archer')
This close-range missile was one of the new weapons displayed for the first time at the 1989 Soviet Air Show at Khodinka. Its general configuration is similar to that of the smaller 'Aphid', but it has a number of important new features. Control appears complex, with movable sets of fins both fore and aft of fixed cruciform surfaces at the front of the missile, control surfaces at the trailing-edge of each of the cruciform tail fins, 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. Soviet designation is R-73.
Dimensions: length 10 ft 0 in, body diameter 6.9 in, span of tail fins 1 ft 8½ in.
Weight: 275 lb.
Performance: range 5 miles.

AA-7 missile (NATO 'Apex') on MiG-23 (Jane's/Paul Beaver)



AA-11 missile (NATO 'Archer') on Su-27 (Jane's/Paul Beaver)

Antihelicopter 'Grail'
In addition to carrying AT-3 antitank missiles, Gazelle helicopters license-built by SOKO for the Yugoslav Air Force carry SA-7 'Grail' tube-launched IR homing missiles for use against other helicopters. A four-tube installation on some Mi-24 helicopters has been reported.

Surface-to-Air Missiles

ABM-1 (NATO 'Galosh')
The USSR maintains around Moscow the world's only operational ABM (antiballistic missile) system, to provide a measure of protection for Soviet military and civil central command authorities during a nuclear war. It was expected to return to a state of partial effectiveness last year, after a major upgrading. When fully operational, it will provide a two-layer defense based on a total of 100 silo-based launchers for long-range modified ABM-1 'Galosh' interceptors designed to engage targets outside the atmosphere and ABM-X-3 'Gazelle' interceptors to engage targets within the atmosphere. The launchers will be reloadable and will be supported by engagement and guidance radars, plus a large new radar at Pushkino designed to control ABM engagements.
Missiles purported to be 'Galosh' have been paraded through Moscow inside containers about 65 ft long with one open end on frequent occasions since 1964. No details of the missile could be discerned, except that the first stage has four combustion chambers. A single nuclear warhead is fitted. Missile range is said to be more than 200 miles, giving it an inherent ASAT capability against low-altitude satellites.

ABM-X-3 (NATO 'Gazelle')
This quick-reaction high-acceleration interceptor missile will be deployed in 32 of the modernized ABM-1 silos, at four complexes around Moscow, as the second layer of the capital's antiballistic missile defenses. Similar in general configuration to the long-abandoned US Sprint, it demonstrated a reload capability of much less than a day during test launches at Sary Shagan. It is believed to carry a low-yield nuclear warhead. Range is estimated at more than 50 miles.

SA-2 (NATO 'Guideline')
This land-transportable surface-to-air missile has been operational since 1959 and was used extensively in combat in North Vietnam and the Middle East. It underwent progressive upgrading throughout its service life, but replacement with more advanced weapons has been under way in the Soviet Union for some years. The SA-2 continues in first-line service in most of the 29 countries to which it was exported. *(Data for SA-2F follow.)*
Power Plant: liquid-propellant sustainer, burning nitric acid and hydrocarbon propellants; solid-propellant booster.
Guidance: radio command.
Warhead: high-explosive, weight 430 lb.
Dimensions: length 35 ft 1 in, body diameter 1 ft 8 in, wing span 5 ft 7 in.
Launching weight: 5,040 lb.
Performance: max speed Mach 3.5, slant range 21.75 miles, effective ceiling 90,000 ft.

SA-3 (NATO 'Goa')
Soviet counterpart of the American HAWK, the SA-3 (Soviet S-125 Pechora) was deployed by the USSR at more than 300 sites and by about 26 of its allies and friends as a mobile low-altitude system (on two-, three-, and four-round launchers) to complement the medium/high-altitude SA-2 and SA-5. As the SA-N-1, it is also widely used by the Soviet Navy and is fired from a roll-stabilized twin-round launcher.
Power Plant: two-stage solid-propellant.
Guidance: radio command.
Warhead: high-explosive, weight 132 lb.
Dimensions: length 20 ft 0 in, body diameter 1 ft 2½ in, wing span 4 ft 0 in.
Launching weight: 2,095 lb.
Performance: max speed Mach 3.5, slant range 1.5–11.5 miles, effective ceiling 150–60,000 ft.

SA-4 (NATO 'Ganef')
First displayed publicly in 1964, the SA-4 is carried on a twin-round tracked launch vehicle that is itself air-transportable in the An-22 and An-124 military freighters. Long range, provided by its ramjet propulsion, kept it in service with five Warsaw Pact armies into the late 1980s, but it is being replaced in Soviet nondivisional air defense units by the SA-11 and SA-12A. *(Data for SA-4B follow.)*
Power Plant: ramjet sustainer; four wraparound solid-propellant boosters.
Guidance: radio command, with semiactive radar terminal homing.
Warhead: high-explosive, weight 220–300 lb.
Dimensions: length 27 ft 3 in, body diameter 2 ft 11½ in, wing span 7 ft 6 in.
Launching weight: approx 5,500 lb.
Performance: max speed Mach 2.5, slant range 0.7–31 miles, effective ceiling 78,750 ft.

SA-5 (NATO 'Gammon')
In partnership with the low-altitude SA-3, the long-range high-altitude SA-5 (Soviet S-200 Volga) constitutes the major part of the Soviet Union's home defense force of about 8,000 strategic surface-to-air missile launchers. Each regiment consists of two SA-5 battalions with a total of 12 launchers, and three SA-3 battalions. Approximately 1,930 SA-5s are said to be deployed at more than 100 sites in the USSR, with others in eastern Europe, Mongolia, Libya, and Syria. The SA-5C can have a nuclear warhead; the SA-5E is an antiradiation version for use against AWACS aircraft. *(Data for SA-5C follow.)*
Power Plant: liquid-propellant sustainer; four wraparound solid-propellant jettisonable boosters.
Guidance: command, with semiactive radar homing.
Dimensions: length 35 ft 9 in, body diameter 2 ft 10 in, wing span 9 ft 6 in.
Weight: 17,415 lb.
Performance: max speed above Mach 4, slant range 185 miles, effective ceiling 10,000–100,000 ft.

SA-6 (NATO 'Gainful')
This mobile tactical weapon system took an unexpectedly heavy toll of Israeli aircraft during the October 1973 war. Its unique integral-solid rocket/ramjet propulsion system was a decade in advance of comparable Western technology, and the US-supplied ECM equipment that enabled Israeli aircraft to survive attack by other missiles proved ineffective against the SA-6. First shown on its three-round tracked transporter/launcher in Moscow in November 1967, the missile has since been produced in very large quantities. Substitution of an SA-6B launch vehicle, with SA-11 tracking radar, for one of the original SA-6A vehicles overcomes an earlier shortcoming by enabling two targets to be engaged simultaneously by an SA-6 battery. Export models have been acquired by at least 24 nations.
Power Plant: solid-propellant booster. After burnout, its empty casing becomes a ramjet combustion chamber for ram air mixed with the exhaust from a solid-propellant gas generator.
Guidance: radio command; semiactive radar terminal homing.

Warhead: high-explosive, weight 176 lb.
Dimensions: length 20 ft 4 in, body diameter 1 ft 1.2 in.
Launching weight: 1,280 lb.
Performance: max speed Mach 2.8, range 2.3–15 miles, effective ceiling 260–39,500 ft.

SA-7 (NATO 'Grail')
This Soviet counterpart of the US shoulder-fired, heat-seeking Redeye first proved its effectiveness in Vietnam against slower, low-flying aircraft and helicopters. Further successes were achieved during the 1973 Arab-Israeli war, despite countermeasures. In the Soviet forces, it is being replaced by the SA-14 and SA-16, but has been supplied to more than 55 other nations and is used by various guerrilla/terrorist movements. Designed for use by infantry, the tube-launched SA-7 is also carried by vehicles, including ships, in batteries of four, six, and eight, for both offensive and defensive employment, with radar aiming. Some are deployed on helicopters for anti-helicopter combat use.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared homing with filter to screen out decoy flares.
Warhead: high-explosive, weight 2.65 lb.
Dimensions: length 4 ft 4¾ in, body diameter 2.75 in.
Launching weight: 20 lb.
Performance: max speed Mach 1.7, slant range 0.3–3.5 miles, effective ceiling 50–14,750 ft.

SA-8 (NATO 'Gecko')
First displayed publicly during the parade through Moscow's Red Square on November 7, 1975, this short-range, all-weather tactical system was then unique among Soviet tactical air defense weapons in that all components necessary to conduct a target engagement are on a single vehicle. In the original SA-8A version, two pairs of exposed missiles were carried, ready to fire; the later SA-8B system has six missiles in launcher-containers. Fire control equipment and launcher are mounted on a rotating turret, carried by a three-axle six-wheel amphibious vehicle. Surveillance radar, with an estimated range of 18 miles, folds down behind the launcher, enabling the weapon system to be airlifted by Soviet transport aircraft. The tracking radar is of the pulsed type, with a range of 15 miles. The SA-8B uses the same missile as the naval SA-N-4 system. Each vehicle carries up to six reload missiles. Together with the SA-6, it has largely replaced 57 mm guns in Soviet service; SA-8s have been exported to 15 nations.
Power Plant: single-stage solid-propellant.
Guidance: command guidance. Semiactive radar terminal homing.
Warhead: high-explosive, weight 88 lb.
Dimensions: length 10 ft 2 in, body diameter 8.25 in.
Launching weight: 375 lb.
Performance: max speed Mach 2, range 1–9.3 miles, effective ceiling 33–42,650 ft.

SA-9 ('Gaskin')
This tactical weapon system, deployed initially in 1968, comprises a BRDM-2 amphibious vehicle carrying a box launcher for two pairs of infrared homing solid-propellant missiles. The launcher rests flat on the rear of the vehicle when not required to be ready for launch. Four reload rounds are stowed in the BRDM-2. In addition to the Soviet Union, operators include most Warsaw Pact states and more than 20 other nations. *(See also the SA-13 entry.)*
Warhead: high-explosive, weight 15 lb.
Dimensions: length 5 ft 9 in, body diameter 4.75 in, wing span 1 ft 3 in.
Launching weight: 66 lb.
Performance: max speed above Mach 1.5, range 0.35–5 miles, effective ceiling 50–6,250 ft.

SA-10 (NATO 'Grumble')
Some 15 percent of Soviet strategic SAM launchers carry the highly efficient all-altitude SA-10, which offers major advantages compared with systems such as the SA-1 and SA-2 that it is replacing. These advantages include multitarget tracking and engagement, increased firepower (four-rail launchers), and a limited capability to intercept some types of reentry vehicles and cruise missiles. Deployment to fixed bases of the initial SA-10A began in 1980, with about one-third of the first 150 launch units stationed around Moscow, suggesting a priority on terminal defense of command and control, military, and key industrial complexes. For improved survivability, the Soviets are also deploying the land-mobile SA-10B version on four-axle four-round transporter-erector-launch trucks. This not only permits periodic changes in the location of SA-10 sites within the USSR, but could also be used to support Warsaw Pact theater forces.
Power Plant: single-stage solid-propellant.
Guidance: semiactive radar command.
Warhead: high-explosive, about 200 lb weight, or low-yield nuclear.
Dimensions: length 23 ft, body diameter 1 ft 5¾ in.
Launching weight: 3,300 lb.
Performance: max speed Mach 6, range 1.85–62 miles, effective ceiling 1,000–100,000 ft.

SA-11 (NATO 'Gadfly')
The SA-11 weapon system is replacing the SA-4 in army-level surface-to-air missile brigades, for defense against high-performance aircraft operating at low to medium altitudes as well as cruise missiles. The SA-11 uses a four-round tracked launch vehicle, which carries the engagement radar, making the system autonomous. It has been exported to India, Poland, Syria, and Yugoslavia.
Power Plant: solid-propellant.
Guidance: semiactive monopulse radar command.
Warhead: high-explosive, weight 198 lb.
Dimensions: length 18 ft 4½ in, body diameter 1 ft 3¾ in, wing span 3 ft 11¼ in.
Weight: 1,433 lb.
Performance: max speed Mach 3, range 1.85–17.5 miles, effective ceiling 100–46,000 ft.

SA-12A (NATO 'Gladiator')
This formidable land-mobile tactical missile system is capable of intercepting aircraft at all altitudes as well as cruise missiles and tactical ballistic missiles. Deployment to replace SA-4s had begun by early 1987. The complete system is carried on tracked vehicles, with both two-round and four-round launchers illustrated on DoD artist's impressions. The following data should be regarded as provisional:
Power Plant: two-stage solid-propellant.
Guidance: semiactive radar command.
Warhead: high-explosive, weight 330 lb.
Dimensions: length 24 ft 7¼ in, body diameter 1 ft 8 in, wing span 4 ft 11 in.
Launching weight: 4,400 lb.
Performance: max speed Mach 3, range 3.4–50 miles, effective ceiling 300–98,000 ft.

SA-X-12B (NATO 'Giant')
Said by DoD to have been approaching operational status in 1988, this longer-range, higher-altitude version of the SA-12 is considered capable of intercepting some types of strategic ballistic missiles. In particular, it is expected to be carried on low-loader railcars as a component of the SS-24 ICBM system. This potential would make it capable of nationwide deployment, in contravention of the terms of the ABM Treaty. The missile is believed to be generally similar in configuration to that used in the SA-12A system, but scaled up to a length of about 32 ft. A complete fire unit would probably consist of two twin-round transporter-erector-launchers, a reload vehicle, two planar-array radar vehicles, and a command vehicle, all tracked for maximum mobility. Maximum range is estimated at 62 miles.

SA-13 missile (NATO 'Gopher') (Jane's/Tony Banks)

SA-13 (NATO 'Gopher')
Deployed in two twin-box launchers on a tracked vehicle in the mid-1970s, the SA-13 is a replacement for the SA-9, providing improved capability in rough terrain and increased storage for reload missiles. Together with the ZSU-23-4 tracked gun vehicle, it equips the antiaircraft batteries of Soviet motorized rifle and tank regiments and has been exported to at least ten countries.
Power Plant: solid-propellant.
Guidance: infrared homing.
Warhead: high-explosive, weight 9 lb.
Dimensions: length 7 ft 2 in, body diameter 4.75 in.
Launching weight: 121 lb.
Performance: max speed Mach 1.5, range 0.3–5 miles, effective ceiling 33–10,500 ft.

SA-14 (NATO 'Gremlin')
This uprated version of the SA-7 superseded the latter in Soviet service, offering greater resistance to IR countermeasures. It can engage aircraft pulling up to 8*g* and has an all-aspect capability enabling it to engage targets head-on at ranges up to 13,000 ft.

SA-15
Known to NATO as the SA-15, a new mobile, low- to medium-altitude, surface-to-air missile system is now being deployed to replace the SA-8 'Gecko'. Few details are available, except that the tracked launch vehicle is related to that of the SA-11, and the SA-15 missile may be similar to the Soviet Navy's SA-N-9. The following information is provisional.
Dimensions: length 11 ft 6 in, body diameter 1 ft 11½ in.
Performance: range 0.6–10 miles, effective ceiling 60–60,000 ft.

SA-16 (Soviet name Igla)
DoD's *Soviet Military Power* publication refers to 'new, highly accurate SA-16 handheld SAMs replacing the SA-7 and SA-14 in tactical units'. No details are available, except that the SA-16 is considerably longer than the SA-14.

SA-17
Little is known about this successor to the SA-11, except that it is being deployed on a similar chassis. It operates in conjunction with a new surveillance radar (NATO 'Snow Drift') instead of the 'Tube Arm' radar associated with SA-11 batteries.

SA-19
A new Soviet regimental air defense vehicle known as the 2S6 entered operational service in 1987, to replace earlier gun and missile vehicles. Twin 30 mm guns resemble those fitted to the Mi-24 'Hind-F' and Su-25 'Frogfoot'. Twin launchers house SA-19 missiles. Nothing is known about these, although it has been suggested that they are hypersonic and employ infrared homing guidance.

SA-N-1 (NATO 'Goa')
Ship-launched variant of SA-3, carried on roll-stabilized twin launchers by 42 ships of the Soviet Navy.

SA-N-2 (NATO 'Guideline')
Ship-launched version of SA-2. On cruiser *Dzerzhinski* only.

SA-N-3 (NATO 'Goblet')
Twin-round surface-to-air missile launchers fitted to many Soviet naval vessels, including *Kiev*-class carrier/cruisers, helicopter cruisers *Moskva* and *Leningrad*, and *Kara* and *Kresta II* cruisers, carry a more effective missile than the SA-N-1 ('Goa'). This is said to have an antiship capability and to carry a 175 lb high-explosive warhead. The original version has a range of 18.6 miles and effective ceiling of 82,000 ft. A later version has a range of 34 miles.
Dimension: length 19 ft 8 in.
Weight: 1,200 lb.

SA-N-4
This naval close-range surface-to-air weapon system is operational on at least 14 classes of ships of the Soviet Navy. The retractable twin-round 'pop-up' launcher is housed inside a bin on deck. The missiles are similar to those used in the land-based mobile SA-8B system.

SA-N-5
Around 200 small Soviet ships have this simple air defense system, which carries four SA-7 'Grail' launch-tubes in a framework that can be slewed for aiming.

SA-N-6 (NATO 'Grumble')
Similar to the land-based SA-10, this missile is housed in 12 vertical launchtubes under the foredeck of the Soviet battle cruisers *Kirov* and *Frunze* and is carried also by *Slava*-class cruisers and the *Kara*-class *Azov*. It is assumed to deal with the same multiple threats as the US Navy's AEGIS area defense system.

SA-N-7 (NATO 'Gadfly')
Two single-rail launchers for this new missile are fitted in each ship of the *Sovremennyy* class of guided missile destroyers. The sophistication and rapid-fire potential of the weapon system are indicated by the requirement for six associated fire control/target illuminating radars. The SA-N-7 itself is a naval equivalent of the land-based SA-11, with a 119 lb warhead.

SA-N-9
In addition to the SA-N-4 and SA-N-6 surface-to-air missile systems installed in the *Kirov*, its sister ship, the *Frunze*, has a total of 128 shorter-range SA-N-9 missiles. These are shared between two rows of four vertical launchers, on each side of the stern helicopter pad, and two rectangular groups of four launchers on the forecastle. The same missile is carried by *Udaloy*-class antisubmarine ships and the carrier/cruisers *Novorossiysk* and *Baku*. No details are available. ■

Capitol Hill

By Brian Green, Congressional Editor

A Modified Estimate of the Threat

The CIA tells Congress that the Soviet military drawdown looks "on schedule"—but intelligence experts add that because of force modernization, Soviet capability is undiminished.

CIA Director William Webster and other experts testified that the Soviet threat to the US in Europe and other potential global hotspots is declining as a result of recent political and military developments in the Soviet Union and eastern Europe. The reduced threat is a result of poor Soviet economic performance, the diminishing power of the Communist Party, rebellious non-Russian nationalities, diminishing Soviet military influence in eastern Europe, and a reduction of Soviet military forces in that region. In December 1988, Soviet leader Mikhail Gorbachev promised to reduce Soviet forces in Europe by 5,000 tanks, six tank divisions, and 50,000 men. This "drawdown appears to be on schedule," according to Webster.

The Army's Lt. Gen. Harry Soyster, Director of the Defense Intelligence Agency, described the capability of Soviet forces in Europe as "formidable," but he says the drawdown means that the Warsaw Pact would require more time to reconstitute its forces prior to hostilities. This in turn would provide NATO with greater warning time of an attack, "assuming an effective NATO deterrent." General Soyster also noted, however, that "the advance and proliferation of technology, particularly for nuclear, chemical, and biological weapons, combined with aspirations to regional power by many nations, will present an array of new and more sophisticated threats."

The same experts testified that Soviet strategic capabilities continued to grow as a result of a broad-based, extensive modernization program, apparently undiminished by political and military reforms. This modernization includes continued deployment of the SS-24 ten-warhead ICBM and the SS-25 one-to-three-warhead mobile ICBM, "Blackjack" and "Bear-H" strategic bombers, two new strategic nuclear submarines, and modernization of the SS-18 heavy ICBM, the Moscow ABM system, and the Soviet air defense system. The Soviets, according to Webster, have "made some important gains" in antisubmarine warfare, but still cannot "seriously threaten US subs in the open ocean."

Webster also noted that "by the year 2000, at least six countries probably will have missiles with ranges up to 3,000 kilometers; at least three of them may develop missiles with ranges up to 5,500 kilometers." Four of these nations will have "either nuclear weapons or advanced nuclear weapons programs." He predicted that four more nations could be added to the nuclear list by the end of the decade.

B-2 Still in Trouble

Sens. Patrick Leahy (D-Vt.) and Alan Cranston (D-Calif.) introduced the "B-2 termination bill," to kill funding production of the B-2 Stealth bomber program. The bill has thirty-two cosponsors in the Senate. It would terminate all production funding except for aircraft already in production, but would permit continued R&D and flight testing. About fifteen B-2s would be built in this approach. A similar bill was defeated late last session. Budget pressures, however, are putting the squeeze on the B-2.

One alternative mentioned on the Hill is the B-1 equipped with the Advanced Cruise Missile. Proponents of the B-2 Stealth bomber argue that the promise of the technology and the large investment already made fully justify continuation of the program.

Intelligence as a Key?

Improved intelligence is a recurring theme among those in Congress offering alternative strategies designed to accommodate changing political and military conditions.

Sen. John Warner (R-Va.), ranking Republican on the Senate Armed Services Committee (SASC), argues that the new strategy must "depend on greater mobility, both sea and air; increased sustainability . . . ; increased reliance on strategic defenses; increased emphasis on intelligence, reconnaissance, surveillance, and special operation capabilities; increased emphasis on cruise and extended-range weapons; stealth technology; improved communications with emphasis on commonality; and above all, research and development."

SASC member Sen. Malcolm Wallop (R-Wyo.) contends that the US should avoid an unseemly rush to conclude arms-control agreements and avoid unilateral arms cuts. He suggests that strategic weapons will be even more important in the future and that more focus on space and strategic defenses will be required. Special operations forces need to be "equal players within the services." Finally, he argues that the defense industrial base must be maintained and that high technology weapons should be used to "end-run potential opponents." Particular attention should be paid to intelligence, he says, as the best way to avoid surprise.

Chairman of the House Armed Services Committee Rep. Les Aspin (D-Wis.) places his emphasis on intelligence, maintaining the industrial base, and purchasing newly developed weapons only when new threats emerge to justify their acquisition. He pointedly notes that "[w]e may not want to bring the ATF [Advanced Tactical Fighter] to production until we see whether the Soviet threat develops in a way that requires it." He suggests that the HASC might hold up the ATF and continue to buy the F-16 and F-15. The F-15 is slated for termination after FY 1991.

Representative Aspin also offered a menu of alternatives that "could" accommodate the altered military equation. These include relaxing the readiness of forward deployed US/NATO forces; changing the mix of active and reserve forces; deemphasizing "expensive, risky, high-tech weapons" if NATO achieves numerical parity with the Warsaw Pact in Europe; and reexamining troop lift. "[M]aybe we don't need to buy expensive airlift . . . [if] we can get by with slower but less expensive sealift," he said. ■

Built-in passive sensors can make an airplane stealthier. The sensors can also be more powerful, with greater spectral range.

Smart Skins

By John Rhea

THEY ARE called "smart skins," and the aircraft that have them may enjoy a major, if not decisive, edge in air warfare of the future. In tomorrow's combat environment, survival will turn not just on maximizing one's own stealthiness, but on overcoming the stealthiness of enemy aircraft. Emerging smart skin technologies hold high promise of doing both.

Today, the metallic surface, or "skin," of USAF aircraft is inert, doing little more than covering the structure of a plane. With smart skins, however, avionics functions would be embedded in the surface, making it electronically "alive." Technologies needed to make such smart skins are in the embryonic stage. Even so, they already are beginning to converge into what could be a major new departure for military avionics.

Smart aircraft skins, the concept of which originated in the Air Force's Project Forecast II studies completed four years ago, would be designed to work in two different ways.

First, the smart skin of an aircraft would reduce the plane's "observability" to electronic means of detection. By replacing electromagnetically radiating elements, such as radars and communications links, with passive and directional devices, smart skins would increase stealthiness in tactical aircraft. They would be particularly beneficial in helping to eliminate highly "visible" wing-mounted pods and other external structures.

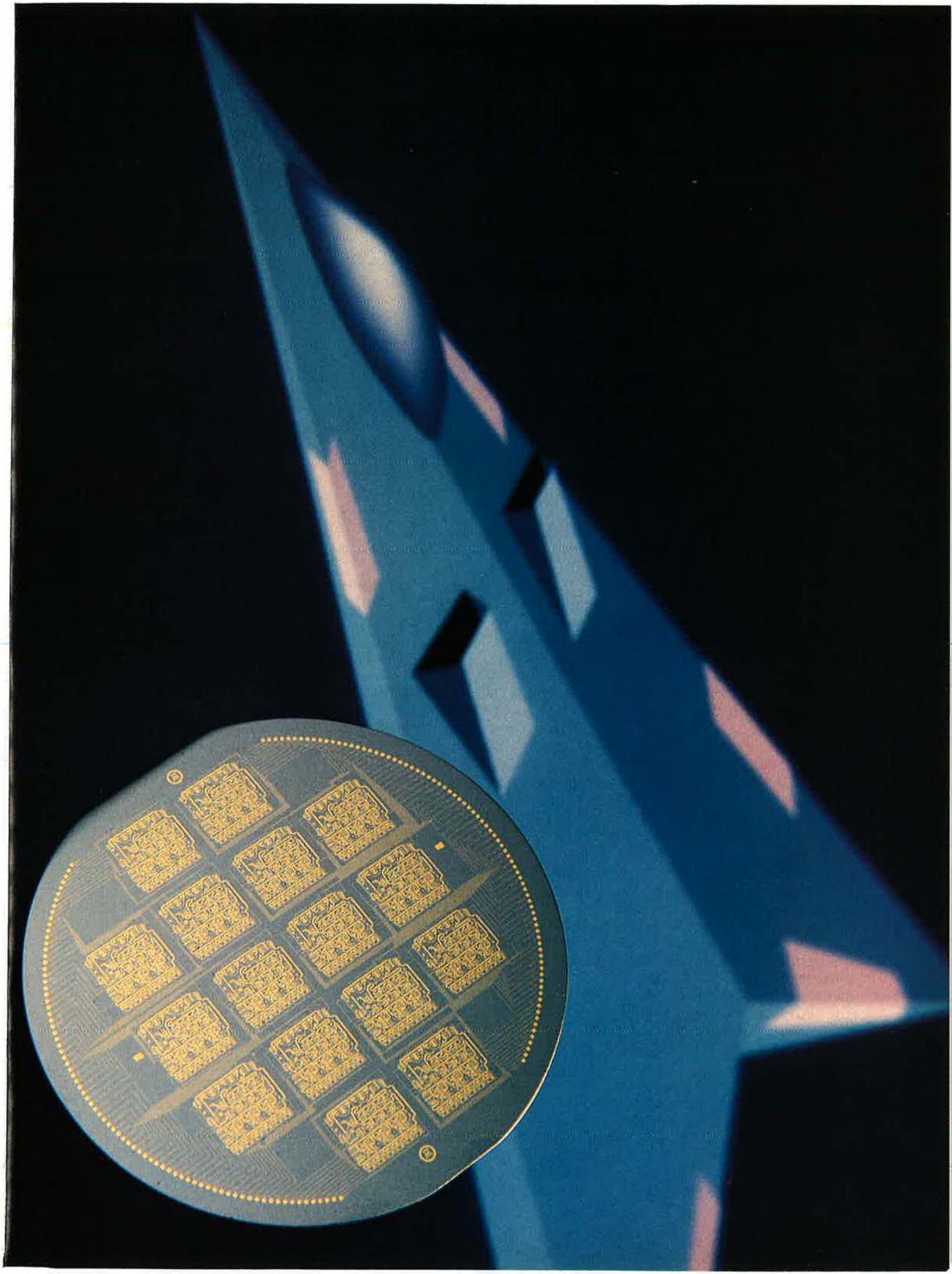
Second, smart skins may enable USAF aircraft to carry far more powerful detection devices with greater spectral range (including radar and infrared sensors), thereby increasing their ability to counter low-observability features in hostile forces.

A third application is becoming even more attractive for near-term use: distributing acoustic and other diagnostic sensors throughout an aircraft to monitor its health during operations. This variation is called "smart structures."

Smart skins technology could greatly increase an aircraft's stealthiness and detection capability while decreasing its weight. One project sponsored by DARPA is building entire aircraft subsystems from integrated wafers, like the one at right, made up of gallium arsenide chips. The first prototype is scheduled for March 1990 delivery.

Understanding Smart Skins

To visualize how technological smart skins work, consider a cross-section view of human skin. The outer layers, or epidermis, form a



passive surface comparable to the energy-absorbing skin of a stealth aircraft. All the action takes place at the next level down, known as the dermis. Embedded nerve endings act as sensors to respond to external stimuli. Networks of blood vessels and sweat glands maintain a constant body temperature. The epidermis and dermis combined are only a few millimeters deep.

Smart skins, which would be about two inches deep, would perform similar functions for an aircraft. The information needed to respond to threats would be routed by subsurface fiber optic cables. Other cables would carry electrical power and radio frequency (RF) signals. Coolants would be circulated through channels to remove heat generated by electronic components.

Also like human skin, smart skins would be to some degree self-repairing. Both are distributed systems capable of sensing and responding to damage. Based on information from the neural network, the blood vessels in the human skin carry infection-fighting antibodies to the area of a wound. Diagnostic sensors in smart skins would detect damage from combat or other causes and reroute signals around the damaged area. In each case, essential functions continue in a slightly degraded mode.

Smart skin applications depend on the development of much more powerful airborne distributed digital information processing systems and corresponding intra-aircraft communications networks with sufficient bandwidth to handle the increased data loads.

Today's F-16 fighter, for example, has a total internal data traffic of less than one billion operations per second (BOPS). The Advanced Tactical Fighter (ATF) should triple that figure, but that's still a long way from the 200 BOPS projected for the USAF aerospace vehicles of the twenty-first century *[see "The Next Generation of Avionics," p. 68, January 1990 issue]*.

There's only one way to get there from here, and that is with the technology of photonics. The 100-megabit (million bits per second) fiber optic data buses of the ATF generation of aircraft will have to be upgraded to gigabit (billion bits) equivalents. High-speed, low-power, radiation-resistant, optical computers will have to replace today's lower-performance electronic data and signal processors.

Much more powerful information processing systems and communications networks must be developed for the Advanced Tactical Fighter (above, in artist's conception), which will need to handle three times the data traffic of today's F-16.

Both of these enabling technologies are in the very early research phase and are unlikely to emerge in the form of operational hardware for at least another decade.

In the meantime, however, some features of smart skins can be implemented on a piecemeal basis. One is use of conformal radar antennas flush-mounted onto the surface of composite aircraft structures. This limited implementation has probably already occurred in two stealthy USAF aircraft, the B-2A strategic bomber and the F-117A tactical fighter.

Other near-term possibilities include retrofits of certain avionics functions of the ATF and the Wild Weasel radar suppression aircraft, such as building a tail warning radar directly into the tail structure; building a successor to the E-3 Airborne Warning and Control System (AWACS) surveillance aircraft by replacing the mushroom-shaped rotodome (this craft is nicknamed "Son of AWACS"); and developing the Navy's proposed Advanced Tactical Surveillance carrier-based aircraft to replace its existing S-3 antisubmarine warfare, E-2C airborne early warning, and EA-6B standoff jamming aircraft with a single multipurpose system.

Smart Drones?

For many, an even more attractive near-term possibility is use of smart skins technologies in a new generation of unmanned air vehicles (UAVs). The advantage here is that, unlike the ATF, these are new platforms and the design is not frozen at a stage that would exclude technologies that won't be ready for another ten years. These are generally low-flying, slow air vehicles that don't pose the skin-heating problems of high-performance aircraft. The weight-saving potential of photonics is particularly valuable for these small drone aircraft.

A long shot for smart skins would be use on hypersonic vehicles derived from the X-30 National Aerospace Plane research program. At hypersonic speeds, the problem of surface heating would be formidable, but the development cycle is stretched out so far that the supporting technologies may be available in time for any flight-testing.

The payoff of smart skins, in addition to improved aircraft performance, should be reductions in the percentages of aircraft cost and weight devoted to avionics. Substituting fiber optics for copper cables has already demonstrated a weight saving of at least eighty percent, but the other benefits are harder to quantify.

The prevailing logic holds that increasing the level of avionics integration, *e.g.*, by reducing the parts

count and the connections among parts, should eventually yield savings after the development costs have been amortized. An example is the wafer-scale integration research project sponsored by the Defense Advanced Research Projects Agency, in which Westinghouse is fabricating entire subsystems such as radar transmit/receive modules out of gallium arsenide (GaAs) wafers instead of individual chips. The first prototype package is due to be delivered in March 1990.

This approach reduces not only the weight (and thus the cost) of the avionics systems themselves, but also the aircraft structure required to contain those systems. The new stealth aircraft are built out of fiber-reinforced polymers to reduce their radar cross section (RCS), but they're also fifty percent lighter than equivalent aircraft made of aluminum. Lighter aircraft don't consume so much fuel.

Kevin Romer, the smart skins marketing manager at Westinghouse Electric Corp.'s Baltimore-based Electronic Systems Group, estimates that this technology should eventually cut both avionics cost and weight by a factor ranging between five to one and ten to one. Mr. Romer, however, quickly adds two caveats: This is strictly an extrapolation of current trends, and it is on a per-function basis.

Other companies involved in smart skins development programs, including Boeing, Hughes Aircraft, and Rockwell International, project weight savings of fifty to seventy-five percent, according to Joseph Smalanskas, an advanced programs engineer at Hughes's Radar Systems Group, based in El Segundo, Calif. He also stresses that this is on a per-function basis. That distinction is important, because all the services have traditionally opted for more functions rather than cashing in the technology dividend—at least they did during the days of robust defense budgets.

First Demonstration

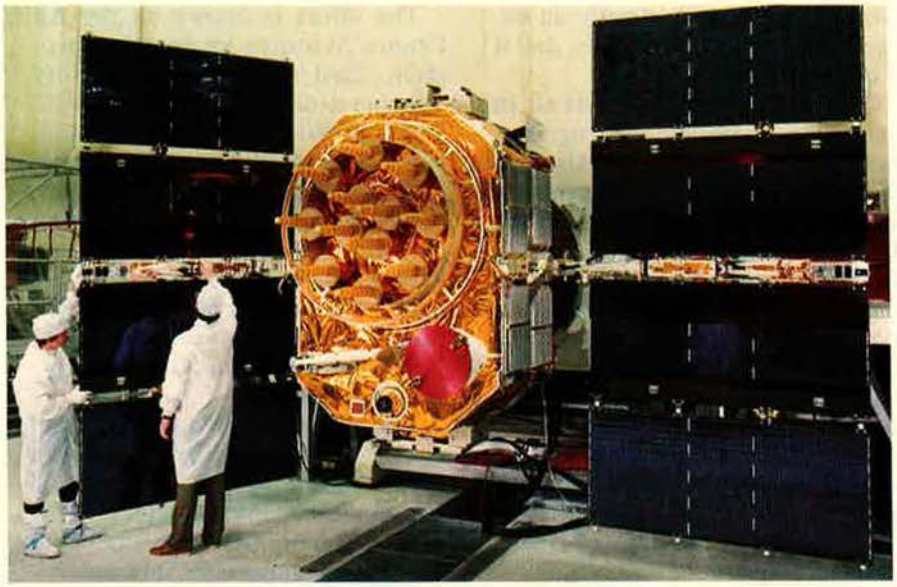
The Air Force has launched its first modest smart skins demonstration project, costing about $1 million over the next two years, at the Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio. The baseline vehicle is a UAV, according to James Tuff, senior aerospace engineer in the lab's Structures Division, and ground tests of prototype hardware are scheduled for the spring of 1992. No flight-test program has yet been approved.

The effort is known as the Air Frame/Avionics Integration program. Last month, the laboratory was due to negotiate a contract with Boeing's Wichita, Kan., division, supported by Hughes. The objective is to develop a jam-resistant, steerable, phased-array antenna embedded in a two-foot-square panel of a prototype Boeing UAV. The antenna would be used to provide position updates via the Global Positioning System (GPS) navigation satellites.

The prototype is a rather small UAV, about twenty feet long with a fifteen-foot wingspan. Its planned mission is damage assessment. This is a volume-limited application in which removing bulky internal avionics could make a major contribution, but Mr. Tuff envisions another promising use of smart skins at the other end of the aircraft size scale: The same panel on top of a C-5 Galaxy or other transport aircraft could provide a secure data link to the GPS constellation of satellites.

Mr. Smalanskas of Hughes says a small, unmanned, vertical takeoff and landing craft weighing as little as 900 pounds, some 100 pounds of which would be devoted to the avionics package, could be fitted with smart skins for use in lethal mis-

Although a great deal of smart skin technology and applications is in the research and development stage, some applications are already being implemented. The B-2A strategic bomber (above) and the F-117A tactical fighter probably make use of conformal radio antennas, which are mounted into the surface of composite aircraft structures, such as wings.



USAF's first smart skins demonstration project is developing a jam-resistant, steerable, phased-array antenna that would be embedded in a panel of an unmanned air vehicle. The antenna would transmit the UAV's position via the Global Positioning System navigation satellites.

sions by the 1995–2000 period. Such a craft's avionics functions would include millimeter-wave radar and a GPS link.

The advantage of conformal antennas is that they can be placed in areas of an aircraft that are not normally available, such as wingtips, to achieve directional operations. This would be a major improvement in security over conventional antennas radiating telltale electromagnetic signals over a 360-degree field of operation.

In the counterstealth role, smart skins could well improve the detection of increasingly small targets—specifically cruise missiles. Because the RCS of these threats is inversely proportional to frequency, it is desirable to use as low a frequency as possible in detection. Thus UHF frequencies above 200 MHz are used for long-range detection, but these types of lower-frequency antennas generate beams that are vulnerable to jamming.

The solution, according to Jock McKinley, an advanced programs engineer at Westinghouse's Electronic Systems Group, is an integrated multifrequency system with additional higher frequency S- and C-band antennas to update target tracking. This can be done without smart skins, but it increases the number of externally mounted structures and causes problems even in an aircraft as large as the AWACS.

Under a program known as Structurally Integrated Radio Frequency Aperture Surfaces, the company is developing conformal antennas to consolidate the necessary frequencies in a single system. This technology is being groomed for the Air Force's "Son of AWACS" and the Navy's next generation of carrier-based surveillance aircraft.

Smart Skins Hazards

The relatively slow speeds of both UAVs and transport aircraft provide an added inducement for widespread use of smart skins. The skin temperature of high-performance fighter aircraft can reach 200 degrees centigrade, but GaAs devices must be kept below 145 degrees centigrade, and other electronic devices begin to fail at temperatures above 100 degrees centigrade. A way has to be found to make that heat dissipate before it reaches the electronic and photonic layers embedded directly under the aircraft's skin.

Furthermore, the dense packaging of today's electronics is already generating dangerous levels of heat. Power dissipation, the source of the internal heat, is up to 100 watts per cubic inch in some cases. Convection cooling can cope with that problem for now, according to Paul H. Freedman, senior engineer for receiver systems at the Westinghouse group, but new techniques will be needed for future surveillance aircraft requiring kilowatts and megawatts of power. "Cooling," he concludes, "may be one of the biggest challenges in the design of a smart skins module."

Another potential pitfall for smart skins is the severe aerodynamic stress that aircraft operations could inflict on the electronic and photonic layers of the surfaces. For example, Hughes notes that conformal packaging near the wake of a jet engine will encounter a dynamic environment some thirty times harsher than conventional avionics experience inside their protective packaging. Because they are not shielded inside the aircraft, the layers will have to have special protection against electromagnetic pulses and electromagnetic interference.

Other variations of smart skins technology are being explored for commercial aviation and even for automotive applications. Hughes, as a subsidiary of General Motors, is looking at the possibility of automotive collision-avoidance systems embedded into vehicles.

Ball Aerospace in Boulder, Colo., has developed what it calls the microstrip antenna for missile applications. Last year, Boeing selected a commercial version, known as Airlink, for satellite communications for its new 747-400 aircraft.

"Aircraft can now be linked to communications satellites that will allow pilots access to air traffic control communications, weather reports, engine monitoring, and the selection of flight paths that will save fuel costs," claims John Friesz, Ball Aerospace marketing manager.

For what the company calls "smart cars," Ball Aerospace is developing conformal antennas to provide satellite communications from the roof of a car. In another application, the state of New York has tested a warning system for school buses; antennas are used to detect the presence of children obscured from view and warn the bus driver not to back up. ■

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

Valor

By John L. Frisbee, Contributing Editor

The Mills Grind Slowly

Ben Drew waited forty years to be decorated for a feat that no man had achieved up to his time.

The first man to down two German jet fighters in the same fight and one of only two men to receive the Air Force Cross for actions performed during World War II, Maj. Urban Drew also ended Nazi experiments on a very-long-range bomber by destroying the prototype.

THE Air Force Cross was authorized by Congress in July 1960 as USAF's equivalent to the Army Distinguished Service Cross and the Navy Cross. All three rank second only to the Medal of Honor, this country's highest award for valor in combat.

The first AFC was awarded posthumously to U-2 pilot Maj. Rudolf Anderson, who was shot down while photographing missile sites in Cuba in October 1962. It follows, then, that all subsequent awards of the Air Force Cross were for extraordinary heroism in Southeast Asia. Right? Wrong. At least two awards have been made for World War II combat actions that were not adequately recognized at the time. One of them was to Maj. Urban L. (Ben) Drew.

When Lieutenant Drew reported to the 375th Squadron, 361st Fighter Group, at Bottisham, England, in June 1944, he came full of self-confidence, eager for combat, and well prepared. For a year, he had been instructing fledgling P-51 pilots in air combat tactics at Bartow, Fla. On his initial combat mission, Drew destroyed a Ju-52 on the ground near Paris. During the next two weeks, he established an enviable record in that most dangerous of fighter missions—strafing anything that moved bearing a swastika in enemy-held territory. His first air victory, over an Me-109, came on June 25, followed by two more in late August and early September.

The importance of Ben Drew's September 18 mission was not recognized at the time. His group was escorting USAAF heavy bombers on a shuttle mission to Russia. As the 361st approached its break-off point south of Sweden, Drew saw a twin-engine bogey skimming the water off the German coast. He was given permission to investigate and, with two wingmen, headed for the deck, where he destroyed an He-111 bomber. Climbing back up, he spotted "the biggest aircraft I had ever seen" sitting on the water at a seaplane base. The six-engine aircraft he and his wingmen destroyed was later acknowledged to be a BV-238 V1, a new very-long-range bomber that had just finished its operational tests and with which Hitler had hoped to attack New York and Washington. With the prototype sunk, the Nazi program apparently was abandoned.

Three weeks later, while returning from an escort mission to Czechoslovakia, Lieutenant Drew spied two aircraft taking off from the Luftwaffe base at Achmer. He recognized them as Me-262 jet fighters, a new breed with which he had tangled a few days earlier. Telling his deputy squadron leader to take over, Drew, with his Number 2 and 3 wingmen, rolled over in a near-vertical dive, approaching compressibility as he pulled out and began firing at the airborne Number 2 Me-262, which exploded, nearly flipping Drew's P-51 over.

The lead -262 broke left in a steep climbing turn. In his report, Drew wrote: "I was still indicating about 400 mph, and I had to haul back on the stick to stay with him. I started shooting from about sixty degrees deflection, 300 yards, and my bullets were just hitting the tail section of the E/A. I kept horsing back on the stick, and my bullets crept up the fuselage to the cockpit. . . . I saw the canopy go flying off . . . and the plane rolled over . . . hitting the ground at about a sixty degree angle."

Thinking he might not make it home through the curtain of flak that surrounded him all the way to the North Sea, Drew passed the word of his double Me-262 victory to his deputy lead. He did make it—the only man to have downed two German jet fighters at that time.

Unfortunately, his gun camera had jammed. His Number 2 man had been shot down by flak and became a POW. His Number 3, who had broken to the right early, saw only two columns of black smoke—not the actual shootdown. The recommendation that Drew be awarded the Distinguished Service Cross was turned down because of insufficient confirmation.

In 1950, after volunteering to fly P-47Ns in the Pacific, Ben Drew left the Air Force as a major. Years after the event, German sources confirmed that Lieutenant Drew had destroyed two Me-262s at Achmer that October day in 1944. The Air Force Board for the Correction of Military Records recommended that he be awarded the Air Force Cross, successor to the DSC. Chief of Staff Gen. Charles Gabriel arranged for Ben Drew and his wife, Lynette, to be flown from their home in Pretoria, South Africa, to Washington, where Air Force Secretary Verne Orr presented the medal in May 1983. It had been a long wait for that happy ending. Indeed, the mills sometimes do grind slowly. ■

The National Security Advisor, who has seen a lot of policies come and go, says the importance of strategic stability has not diminished.

Scowcroft Urges Caution

By James W. Canan, Senior Editor

BRENT Scowcroft has been there before. This is his second time around as National Security Advisor to the President, the powerful White House post that he held fifteen years ago under President Ford. Through two decades, as government official and as private citizen, Mr. Scowcroft has had a great deal to do with shaping and carrying out US strategic and foreign policies.

He is still in the thick of them, and his positions are characteristically clear.

Mr. Scowcroft counsels against a unilateral reduction of US strategic forces. He would be willing to cut those forces, however, on two conditions—if the Soviets cut theirs and if there were no net loss of US strategic strength in the bargain.

Tactical forces are another matter. The National Security Advisor believes that the time may be at hand to transform US forces and their missions, possibly expanding the role of the Air Force.

Through the years, Mr. Scowcroft has gained recognition as a thoughtful, politically moderate man who could always be counted on for fruitful, nonideological public service. In the Nixon and Ford Administrations, first as Henry Kissinger's right-hand man and then in his own right, Mr. Scowcroft became closely identified with the US policy of détente with the Soviet Union.

Détente died when the Soviet Union invaded Afghanistan in 1979. Mr. Scowcroft subsequently said it had been "a good try" and added, "I backed détente, but we oversold it. It was a very sophisticated policy, and the American people got the wrong idea from it that the Soviet threat was over."

He made that comment in an interview seven years ago, just after President Reagan chose him to head the President's Commission on Strategic Forces, which became known as the Scowcroft Commission. Now, back in the White House and at work for President Bush on policies apropos of a seemingly friendlier and more tractable Soviet Union, he leaves no doubt that his message of 1983 still stands.

"We Have to Be Cautious"

Mr. Scowcroft credits the Soviet Union with having a constructive

attitude toward the Strategic Arms Reduction Talks (START). He is certain that Soviet leader Gorbachev means well. But he takes the view that actions speak louder than words and, from that standpoint, sees "almost no change" in the Soviet strategic setup, either in strategic systems or in a willingness to make major concessions on such systems in the furtherance of START.

"So I think we have to be cautious," the National Security Advisor says in his soft-spoken manner.

On assuming the Chairmanship of the President's Commission on Strategic Forces in 1983, Mr. Scowcroft also declared, "We Americans have tended to look on nuclear weapons as being so horrible that they will never be used. The Soviets are no more anxious for nuclear war than we are. But they do believe one could occur, and they are doing everything they can to prepare for it.

"The essence of our planning to deter nuclear war must be not what *we* think about its possibility, but what the Soviets think about it. We have to convince the Soviets that they must never conclude that nuclear war is a rational course of action."

Those words, too, ring as true now as they did then, Mr. Scowcroft believes. He concedes that the possibility of nuclear war is probably lower now than at any time in the history of the US-Soviet nuclear confrontation. He warns, however, that such a war—or the abrupt threat of one resulting from a Soviet reversion to type—cannot be ruled out, given the political volatility in the land of the Volga. He doubts that deep-seated suspicion of US nuclear intentions—some would call it paranoia—has been expunged from the Soviet mindset, notwithstanding Gorbachev's conciliatory leadership.

"So the rationale for the [Scowcroft] Commission—ensuring strategic stability—is at least as important as it ever was," the National Security Advisor declares.

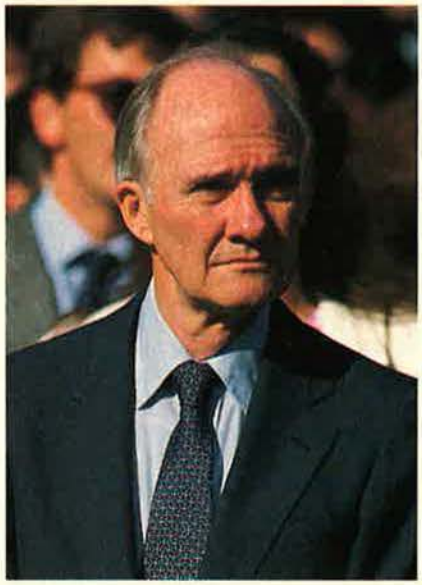
"We need to respond to any changes in the strategic environment," he continues, "but we also need to remember what got us here. If the possibility of nuclear war has been reduced, it is testimony to the wisdom and success of our strategic policies over the last forty years or so."

Mr. Scowcroft has been a central figure in the formulation and implementation of those policies for much of that time. They are predicated on the triad of strategic forces—land-based ICBMs, submarine-launched ballistic missiles, and bombers—that the Scowcroft Commission reevaluated, and recommended reshaping, in 1983.

Among other things, and perhaps most importantly, the bipartisan Commission stoutly endorsed the MX ICBM program. By then, the Reagan Administration had redesignated MX the "Peacekeeper" missile, but it took awhile for the new name to catch on. Commission members referred to the ICBM as MX, and some still do. Mr. Scowcroft himself harks back to "the MX commission."

The commission recommended that the Air Force deploy 100 ten-warhead Peacekeeper missiles in Minuteman III missile silos and that USAF also develop a smaller, single-warhead ICBM, which became known as Midgetman, to be deployed in a less vulnerable, mobile mode in the 1990s.

Brent Scowcroft: National Security Advisor to the President and veteran strategic player.



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Taken as a whole, the Scowcroft Commission's recommendations proved politically and strategically palatable on all sides and, thus, were pivotal in persuading Congress to approve Peacekeeper production and Peacekeeper silo basing. Congress took a fancy to Midgetman in the belief that its single-warhead configuration would make it easy for the Soviets to verify its deployed numbers of warheads under the terms of an arms treaty and that its mobility would keep it safe from attack.

One ICBM or Two?

Midgetman went into development. The budget crunch that lay ahead would make the Air Force settle for fifty Peacekeepers and propose dispensing with Midgetman. Opposition to Midgetman seems to have grown stronger lately in the wake of USAF's move to redeploy Peacekeeper missiles from silos to railways, thus giving them the mobility that had been Midgetman's *raison d'etre*.

Should the US back away from the two-ICBM program that the Scowcroft Commission once proposed? "Well, no," Mr. Scowcroft replies. "We're not spending all that much money on them [the Peacekeeper and Midgetman programs] right now, and it seems prudent to keep on with both of them while we see how things go."

The National Security Advisor is not locked into any particular strategic system, though. He takes the view that all strategic weapons are negotiable and that "if we can enhance our security more by giving up a system than by fielding it, we ought to do so."

Consistent with this viewpoint, Mr. Scowcroft reportedly proposed behind the scenes earlier this year that the US offer to negotiate with the Soviet Union a ban on all mobile, multiple-warhead, land-based ICBMs. Such a ban would be a blow to Peacekeeper and a boon to Midgetman.

By all accounts, the Scowcroft proposal was cold-shouldered at the Pentagon, where there is far greater support for Peacekeeper than for

Midgetman, but was welcomed on Capitol Hill, where it's the other way around. A Presidential endorsement of the Scowcroft proposal was considered unlikely.

But it has always been considered unwise in Washington to sell Mr. Scowcroft short in the strategic arena, where he has shown that he has the touch.

The makeup of the entire US strategic force was very much at issue when the Scowcroft Commission was put to work by President Reagan in 1983. The hottest, most immediate questions were whether to put Peacekeeper missiles into production, how many of them to build, how to base them, and what kind of new land-based ICBMs—if any—the US should begin developing.

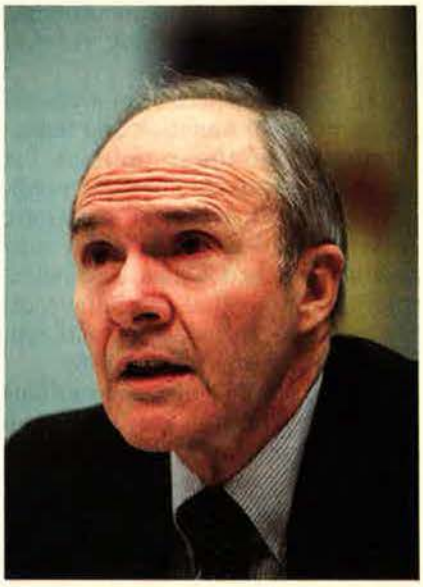
All those questions were subsets of a broader one of surpassing interest to the Air Force—whether land-based ICBMs had seen their best days and were on the way out, given the seemingly chronic and increasingly divisive issue of their vulnerability. The answer would lie in how the narrower, hotly controversial Peacekeeper issues were resolved.

The Reagan Administration, like the Carter Administration before it, was committed to the Peacekeeper program. Mr. Scowcroft's political mandate was to find a way to forge a commission consensus in support of Peacekeeper and of a particular basing mode that would be acceptable to all the many political and military factions then at war over the weapon.

Mr. Scowcroft had his heart in the job. He had spent twenty-eight years in the Air Force, retiring as a lieutenant general in 1975, and was a firm believer in land-based missiles as an indispensable leg of the strategic triad.

"Without MX," he said at the time, "it's hard for me to see what incentive the Soviet Union would have to move to arms control and greater world stability."

He was by no means confident of success. "I was not enthusiastic about becoming Chairman of the President's Commission on Strategic Forces," he recalled later. "I questioned whether we could reach a consensus in proposing constructive solutions to the MX issue and the problems of shaping our future strategic missile forces."



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Mr. Scowcroft is known as a consensus-builder who gets things done in a low-key, businesslike manner.

Wryly, he also noted back then, "Our report will have to be politically and militarily acceptable, first to the President, then to the Defense Department, the State Department, and the Joint Chiefs of Staff, and then to the Senate and the House. That's a tall order."

Vindicating the Strategic Triad

The Commission brought it off. In the afterglow of its well-reasoned report, it was credited with justifying Peacekeeper and with reaffirming the rationale for the strategic triad. Its recommendations, which also covered bombers, cruise missiles, and submarine-launched ballistic missiles, became the intellectual framework for the Reagan Administration's far-reaching strategic modernization program.

The report was a smash hit, in large measure because its conclusions came from a membership so clearly knowledgeable, diverse, and, maybe most important, bipartisan. Its members and *ex officio* "senior counselors," all of them big names in US defense, foreign, and domestic policy circles, were drawn from throughout the political spectrum and had publicly expressed about as many views on Peacekeeper as there were in the strategic and political communities at large. They were a tough bunch for their Chairman to pull together, and when all was said and done, they gave him a collective tip of the cap for having shepherded them stylishly and well.

Among the members was William J. Perry, Under Secretary of Defense for Research and Engineering in the Carter Pentagon. Dr. Perry had worked closely with the Air Force and with his boss, Defense Secretary Harold Brown, who served as a senior counselor to the Scowcroft Commission, in devising and proposing several mobile basing modes for Peacekeeper. All were rejected by Congress through the late 1970s for one reason or another and were political anathema to the incoming Reagan Administration in 1981.

Dr. Perry, who strongly believed that the nation needed Peacekeeper but who had become weary of doing battle in its behalf, had extraordinary praise for Mr. Scowcroft. He said that he had agreed to serve on the Commission on Strategic Forces "only because I believed that Brent's leadership, intellectual ability, and personal qualities could make it succeed. He is first-rate."

A Consensus-Builder

Mr. Scowcroft established a reputation as a consensus-builder during his Air Force career, which he capped while serving in the White House. He became President Nixon's military assistant in 1972 and then, while still in uniform, became Vice Chairman of the National Security Council. His boss and benefactor was Henry A. Kissinger, who headed the NSC as Mr. Nixon's National Security Advisor before becoming Secretary of State.

Mr. Scowcroft, having retired from the Air Force, took charge of the NSC in December 1975. At about the same time, Richard Cheney became White House Chief of Staff, succeeding Donald Rumsfeld, who had moved to the Pentagon as Secretary of Defense in place of James Schlesinger.

Mr. Scowcroft and Mr. Cheney left the White House on January 20, 1977, when the Carter Administration got under way. Mr. Scowcroft

took charge of the Washington office of Kissinger Associates, an international consulting firm that Mr. Kissinger ran (and still runs) from offices in New York. Mr. Cheney later took Wyoming's seat in the House of Representatives and, after serving five terms, rejoined Mr. Scowcroft in the upper reaches of the Bush Administration as Secretary of Defense.

Mr. Scowcroft, Mr. Cheney, and Secretary of State James Baker make it a point to meet at breakfast about once a week when all are in Washington. There have been reports of a rift between Mr. Baker and Mr. Scowcroft, of differences over foreign policy, and of competition for the President's attention. Administration sources dismiss such reports. They acknowledge some differences between the two but describe them as minor. The Secretary of Defense was said to be strongly against the Scowcroft proposal for a bilateral ban on all mobile, multiple-warhead ICBMs, but relations between the two men reportedly remained warm.

Mr. Scowcroft's associates insist that he does not see himself as a rival of Mr. Baker or of Mr. Cheney and that he gladly defers to them when it comes to advising the President on defense and foreign affairs and policies. He believes that his job is to integrate such policies and to mold—and advise the President on—the broader strategic concepts that drive, or are derived from, those policies.

The National Security Advisor sees his most important responsibilities as making sure that the President knows the right questions to ask while in the process of coming to decisions, that the President finally has good and sufficient information on which to base each decision, and that, in the end, "what gets done is what the President wanted done."

Mr. Scowcroft goes about his business without flourish or fanfare. He has never been one for flamboyance, playing power games, or letting his ego get in the way. It has been said of him through the years that he "quietly dominates" settings in which he finds himself, including top-level gatherings of more temperamental types, and that he has a rare talent for persuasion, for bringing out the reasonableness in others.

He has his detractors, of course, many of them in the ranks of political archconservatives. Some have always been suspicious of him because of his long association with Mr. Kissinger, whom they reviled for his pursuit of détente with Moscow. Others take a dim view of Mr. Scowcroft to this day for having served on President Carter's bipartisan General Advisory Committee on Arms Control. They accuse him of having lent his influence and credentials to the selling of SALT II, which they abhorred.

Strength in Constancy

The fact is, the General Advisory Committee on Arms Control did not endorse the proposed SALT II treaty that President Carter submitted to the Senate and withdrew from Senate consideration after the Soviets invaded Afghanistan, Mr. Scowcroft recalls. In any case, he simply did what he thought he had to do and let the whole thing pass.

Mr. Scowcroft has never seemed to be thrown off stride by praise or criticism. One of his greatest strengths, admirers claim, is constancy, an attribute that he in turn believes is a major reason for the success of US national security policy in the cold war.

"We've come a long way, partly because we were never an attractive opportunity for the Soviets," Mr. Scowcroft says. Thus, he notes, the US should be careful about changing course, but should also "be in tune with reality," which is that budgets are tight and the Soviets have been making peaceful moves and don't look as menacing as before.

This means that "we need to look seriously at the environment that's coming" and, in light of it, to prepare to make do with fewer new weapon systems and different force structures than formerly planned, Mr. Scowcroft says.

"I'm talking about a transformation in the nature of the threat in Europe," the National Security Advisor asserts. And a transformation in the forces needed to meet that threat? "Yes," he replies.

If negotiations on conventional armed forces in Europe (CFE) result in a treaty along lines now anticipated, NATO and Warsaw Pact forces will be just about evenly matched, an unprecedented state of affairs in Europe, and "we would need to change some of our assumptions," Mr. Scowcroft says.

He adds, "We have been struggling for forty years with the disparity of forces in Europe. Compensating for numerical inferiority has been a hardy perennial in all of our planning. Now we may be able to wipe that out, and we're going to have to think hard about what that does for us, how that allows us to change the emphasis on forces to be provided, the timing with which we provide them, and so on."

NATO battle plans have always taken into account the possibility of a massive surprise attack by Soviet and other Pact forces. "Maybe we won't need to be concerned about that any more," Mr. Scowcroft says. "Many things could change in Europe, and we ought to look at our defense budget and requirements in light of them—as part of the NATO alliance. We ought not to go running off unilaterally."

How would his former service, the Air Force, fit into all this? "I think the Air Force would be at least as useful as it is now," the National Security Advisor says. "Air forces can be employed like mobile artillery, in support of a mobile defense, which is a consideration. They are flexible, responsive. They can be concentrated very quickly at points of breakthrough."

Mr. Scowcroft also sees an expanding role for stealthy systems, declaring that "Stealth will be more and more important to survivability on the battlefield." In broader perspective, he sees no easing of the military's emphasis on high technology, such as stealth.

The National Security Advisor believes that the strategic realities may turn out to be happily opportune for the US in its coping with fiscal realities. The transformation of military forces that may lie ahead could be just what the doctor ordered for the US to solve, or greatly ease, its "serious budget problem," Mr. Scowcroft believes.

"What we ought to be looking at now," he asserts, "are the steps, the cuts, that would make sense for us if CFE goes through. Will we be able to make further reductions? I think the answer is clearly yes." ■

Among the first to wear the "blue pickle" insignia of flight officer was a West Virginia boy named Chuck Yeager.

The Third Lieutenants

By J. H. MacWilliam and Bruce D. Callander

THE military caste system was alive and well in the early 1940s, but it was soon to clash head-on with the realities of rapid mobilization.

With war already under way in Europe and threatening in the Pacific, President Franklin D. Roosevelt called for the production of 50,000 military aircraft per year and aircrews to match. US industry, already building planes for Britain, geared up to produce more. Training flyers to man them would be a bigger problem.

The Army Air Corps still required pilot trainees to be at least twenty-one years old and to have at least two years of college, because they were to be commissioned on graduation from the training program. If the Army were to meet the new training goals, something had to give. Gen. H. H. Arnold, Chief of the Air Corps, supported the idea of training enlisted men with high school diplomas and graduating them as sergeant pilots.

Some of General Arnold's staff officers and field commanders had reservations. Britain's Royal Air Force had been using enlisted pilots, and some had wound up commanding crews with commissioned officers acting as copilots and navigators. The Air Corps did not want to repeat that social *faux pas,* the officers said.

Still, the Air Corps needed to broaden its pool of potential pilots, and there seemed to be little choice but to lower the age and education requirements. In June 1941, Congress authorized the training of enlisted "aviation students" to be graduated as staff sergeant pilots. The understanding was that they would tow targets, fly transports, instruct students, and do other odd jobs. Like the service pilots recruited directly from civilian life and the women in the ferry service auxiliary, they were to relieve officers for combat flying.

Then Came Pearl Harbor

When the United States entered the war, the Army still was woefully short of commissioned pilots, but it had graduated more than 400 men as sergeant pilots, and hundreds more were in the pipeline. The newly formed US Army Air Forces began to use the enlisted flyers wherever they were needed, including combat. Some did, in fact, command crews that included commissioned officers.

By then, the distinction between officer and enlisted pilots had blurred. As the pace of the buildup increased, USAAF lowered the entrance requirements for aviation cadets to admit eighteen-year-olds with high school diplomas. Now the criteria were essentially the same for the cadets who would be commissioned as for the aviation students who would become staff sergeants.

Logically, the solution might have been to commission the flying sergeants, but officials still had reservations. USAAF might find itself overpopulated with officers who couldn't have come within a country mile of prewar standards. In May 1942, USAAF asked Congress to create a new grade above the enlisted ranks but below that of second lieutenant. On July 8, the President signed Public Law 658, establishing the grade of flight officer (F/O), equal in status to that of warrant officer junior grade.

Three weeks later, Headquarters

Though scorned at first by the "old Army," flight officers were often outstanding in combat. Chuck Yeager (shown with Bell Aircraft President Lawrence Bell), fighter ace and first man to crack the sound barrier, was one of thousands who held that rank.

notified all commanders, "It is the desire of the Commanding General, AAF, that these new Flight Officers be accepted in the nature of 'Third Lieutenants' by all personnel and that they be required to comply with, and in turn to be treated in accordance with, all the customs and courtesies of the military service pertaining to commissioned officers."

That November, the first F/O appointments were made as pilot Class 42-J graduated from flight training. They were to wear colored bars like those of warrant officers except that the enameled portion would be blue instead of brown. With no such insignia available, the first graduates doctored officer bars with blue paint. Most pinned the makeshift insignia onto their enlisted uniforms, but a few managed to order the "pinks and greens" they were entitled to wear in officer status.

Among the first to wear the new rank was a cocky eighteen-year-old country boy from West Virginia. He had enlisted before the war, had become an aircraft mechanic, and had applied for the aviation student program. While he was still in training, the F/O law took effect, and he graduated with blue bars instead of staff sergeant stripes. A born flyer, he was assigned to fighters and became an ace. In the process, he received a battlefield commission. Later, Charles Yeager would become America's leading test pilot and retire as a general officer.

The law that created the F/O rank applied not only to aviation students such as Yeager, but also to aviation cadets. Those who entered after the date of enactment could be graduated either as second lieutenants or as flight officers. By the spring of 1943, graduating classes from pilot, navigator, and bombardier schools were sprinkled with blue bars. The aviation student program had lasted only fifteen months and was phased out. The fact that hundreds of pilots had flown as enlisted men would be all but ignored by aviation historians for many years.

Meanwhile, Back at the War

Though USAAF was creating no more staff sergeant pilots, it already had more than 2,000 of them in the field. By the time the F/O rank was created, at least three enlisted pilots had been killed in a troop carrier unit in the Pacific. Others were flying fighters in North Africa and New Guinea, commanding transports, or performing aerial reconnaissance. Bomber crews were being formed with sergeant pilots and commissioned bombardiers and navigators.

Headquarters gave commands authority to promote the enlisted pilots in their units, but it was a slow and confused process. Commanders debated whether the sergeants should be made flight officers or, since they already were senior to many of the newly graduated second lieutenants, given direct commissions. At one point, Headquarters said the sergeants should be moved through the flight officer rank before being made lieutenants. Two months later, it said they could be granted direct commissions.

At least six more sergeant pilots died in combat and another fifty-eight in training accidents before they were promoted to either grade. Those serving with the 82d Fighter Group were promoted en masse to second lieutenant before moving overseas. Others made lieutenant or flight officer, depending on where they were and what local policies were in effect at the time. Ironically, those flying with Stateside training and defense outfits usually received their promotions first. It was well into 1943 before those in England, New Guinea, and North Africa received theirs. As late as March 1943, there still were more than 800 pilots flying in enlisted status.

Rapid wartime reassignments were part of the problem. Some enlisted pilots were recommended for promotion at one base but moved to

another before their orders came through. In the confusion, some continued to serve for months as flying sergeants.

One of the more extreme cases was that of Robert L. Bryant. Graduated as a staff sergeant in September 1942, he was assigned to the 1st Air Force in the northeastern US, but then quickly transferred to 3d Air Force in Florida, where he qualified in P-40s and P-39s. Both 1st and 3d Air Forces issued orders appointing him a flight officer. They caught up to him in North Africa, where he pinned on his blue bars and, six months later, received a direct commission from 12th Air Force. Thirty-two years later, when he retired as an Air Force colonel, Bryant discovered that officially he had never been a flight officer. Both of his Stateside F/O orders had been revoked and, without telling him, USAAF had revised his records to show that he had been a staff sergeant when he received his battlefield commission. Generously, however, the Air Force did not dock him for the months for which he had been overpaid.

Neither Fish Nor Fowl

If the flight officer program solved the problem of putting enlisted men in command of aircraft, it also created a new one. USAAF was never entirely comfortable with the status of its warranted but still noncommissioned officers. Although General Arnold had said they were to be treated as officers, socially they fell somewhere between the enlisted and commissioned ranks.

They were a particular trial to some of the commanders who had risen through the ranks of the prewar Regular Army. In the explosive growth of the war, USAAF's numbers had swollen with teenagers commissioned in the temporarily large Army of the United States. The veterans of the "old" Army barely recognized these lieutenants as officers. They were even more reluctant to accept the newly contrived flying warrant officers as their peers.

There were fewer problems among flight crew members, most of whom were recently plucked from civilian life and had little feel for the subtleties of the ranking system. The F/Os who had been sergeant pilots had more experience than most of the newly commissioned officers had. The more recently graduated F/Os often were the classmates of the commissioned officers in their outfits. Their relative ranks weren't that important. If there was any resentment when an F/O was picked to lead a squadron or group, it was short-lived. Combat was not the place to debate one's social standing.

Financially, F/Os were actually a little better off than their commissioned counterparts. Their $150 per month in basic pay was the same as that of junior grade warrant officers and second lieutenants and, like other officers, they received another $75 (half of basic pay) as flight pay. But where the overseas allowance for commissioned officers was ten percent of their basic pay, that for warrant officers was twenty percent. Flight officers collected the warrant rate. Thus, a second lieutenant collected $240 in combat, while a flight officer drew at least $255 and often more because of his added time in service.

F/Os enjoyed another advantage over lieutenants. As the equivalent of warranted officers, they were not given the full responsibilities of commissioned officers. Whereas lieutenants were saddled with numerous additional duties when they were not flying, flight officers usually had their ground time to themselves.

Who Got the Pickle?

One question about the F/O status persisted through much of the war. When the Army had authority to award a flight training graduate either the gold bars of a second lieutenant or the "blue pickle" of a flight officer, how did it decide which he should receive?

Officially, the policy was to commission those with the best training records and leadership qualities and make the rest flight officers. However, there is no record to show that any of the aviation students in training when the F/O law took effect were commissioned on graduation, even though they legally could have been. When aviation cadets could have been granted either rank on graduation, some of the better students received blue bars, while some of those who had seemed on the verge of washing out became second lieutenants. At best, the decision of who qualified as "officer material" often appeared to rest with the subjective judgment of local flight school officials.

Another theory about the appointments was that the flight officer bars went to the men who had been the class mavericks, the cocky "hot pilots" who gave only a passing nod to military discipline. Though they often proved to be the best flyers in their outfits, F/Os had a reputation for being a wild bunch, and some seemed determined to act the part.

How many flight officers finally were appointed is uncertain. While the bulk of the blue bars went to pilots, bombardiers, and navigators, the rank was also worn by glider pilots, service pilots, flight engineers, gunnery control officers, and others. As late as the summer of 1945, there still were more than 32,500 on active duty. By then, of course, many who had held the rank earlier had already been commissioned. A check of the service numbers blocked out for F/Os shows that more than 200,000 were available, and most appear to have been used.

Exactly when the last flight officers entered service is also unclear, but the law authorizing the grade was not repealed until July 1947, two months before the Air Force became a separate service. At the same time, flight officers who had served in time of war were made eligible for reserve commissions. The short, turbulent era of the "Third Lieutenant" was over. ■

James H. MacWilliam was graduated as a staff sergeant pilot in July 1942 and flew B-25s in New Guinea. He was appointed a flight officer and then commissioned. After a postwar hiatus, he returned to USAF in 1948 and retired in 1964 as a lieutenant colonel. He is editor and publisher of Sergeant Pilots' Newsletter, *a publication preserving the history of enlisted pilots.*

A veteran of World War II and Korea, Bruce D. Callander joined Air Force Times *in 1952 and became Editor in 1972. His most recent article for* Air Force *Magazine was "Five Smart Men Who Didn't Invent the Airplane" in the January 1990 issue.*

Reviews

By Jeffrey P. Rhodes, Aeronautics Editor

The Borrowed Years 1938–1941: America on the Way to War, by Richard M. Ketchum. Between the Munich Pact in 1938 and the attack on Pearl Harbor in 1941, the United States believed it could remain aloof from the problems of the rest of the world. The author, who was a teenager at the time, notes that, "[l]ooking back on it a half a century later, it is much easier to see that the headlines I read, the news broadcasts I heard, echoed the cadence tramp of approaching doom. The reason I wasn't more aware of this at the time is that, like most Americans, I didn't want to be aware of it." The wonderfully lyrical text switches between events in Europe and events at "home," describing both daily life in the author's hometown, Pittsburgh, and such homefront events as the hurricane that hit the northeast in 1938 and the Lindbergh kidnapping. The author not only captures the events of history, but also gives the feel of the tapestry on which it was woven. Random House, New York, N. Y., 1989. 899 pages with photos, maps, notes, bibliography, and index. $29.95.

The Dictionary of War Quotations, edited by Justin Wintle. The author states in his introduction that he wanted this book to be "sufficiently broad-based to reflect the changing nature of warfare" but "not so large that it necessarily becomes a piece of furniture in the reading rooms of libraries, . . . whence it is too bulky to be removed." He has achieved that balance. "Readable reference" may sound oxymoronic, but that's exactly what this volume is. Divided into three parts, the book first lists general statements about war, arranged chronologically by author. The second part deals with individual wars and engagements, again arranged chronologically. The final section contains famous quotations from and about the great captains of war through the ages. Pacifists are also given their due, and the author has gone to great lengths to include the wartime humor that relieved the stress of those doing the fighting. The Free Press, New York, N. Y., 1989. 506 pages with notes, acknowledgments, and indices. $29.95.

Nautilus 90 North, by Cmdr. William R. Anderson, USN, and Clay Blair, Jr. The late July–early August 1958 voyage of the USS *Nautilus* (SSN-571) from Seattle, Wash., to Greenland under the ice cap and via the North Pole would not seem a "big deal" today. But it was a momentous event then and is still of great significance. In addition to being the first underwater transpolar voyage, it was an excellent test run to gauge the stresses on a submarine crew during an extended cruise—conditions crews on the then-coming Polaris ballistic missile-carrying boats would face when they went on patrol. Commander Anderson, the skipper of the *Nautilus,* relates the intricate planning for the trip, which was carried out in strict secrecy (an announced trip to Panama was actually an elaborate cover-up), the joy of arriving at ninety degrees north latitude, and the hair-raising incidents that occurred under the ice. This reissue is part of Tab Books' Military Classics Series. Tab Books, Blue Ridge Summit, Pa., 1989. 251 pages with photos, ship's complement, and index. $16.95.

One Day in a Long War: May 10, 1972, Air War, North Vietnam, by Jeffrey Ethell and Alfred Price. Basing their book on nearly 100 interviews, official (some just recently declassified) and unofficial contemporary documents, diaries, and cockpit voice recordings, the authors present a complete picture of the launch day of the Linebacker I operations over North Vietnam from both the Air Force and Navy perspectives. On this day, American pilots flew more than 330 sorties against targets around Hanoi and Haiphong. They were met by more than ninety-three SA-2 Guideline SAMs and forty North Vietnamese MiG fighters. Eleven MiGs were shot down, the Paul Doumer Bridge was knocked out, and Naval aviators Randy Cunningham and Willie Driscoll became the first US flyers to earn the title of "ace" in the Vietnam War. The amount of information in this book is staggering, but nonetheless it is a highly entertaining read. Random House, New York, N. Y., 1989. 219 pages with photos, interview list, glossary, appendices, bibliography, and index. $18.95.

100 Years of Army-Navy Football: A Pictorial History of America's Most Colorful and Competitive Sports Rivalry, by Gene Schoor. Introduction by Brig. Gen. Pete Dawkins. Army-Navy is the one college football rivalry that generates wide interest outside the college world, probably because there are no NFL contracts waiting for a vast majority of the players and because the leaders on the gridiron become America's leaders on the battlefield. Army lost the first game, and the series today stands in Navy's favor. Rather than a game-by-game rundown, the book breaks the series down into "eras" and focuses on the dominant players (such as Army's "Doc" Blanchard and Glenn Davis and Navy's Roger Staubach) and coaches (such as Army's "Red" Blaik). Details about the players who went on to military fame, such as Omar Bradley, Dwight Eisenhower, and Richard E. Byrd, are also included. The appendix could be improved (such as by adding a lettermen's list and a single list of all the scores), but this is a very interesting book. Henry Holt and Company, New York, N. Y., 1989. 244 pages with photos and appendix. $24.95.

Rockwell International Space Shuttle, by Dennis R. Jenkins. This title in the Aerofax Datagraph series gives the pre-*Challenger*-accident history of the space shuttle fleet. Starting with the early work of Eugene Sänger—who proposed in 1929, in his doctoral thesis, a spacecraft that could make aircraft-like landings—the book traces the history of space shuttle development, from the early integral launch and reentry system designs, through the construction of the orbiters, and finally to approach and landing tests with the nonflightworthy orbiter *Enterprise.* A separate section gives details about the flights. A slightly bothersome characteristic of the text is that the author refers to many of the missions by the internal NASA notation, not always by the "outside" designation. Mission 51-L (the *Challenger* accident), for example, is referred to as STS-33, a number also given to the recent DoD mission. The final section details the orbiter's structures and equipment, a specialty of this series. Aerofax, Inc., Arlington, Tex., 1989. 72 pages with photos, diagrams, charts, and acronym list. $14.95.

Strike From the Sky: The History of Battlefield Air Attack, 1911–1945, by Richard P. Hallion. "Close air support" and "battlefield air interdiction" are not new concepts. As early as 1917, BAI played an important role in the collapse of Turkish forces in Palestine. Air attack against ground forces was a critical part of such interwar conflicts as the Spanish Civil War, and it was of decisive significance in World War II. This ground-attack mission led to the development of such aircraft as attack, dive, and medium bombers. But anti-aircraft guns and fighters rendered specialized attack planes vulnerable and hastened the development of flexible fighter-bombers such as the P-47, Typhoon, and FW-190G. Mr. Hallion uses case studies to illustrate the evolution of battlefield air attack. Doctrine, technology choices, military strategy, and lessons learned are also addressed. This is the first volume in the Smithsonian Studies in Aviation History series. Smithsonian Institution Press, Washington, D. C., 1989. 336 pages with photos, maps, charts, glossary, notes, bibliography, and index. $24.95.

AFA/AEF Report

After getting a close-up view of the legislative branch in action on a recent trip to Washington, D. C., members of the Connecticut State AFA delegation pause before the East Front of the US Capitol during their rounds of the halls of Congress. From left, former State President Brad Day, National Director Joe Falcone, Mrs. Dennis Therieault, Dennis Therieault, Mrs. Marshall Dunbar, John McGrath, Mrs. Brad Day, Ray Lupari, and State President Alton Hudson.

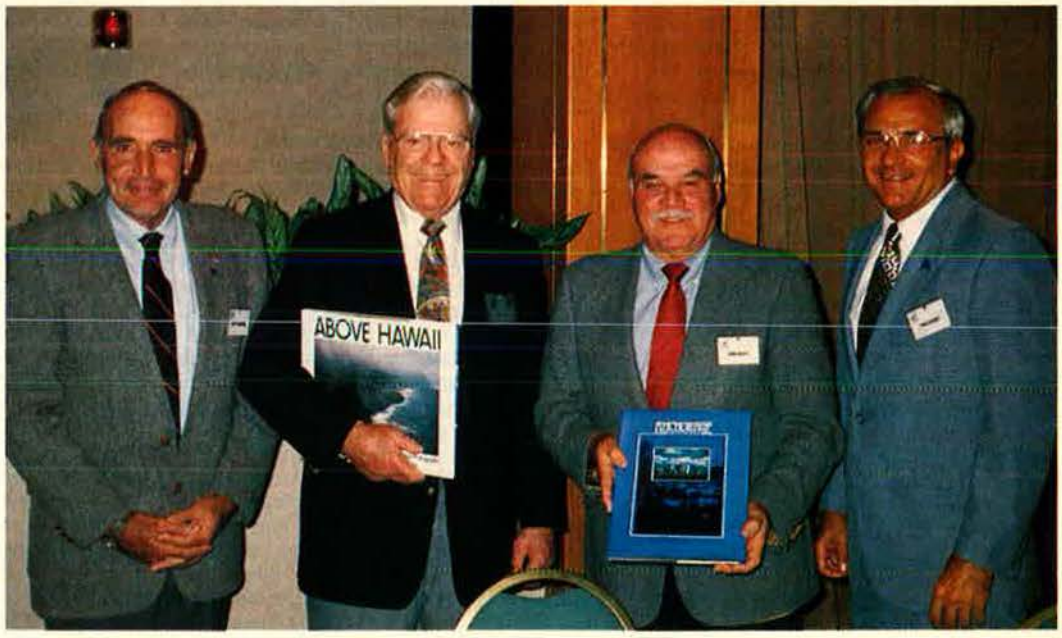
New Vice President

AFA National President Jack C. Price recently appointed Col. John A. Madden, Jr., USAF, as Vice President-Pacific. A Life Member of AFA, Colonel Madden serves as Vice Commander of PACAF's Thirteenth Air Force, Clark AB, the Philippines. His AFA role will be that of liaison between National Headquarters, the Pacific theater command elements, and the individual chapters at Clark AB and Manila in the Philippines and at Kadena, Misawa, and Yokota ABs in Japan.

Colonel Madden has had a distinguished career. A veteran of 254 combat missions, he is credited with downing three MiGs in Vietnam and holds many decorations, including the Silver Star with oak leaf cluster.

News from the Heartland

Congratulations to AFA's newest chapter, the Eastern Iowa Chapter, located in Cedar Rapids, Iowa. National Vice President (Midwest Region) Raymond Peterman was among the dignitaries to watch National President Jack C. Price install Louis M. Rapier as the Chapter's charter President, Ray D. Airy as Vice President, and



The last two states to enter the Union are separated by thousands of miles, but AFA officials from Alaska and Hawaii were able to get together for an exchange of ideas and gifts that made the distance seem smaller. From left, Hawaii State President Jack O'Donnell, Chairman of the Alaska area Bob Attwood, Chairman of the Hawaii area Don Daley, and Hawaii Chapter President Tom Keeney.

Stephanie D. Burkemper as Secretary-Treasurer. AFA's third chapter in Iowa begins its participation in the Association with a good starting base of some eighty members.

In neighboring Missouri, members from Iowa, Kansas, Missouri, and Nebraska gathered in Kansas City for the Midwest Regional Workshop. Mr. Peterman hosted the session, in which National Directors Don Adams, Charles Church, Earl Clark, James McCoy, and Mary Ann Seibel discussed membership, constitutions, budgets, organization, and member benefits with state and chapter officials from throughout the region.

Remembering Veterans

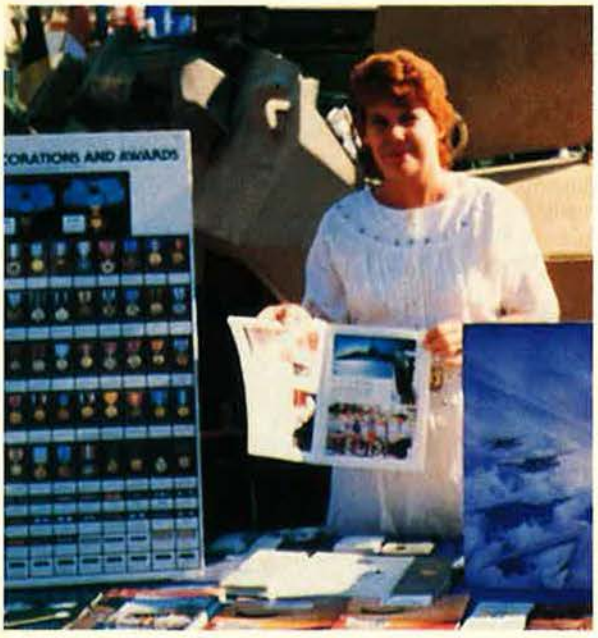
The Bernie V. Guthrie Squadron of the Arnold Air Society and the newly formed Silver Wings Society at South Dakota State University in Brookings, S. D., took on three projects last November to honor veterans, POWs, and MIAs. Besides preparing a display for the campus library and staffing a booth to distribute information and sell POW/MIA bracelets, members of the two societies conducted a vigil to promote POW/MIA awareness. A ceremonial cadet guard marched through the night, keeping white candles burning and maintaining a watch over the US and POW/MIA flags.

Both societies are located at AFROTC Det. 780 and were aided in their projects by the Cadet Corps of the Air Force and Army ROTC detachments at the University.

Chapter News

The **General Bruce K. Holloway (Tenn.) Chapter** held its quarterly luncheon meeting at Knoxville ANGB, located at McGhee Tyson airport. A crowd of more than 100 members and guests heard Gen. William C. Westmoreland, USA (Ret.), give a talk about experiences he had commanding US forces in Southeast Asia. He exhorted the crowd to honor those who participated in the War, especially the almost 60,000 who gave their lives. Famed sportscaster Lindsey Nelson (who served in Europe during World War II with the General), best-known as the voice of Notre Dame football and the New York Mets, was a surprise guest at the luncheon and congratulated General Westmoreland after his fine talk. Later that day, General Westmoreland addressed a group of 500 people who had gathered to see the Vietnam Moving Wall, which was on display in nearby Maryville, Tenn., under the sponsorship of the United Veterans of Blount County. Tennessee State President Leo Bolster hosted the General and Mrs. Westmoreland and participated in both events.

In an innovative effort that combined physical fitness and chapter promotion, the **Salt Lake (Utah) Chapter** sponsored a 5K (five kilometers, or about 3.1 miles) Fun Run/Walk. Working with USAF Morale, Welfare, and Recreation officials, Chapter President Pat R. Rathman and his fellow Chapter officials conducted a sanctioned fun run for about sixty Chapter members and ANG personnel in the Ogden, Utah, area. The first male finisher and the first female finisher each received a Chapter-sponsored AFA membership, and everyone who crossed the finish line got a bronze medal with a red, white, and blue ribbon. The Chapter's efforts were aided immensely by some local police officers who were also ANG



In a joint effort with the Air Force Recruiting Service, the General Doolittle/Los Angeles Area Chapter mounted an exhibit good enough to win the "Outstanding Military Display Award" at the Western States Guns and Militaria Show in Los Angeles. Here, Donna Zweifel, wife of Chapter Secretary-Treasurer Don Zweifel, tends the booth and shows some of the products that helped make the Chapter's educational and public-relations campaign a success.

members and who provided traffic control for the race at no cost to the Chapter. Chapter Vice President for Communications Robert Sorensen enthusiastically recommends that other chapters try this enjoyable, community-spirited method of fund-raising but cautions, "Tell your AFA story *before* the race."

The **Wright Memorial (Ohio) Chapter** honored its Community Partners during a quarterly program held at a reception in the recently expanded USAF Museum at Wright-Patterson AFB, Ohio. William Schaff (Chapter President at the time of the reception) was guest speaker at the large gathering, which helped foster good relations between AFA and its corporate sponsors in the Dayton area. State President Cecil Hopper also attended the event.

In other party news, a good crowd turned out for the **General E. W. Rawlings (Minn.) Chapter's** Annual Hangar Party at the Minnesota ANG Museum. During the festivities, Museum President Maj. Gen. Albert Schwab, ANG (Ret.), spoke about Museum programs and plans, and Chapter President Chuck Melby presented a check on behalf of AFA to the museum curator.

Many chapters have enthusiastically taken to the sport of golf as a way to simultaneously raise money and have some fun. This $1,000 check for scholarship donations, being presented by Ak-Sar-Ben Chapter President Jim McCoy (right) to Aerospace Education Foundation Chairman of the Board Jim Keck, is evidence of the fund-raising potential of the sport. This event drew nearly 100 golfers to the Willow Lakes Golf Course at Offutt AFB, Neb.

Lowry AFB, Colo., hosted a meeting of the **Mile High (Colo.) Chapter.** The Professional Military Education (PME) center was the site of the meeting, and afterwards a luncheon was held at the NCO Open Mess. National Vice President (Rocky Mountain Region) Jack Powell; Chapter President Bob Cardenas; Mitzie Martinez, Staff Assistant to Rep. Pat Schroeder (D-Colo.); Brig. Gen. Edwin Wittbrodt, USAF (Ret.); Col. Steven Hurwitz, Lowry AFB Deputy Commander for Resources; Col. Emilio Falcone, Lowry Center Chaplain; and representatives from ten Community Partners were among those who took an informative tour of the military education center. MSgt. B. B. Walls, Commandant of the PME center, briefed the tour group on the center's mission, which is to prepare selected NCOs for positions of responsibility by broadening their military, management, and leadership skills through on-base formal education.

Mile High Chapter officials took their act on the road later that same week, traveling westward to an Aerospace Education Workshop in Breckenridge, the county seat of Summit County, Colo. There they met with county educators and senior members of the Civil Air Patrol. The topics discussed included aerospace education, general aviation, military aviation, the US space program, the Federal Aviation Administration, airports, and aviation history. Several speakers with an abiding interest in the promotion of aerospace education addressed the workshop, including Frank G. Mitchell of Beech Aircraft, Wichita, Kan.; Lt. Col. Michael L. Connolly, USAF, Colorado Wing Liaison Officer, Lowry AFB, Colo.; Sharon Henry of the Denver public school system; Dr. Ben Millspaugh (winner of AEF's 1989 Christa McAuliffe Memorial Award for the year's outstanding math and science teacher) of the Littleton, Colo., public school system; Norm Avery of the City and County of Denver Airports; Dean Davis of Martin Marietta; Col. Howard J. Rice, CAP, Commander of USAF/CAP Rocky Mountain Liaison Region; and Phil Woodruff of the Federal Aviation Administration.

Have AFA News?

Contributions of AFA or AEF news should be sent to "AFA/AEF Report," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA. 22209-1198. ■

Coming Events

March 17–18, **Mississippi State Convention,** Columbus, Miss.; March 30–April 1, **Great Lakes Regional Workshop,** South Bend, Ind.; April 6–7, **South Carolina State Convention,** Charleston, S. C.; April 7, **Iron Gate Salute,** New York, N. Y.; May 11–13, **New York State Convention,** Rome, N. Y.; May 18–19, **Maryland State Convention,** Andrews AFB, Md.; May 18–20, **New Jersey State Convention,** Cape May, N. J.; May 26, **USAFA Outstanding Squadron Dinner,** USAF Academy, Colorado Springs, Colo.; June 2, **Alabama State Convention,** Huntsville, Ala.; June 2, **Massachusetts State Convention,** Worcester, Mass.; June 8–10, **Oregon State Convention,** Portland, Ore.; June 22–23, **Arkansas State Convention,** Hot Springs, Ark.; June 29–30, **Arizona State Convention,** Litchfield Park, Ariz.; July 6–7, **Ohio State Convention,** Dayton, Ohio; July 13–14, **Texas State Convention,** Fort Worth, Tex.; July 13–15, **Pennsylvania State Convention,** Philadelphia, Pa.; July 26–28, **California State Convention,** Los Angeles, Calif.; July 27–29, **Florida State Convention,** Tampa, Fla.; August 17–18, **Wisconsin State Convention,** Milwaukee, Wis.; August 18, **Mid-America Ball,** St. Louis, Mo.; August 18–19, **Illinois State Convention,** St. Louis, Mo.; August 24, **Utah State Convention,** Hill AFB, Utah; September 7–8, **Colorado State Convention,** Colorado Springs, Colo.; September 17–20, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.; October 13, **North Central Regional Workshop,** Bloomington, Minn.

Lt. Gen. Kenneth L. Tallman, USAF (Ret.), left, and Eric S. Doten, right, display their AFA National Exceptional Service Awards as Florida State AFA President Bill Bingham looks on. Mr. Bingham presented the awards during his recent visit to Embry-Riddle Aeronautical University in Daytona Beach, Fla. General Tallman, a former Superintendent of the Air Force Academy, is President of the University, while Mr. Doten serves as its Chancellor.

Bulletin Board

Seeking whereabouts of Air Force personnel who are graduates of **Brooklyn Tech. Contact:** BTHS Alumni Association, 29 Fort Greene Pl., Brooklyn, NY 11217.

Seeking information from anyone who knew **Harry E. Moore, Jr.,** who was with the 571st Service Squadron in Cairo, Egypt, during World War II. Also interested in whether there is a squadron or group association for his unit. **Contact:** Harry E. Moore III, 68-262 Via Domingo, Desert Hot Springs, CA 92240.

Seeking the recollections of all who saw, met, or were cared for by **"Col. Maggie" (Martha Raye)** during World War II, the Korean War, or the Vietnam War. **Contact:** Noonie Fortin or Belle Pellegrino, 1 Midway Dr., Albany, NY 12205.

Copies of "Windsock" are available for members of **Class 42-I,** Lindbergh Field, Calif., and **Class 43-C,** Ryan School of Aeronautics, Tucson, Ariz. **Contact:** Lt. Col. Norman F. Reed, USAF (Ret.), Box 78, Port Medway, Queensland, Nova Scotia, Canada B0J-2TO.

For a book on the subject, I am researching what constitutes a good **résumé for retired officers** and NCOs. Seeking the résumé that secured your first civilian job. **Contact:** Capt. James P. Aiello, Box 287, APO New York, NY 09173.

Seeking the whereabouts of **A1C James R. Weldon,** who was with the 6th Aircraft Maintenance Squadron at Walker AFB, N. M., in 1943 or 1944. **Contact:** Ed and Sue McCarthy, 3 Station Rd., Ford, Arundel, West Sussex BN18 0BJ, England.

Seeking **Delbert T. Been,** of Fort Smith, Ark., who was a pilot with the 791st Bomb Squadron, 467th Bomb Group, based at Rackheath, England, during World War II. **Contact:** Arthur L. Prichard, 383 4th Ave., Holland, MI 49424.

Collector seeks to trade USAF **patches** with other collectors. **Contact:** SSgt. Herbert J. Weaver, 438 Montana St., George AFB, CA 92394.

Seeking information on the significance of World War II issued **"Short Snorter"** one dollar US silver certificate. Contact: Arthur F. Reibe, Jr., 2111 Metairie Heights, Metairie, LA 70001.

Beginning collector seeks military and security police **patches,** especially from the Air Force Intelligence Service, Air Force Office of Security Police, and Air Force Office of Special Investigations. **Contact:** Eric Hamilton, 265 W. Moultrie, Bement, IL 61813.

Seeking the whereabouts of **Maj. Albert Dietz,** who was in the Naval Air Reserve and then USAF during the 1950s, and whose last known address was in Texas. **Contact:** TSgt. Jacob G. Babenko, Box 239, Turbotville, PA 17772-0239.

Seeking any and all **patches** related to past and present F-111s (all models), squadrons, wings, deployments, test programs, and comic items. **Contact:** Robert E. Styger, 15 Genesee Lane, Willingboro, NJ 08046.

Seeking the whereabouts of **George and Sarah Dixon,** who were at RAF High Wycombe, England, about twenty-five years ago. They also lived in Haslemere for a time. **Contact:** Teresa (Stallwood) Webb, 28 Yarlington Mill, Belmont, Hereford., England.

Seeking contact with members of the **Air Force Postal and Courier Association** who served with 6005th, 7025th, Squadrons 1 through 12, Courier Transfer Stations, and USAFPCS. **Contact:** Jim Foshee, 3509 Deer Trail, Temple, TX 76504.

Seeking the whereabouts of members of Mather Field Aviation Cadet **Class (Pilot) 43-A-1. Contact:** Lt. Col. Wallace E. Linn, Jr., USAF (Ret.), 8622 Starcrest Dr., #P-3, San Antonio, TX 78217.

Seeking the whereabouts of **TSgt. Calvin J. Graham,** who served at what is now Selfridge ANGB, Mich., and in India during World War II. He was born in Binghamton, N. Y., and his last known address was in Georgia. **Contact:** Lt. Col. Charles M. Norcutt, USAF (Ret.), 934 E. Elmwood Ave., Burbank, CA 91501.

Seeking the whereabouts of **SSgt. John "Big Jay" McClain,** a photographer who was stationed at Evreux AB, France, from 1955 to 1957. **Contact:** Frank Mebane, P. O. Box 51, Victorville, CA 92393.

Seeking information on **Capt. Riggs Mellen,** who flew with the 838th Squadron, 487th Bomb Group, 8th Air Force. His last known address was in the Monterey or Carmel, Calif., area. **Contact:** Harold E. Owens, 1302 Shadeland Rd., Lafayette, IN 47905.

Seeking information on **Morris Dodson,** who served in Korea and was killed in an accident at a railroad crossing in Clovis, N. M., in 1953 while stationed at Cannon AFB. **Contact:** David M. Carpenter, 6514 Jean Dr., Raleigh, NC 27612.

The Southwest Aerospace Museum seeks photos, documents, and recollections from crew chiefs or pilots of a North American **F-86L, serial number 51-6091.** This plane served with the 85th FIS, 3625th CCTW, and 3555th CCTW before being retired. It is now mounted on a pylon at Perrin AFB, Tex. **Contact:** Steve Tobey, Southwest Aerospace Museum, P. O. Box 5462, Fort Worth, TX 76108.

If you need information on an individual, unit, or aircraft, or if you want to collect, donate, or trade USAF-related items, write to "Bulletin Board," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA. 22209-1198. Letters should be brief and typewritten. We cannot acknowledge receipt of letters to "Bulletin Board." We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Photographs cannot be used or returned.—THE EDITORS

Seeking information on **2d Lt. Richard C. Henry,** an F-84 fighter pilot assigned to the 53d FBS at Fürstenfeldbruch, Germany. He was killed on November 2, 1952, shortly after completing a 100-mission tour in F-80s in Korea. **Contact:** Col. David M. Williams, USAF (Ret.), 5312 Alta Bahia Ct., San Diego, CA 92109.

Seeking the whereabouts of **1st Lt. Tony Frazier** of Charlotte, N. C. His last known address was at Tan Son Nhut AFB, Vietnam, in 1969. **Contact:** Eddie Cosper, Box 190-A, Rte. 3, Rincon, GA 31326.

Seeking the whereabouts of the following people who were in the Accounting & Finance Office at Ramstein AB, Germany, between 1976 and 1979: **Capt. James Koehler, MSgt. John Horn,** and **MSgt. Gary Cabana. Contact:** Daniel L. Miley, 332 Sugartown Rd., Apt. B-49, Devon, PA 19333.

Seeking the whereabouts of **Capt. Robert L. Spaulding, Jr.,** of Eagle Rock, Calif., who was a former B-29 commander and a member of the 39th Bomb Group, 20th Air Force, stationed on Guam during World War II. **Contact:** Robert E. Laird, Box 4836, RR3, Chasanna Dr., Rutland, VT 05701.

Seeking Air Force witnesses or US Navy crash survivors who can confirm that Maj. J. Bruce Bradley was directly involved in the rescue of survivors of the **crash of US Navy EC-121M, PR-26** behind the 366th TFW Command Post on March 16, 1970. **Contact:** Col. Curtis D. Westphal, USAF (Ret.), 4500 Malaga Dr., Austin, TX 78759.

Information on anyone who was stationed in the **Cairns-Mareeba-Atherton area** in North Queensland, Australia, in 1942 and stayed at the Imperial Hotel in Cairns during their leave. **Contact:** Ann Suranyi, 2 Dougan St., Ashfield 2131, Australia.

Seeking information from and contact with anybody serving with the **535th Squadron,** 321st Bomb Group, 8th Air Force, based in England in December 1942. **Contact:** Irl R. Mitchell, 1205 Woodrow, Wichita, KS 67203.

For a display at the fiftieth anniversary celebration of **Westover Field/Westover AFB, Mass.,** July 27–29, 1990, seeking memorabilia pertaining to the base and the units assigned there. **Contact:** CMSgt. Robert C. Adams III, AFRES, 42d APS, Westover AFB, MA 01022.

Seeking old, unbuilt, plastic **model kits** of military aircraft, missiles, and spacecraft. Also manufacturers' display desk models of aircraft, missiles, and spacecraft. **Contact:** Joseph Dodyk, 29144 Cambridge, Flat Rock, MI 48134.

Seeking firsthand information and details of the accidental **bombing of Boise City, Okla., on July 5, 1943,** during B-17 bombardment training conducted by the 333d Bomb Group of the 46th Bombardment Operational Training Wing, operating out of Dalhart, Tex. **Contact:** Stanley Ed Manske, Director, Boise City Chamber of Commerce, Box 128, Boise City, OK 73933.

Seeking information on the whereabouts of members of Laughlin AFB UPT **Class 69-07** for purposes of completing and distributing class update. **Contact:** Jerry E. Tobias, 2104 Morrie Dr., Omaha, NE 68123.

Seeking information on my brother **(son of Elfriede Willmann Metzger)** who was **adopted by an Air Force officer** (possibly a colonel), who may have been named "Pierce," in or about 1955, from a Catholic orphanage near Stuttgart, Germany. **Contact:** Carl T. Sickman, 2105 128th St. East, Tacoma, WA 98445.

Seeking the whereabouts of **Lt. Col. Michael Joe (Micki) Griffin,** whose last known (1987) address was near Provo, Utah. **Contact:** William I. Parker, 7009 Amberly Way, Memphis, TN 38018.

Seeking contact with anyone who knew or served with **Louis J. Winiecki, Jr.** during World War II. He was in the 498th Bomb Squadron, 345th Bomb Group (M), and was from the Alden or Lancaster, N. Y., area. **Contact:** Richard Winiecki, 3730 S. Mill Ave., Apt. K-204, Tempe, AZ 85282.

Seeking the whereabouts of any and all Civil Air Patrol pilots or ground crew members who were in the **Southern Liaison Patrol** during World War II. **Contact:** Maj. Joe R. Myers, CAP, 4123 Hastings, El Paso, TX 79903.

Seeking the whereabouts of the following members of Kelly Field Aviation **Class 42-H:** Earl W. Callaway, Robert D. Campbell, Albert B. Connelly, Richard L. David, and Elmo L. Dickerson. **Contact:** Allan F. Beck, 4905 Casa del Oso NE, Albuquerque, NM 87111.

Seeking the whereabouts of **Capt. Wiley B. McKee,** who was an instructor pilot at Reese AFB, Tex., in 1955. **Contact:** Robert H. Barnes, 35 Golden Ave., Apt. 22A, Battle Creek, MI 49015.

Seeking contact with pilots and ground personnel who participated in the **Alaska-Siberia route to deliver lend-lease aircraft** to the Soviet Union between 1942 and 1945, for a book on the subject. **Contact:** James L. Barnett, 914th Tactical Airlift Group Retirees Activities Office, Niagara Falls IAP, NY 14304-5000.

Seeking the whereabouts of **SSgt. Bryant Gifford "B. G." Davis,** who served at West Ruislip AB, England, between 1966 and 1970. **Contact:** Dennis Wyle, 6 Midhurst Gardens, Hillingdon, Middlesex UB10 9DL, England.

The International B-24 Memorial Museum welcomes the donation of **World War II artifacts. Contact:** Lt. Col. William Feder, Sr., CAP (Ret.), Director, International B-24 Memorial Museum, Pueblo Memorial Airport, 31301 Aldred Rd., Pueblo, CO 81006.

Seeking to purchase a **duplicate class ring** for the November 1942 class of the Air Navigation School at Mather Field, Calif. **Contact:** M. O'Brien, P. O. Box 492, Grand Island, FL 32735.

Seeking the whereabouts of these members of 355th Bomb Squadron (VH), 331st Bomb Group (VH), who served at Northwest Field, Guam, in

1945: **Peter S. Carbone,** flight engineer on *Slicker 4,* and **Frank P. Gennarelli. Contact:** Clarence M. Juett, 3057 Page St., Redwood City, CA 94063.

Seeking information, photos, videos, books, on the **C-124** aircraft and its missions. **Contact:** Lt. Col. H. J. "Pete" Birkhofer, USAF (Ret.), 1463 Front Nine Dr., Fort Collins, CO 80525.

Unit Reunions

Air Commandos
Air Commandos of World War II (2d and 3d Air Commando Groups) will hold a reunion October 11–14, 1990, in Fort Walton Beach, Fla. **Contact:** W. Robert Eason, Rte. 1, Box 28, Orange, VA 22960. Phone: (703) 672-4074.

Air Force Photo Mapping
The Air Force Photo Mapping Association will hold a reunion September 27–30, 1990, at the Palms Hotel, in West Palm Beach, Fla. **Contact:** Richard "Dick" Hinz, 7103 S. Flagler Dr., West Palm Beach, FL 33405. Phone: (407) 586-0926.

Air Weather Recon Squadrons
The 53d, 54th, and 55th Air Weather Reconnaissance Squadrons will hold a reunion September 13–16, 1990, in Fort Walton Beach, Fla. **Contact:** Lt. Col. Ralph R. Ruyle, USAF (Ret.), Box 527, Rte. 6, Crestview, FL 32536. Phone: (904) 689-1244.

American Guerrillas of Mindanao (AGOM)
Members of the American Guerrillas of Mindanao (AGOM) will hold a reunion June 14–17, 1990, at the LeBaron Hotel in San Jose, Calif. **Contact:** Lt. Col. Gerald S. Chapman, USAF (Ret.), 13822 Via Alto Ct., Saratoga, CA 95070. Phone: (408) 379-6558.

Gitmo/Bay of Pigs
Veterans who served during the Bay of Pigs invasion in Guantánamo Bay are planning to hold a reunion October 4–7, 1990, in Norfolk, Va. **Contact:** Ted Dey, P. O. Box 11327, Norfolk, VA 23517.

Pilgrimage to Italy
Fifteenth Air Force veterans and friends will visit former US air bases and other memorable wartime areas in Italy in mid-September 1990. **Contact:** Alex Boggio, P. O. Box 357, South Pasadena, CA 91030.

Society of Retired Air Force Nurses
Retired Air Force Nurses will hold a reunion May 18–20, 1990, in Sacramento, Calif. **Contact:** Rita Whitley, 9371 Blue Oak Dr., Orangevale, CA 95662.

Stearman Fly-In
The Northeast Stearman Association will hold its annual fly-in on July 13–15, 1990, at the Simsbury Airport (4B9) in Simsbury, Conn. **Contact:** Northeast Stearman Association, P. O. Box 44, West Simsbury, CT 06092. Phone: (203) 379-0901 (Bev Hasselmark) or (203) 658-2552 (Ursula Korsen).

USAF Helicopter Pilots
USAF Helicopter Pilots will hold a reunion October 11–13, 1990, in Fort Walton Beach, Fla. **Contact:** USAF Helicopter Pilots Association, P. O. Box 821, Shalimar, FL 32579. Phone: (904) 862-4425 (Robert Mayo).

1st Fighter Group
Members of the 1st Fighter Group will hold a reunion September 25–28, 1990, in Las Vegas, Nev. **Contact:** Harry E. McConnell, 600 Sherry Dr. N., Trotwood, OH 45426.

2d Bomb Group
Members of the 2d Bomb Group who were stationed at Hunter AFB, Ga., between 1950 and 1960 will hold a reunion May 10–13, 1990, in Savannah, Ga. **Contact:** Col. John B. Connor, USAF (Ret.), 9 Priber Lane, Savannah, GA 31411. Phone: (912) 598-1414.

8th Service Group
Members of the 8th Service Group, the 11th and 482d Service Squadrons, and Headquarters Squadron (World War II) will hold a reunion September 14–16, 1990, in Lancaster, Pa. **Contact:** John J. "Jack" Heckler, 76 E. Harbor Dr., Teaticket, MA 02536. Phone: (508) 540-1303.

14th Fighter Group
The 14th Fighter Group "Fork-Tailed Devil" (all squadrons) will hold a reunion October 7–9, 1990, in Dayton, Ohio. **Contact:** Burt Cox, 3640 Kelso Rd., North Adams, MI 49262. Phone: (517) 287-4289.

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.

27th Air Transport Group
Members of the 27th Air Transport Group, along with the 310th, 311th, and 312th Ferrying Squadrons, will hold a reunion September 19–21, 1990, at the Sidney James Motor Lodge in Gatlinburg, Tenn. **Contact:** Rocco G. Bravo, 2712 N. W. 64th St., Oklahoma City, OK 73116. Phone: (405) 843-4480.

29th Fighter-Interceptor Squadron
The 29th Fighter-Interceptor Squadron will hold a reunion July 27–29, 1990, at Malmstrom AFB, Mont. **Contact:** John Baczynski, 4 Romero Ct., Novato, CA 94945. Phone: (415) 897-2419.

39th Bomb Group
Members of the 39th Bomb Group who served on Guam during World War II will hold a reunion August 16–19, 1990, in Omaha, Neb. **Contacts:** James W. Wyckoff, 2714 E. Hayts Corners Rd., Ovid, NY 14521. Phone: (607) 869-2574. Robert E. Weiler, 3360 S. Osprey Ave., #101B, Sarasota, FL 34239. Phone: (813) 954-2118.

Class 42-D
Members of Class 42-D will hold a reunion April 27–29, 1990, at the Rio Bravo Resort in Bakersfield, Calif. **Contact:** Rufus E. Cook, 600 Davies Ct., Bakersfield, CA 93309. Phone: (805) 322-6990.

47th Bomb Squadron
The 47th Bomb Squadron, 41st Bomb Group, 7th Air Force, will hold a reunion in October 1990. **Contact:** John Mahan, P. O. Box 232, Hinsdale, NH 03451. Phone: (603) 336-7457.

P-47 Thunderbolt Pilots
P-47 Thunderbolt Pilots will hold their reunion May 11–13, 1990, at the Omni International Hotel in Norfolk, Va. **Contact:** Bob Richards, P. O. Box 3299, Topsail Beach, NC 28445. Phone: (919) 328-8781.

49th Fighter Group
Members of the 49th Fighter Group, which included the 7th, 8th, and 9th Fighter Control Squadrons of World War II, Korea, and Vietnam, will hold a reunion May 25–28, 1990, at Holloman AFB, N. M. **Contact:** John Roth, 1017 Adams S. E., Albuquerque, NM 87108. Phone: (505) 268-2903.

51st Fighter Group
Members of the 51st Fighter Group (1941–45), which included the 16th, 25th, 26th, and 449th Headquarters Squadrons, will hold a reunion September 20–22, 1990, in Rapid City, S. D. **Contact:** Robert G. Haines, 1720 13th Ave., Belle Fourche, SD 57717.

Class 55V
Class 55V (Hondo/Reese) will hold a reunion in September 1990. **Contact:** Jerry Davenport, 65 Gold Coin Ct., Colorado Springs, CO 80919. Phone: (719) 599-0441.

Class 60-F
Members of Class 60-F will hold a reunion March 16–18, 1990, in the Dallas-Fort Worth, Tex., area. **Contact:** Martin V. Case, Jr., 1306 Shady Creek Dr., Euless, TX 76040. Phone: (817) 267-0465.

63d Station Complement Squadron
The 63d Station Complement Squadron, 9th Air Force (World War II), will hold a reunion June 1–3, 1990, in New Braunfels, Tex. **Contact:** Joe H. Isbell, 475 Comal, New Braunfels, TX 78130. Phone: (512) 625-6020.

68th Fighter Squadron
The 68th Fighter Squadron will hold a fiftieth anniversary reunion September 14–16, 1990, at the Embassy Suites Hotel in Colorado Springs, Colo. **Contact:** Col. William S. Turner, USAF (Ret.), 7 Raven Hills Ct., Colorado Springs, CO 80919. Phone: (719) 598-4225.

72d Observation Group
Members of the 72d Observation Group (Panama), all squadrons, will hold a reunion October 18–21, 1990, in Fort Worth, Tex. **Contact:** Nester Cole, 2732 Warwick Dr., Bloomfield Hills, MI 48013. Phone: (313) 338-1551.

74th Tactical Reconnaissance Group
The 74th Tactical Reconnaissance Group (World War II) will hold a reunion October 18–20, 1990, at the Sheraton Old Town Hotel in Albuquerque, N. M. **Contact:** Phillip G. Cook, 7772 Vale Dr., Whittier, CA 90602. Phone: (213) 693-4035.

80th Fighter Group
Members of the 80th Fighter Group (World War II) will hold a reunion in September 1990, in Washington, D. C. **Contact:** Gale H. Lyon, 19323 Keep Tryst Rd., Knoxville, MD 21758. Phone: (301) 834-8126.

81st/82d Troop Carrier Squadrons
Members of the 81st and 82d Troop Carrier Squadrons, 436th Troop Carrier Group, will hold a reunion September 4–6, 1990, in Dayton, Ohio. **Contacts:** T. W. Bonecutter, 620 Randolph St., Wilmington, OH 45177. Phone: (513) 382-4351. R. J. Franklin, 1049 Keyes Ave., Schenectady, NY 12309. Phone: (518) 377-7938.

84th ATS/MAS Squadron
The 84th ATS/MAS Squadron will hold a reunion April 28–29, 1990, at the Holiday Inn in Fairfield, Calif. **Contact:** William B. Oakes, 261 Peachtree St., Vacaville, CA 95688. Phone: (707) 448-3924.

86th/72d Air Service Squadrons
Members of the 86th and 72d Air Service Squadrons, 52d Air Service Group, will hold a reunion September 14–16, 1990, at the Buffalo Mountain Resort in Johnson City, Tenn. **Contact:** John Hillenbrand, 4 Avondale Circle, Johnson City, TN 37604. Phone: (615) 282-5108.

95th Bomb Group
Members of the 95th Bomb Group (World War II) will hold a reunion October 14–21, 1990, in Fort Lauderdale, Fla. **Contact:** David D. Dorsey, 125 Clark St., Clarks Green, PA 18411. Phone: (717) 587-2290.

99th Bomb Group
The 99th Bomb Group will hold a reunion in April 1990 in Huntsville, Ala. **Contact:** H. E. Christiansen, 4520 Panorama Dr., Huntsville, AL 35801. Phone: (205) 534-8646.

306th Bomb Group
The 306th Bomb Group, 8th Air Force (1942–45), will hold a reunion September 6–9, 1990, at the Marriott Riverwalk Hotel in San Antonio, Tex. **Contact:** C. Dale Briscoe, 7829 Timber Top Dr., Boerne, TX 78006. Phone: (512) 755-2321.

308th Airdrome Squadron
Members of the 308th Airdrome Squadron (World War II) will hold a reunion June 7–10, 1990, in Dayton, Ohio. **Contact:** Dick Whitney, 27 Morningside Dr., Shelby, OH 44875. Phone: (419) 347-2347.

309th Troop Carrier Group
The 309th Troop Carrier Group and the 16th Troop Carrier Squadron (1950–60) will hold a reunion October 19–21, 1990, in Satellite Beach, Fla. **Contact:** William T. DeJarnette, 427 St. Georges Ct., Satellite Beach, FL 32937. Phone: (407) 777-2764.

312th Bomb Group
The 312th Bomb Group will hold its annual reunion September 20–23, 1990, at the Holiday Inn North in Dayton, Ohio. **Contact:** Paul M. Stickel, 1136 Gray Ave., Greenville, OH 45331. Phone: (513) 548-5767.

315th/943d MAW
Members of the 315th and 943d Military Airlift Wings (Associate) will celebrate their twentieth anniversary reunion March 20, 1990, at the Marriott Hotel in Charleston, S. C. **Contact:** Capt. Christopher B. King, AFRES, Hq. 315th Military Airlift Wing (Associate), Charleston AFB, SC 29404-6004. Phone: (803) 566-2034 or (803) 566-3338.

315th Troop Carrier Group
Members of the 315th Troop Carrier Group, which included the 34th, 43d, 309th, and 310th Troop Carrier Squadrons, Headquarters Group, and all support units, will hold a reunion September 27–30, 1990, at the Omni International Hotel in Norfolk, Va. **Contact:** Robert L. Cloer, 1417 Valley View Dr., Yuba City, CA 95993. Phone: (916) 674-3681.

322d Bomb Group
The 322d Bomb Group, 449th, 450th, 451st, and 452d Bomb Squadrons, will hold a reunion August 22–26, 1990, at the Red Lion Inn in Colorado

Springs, Colo. **Contact:** Joseph H. Hayes, 177 Glenview Dr., New Kensington, PA 15068. Phone: (412) 337-3186.

330th Bomb Group
Members of the 330th Bomb Group will hold a reunion April 5–8, 1990, at the Fountain Plaza Hotel in San Antonio, Tex. **Contact:** Robert C. Flischel, 725 Fairview Dr., Carlisle, OH 45005.

330th Bomb Squadron
The 330th Bomb Squadron, 93d Bomb Wing, will hold a reunion June 15–17, 1990, at Castle AFB, Calif. **Contact:** Mike Bogna, 525 Baker Ct., Atwater, CA 95301. Phone: (209) 358-1051.

366th Fighter Group
Members of the 366th Fighter Group, which included the 389th, 390th, and 391st Fighter Squadrons, are planning to hold a reunion in late September 1990 in Dayton, Ohio. **Contact:** Harry C. Hayes, 125 West St., P. O. Box 183, Black River, NY 13612.

398th Bomb Group
The 398th Bomb Group (World War II) will hold a reunion September 12–15, 1990, in Oshkosh, Wis. **Contact:** George R. Hilliard, 7841 Quartermaine Ave., Cincinnati, OH 45236.

401st Bomb Group
Members of the 401st Bomb Group, 8th Air Force (World War II), will hold a reunion September 19–22, 1990, in Portland, Ore. **Contact:** Ralph "Rainbow" Trout, P. O. Box 22044, Tampa, FL 33622.

454th Bomb Group
The 454th Bomb Group (World War II, Italy) will hold a reunion October 4–8, 1990, in Nashville, Tenn. **Contact:** 454th Bomb Group Association, P. O. Box 678, Wheat Ridge, CO 80034.

459th Bomb Group
Members of the 459th Bomb Group will hold a reunion September 6–9, 1990, at the Marriott Airport Hotel in San Francisco, Calif. **Contact:** Lyle McCarty, 19235 Harleigh Dr., Saratoga, CA 95070. Phone: (408) 867-3160.

461st Bomb Group
The 461st Bomb Group (1943–45) will hold a reunion October 3–7, 1990, at the Double Tree Hotel in Tucson, Ariz. **Contact:** Frank C. O'Bannon, P. O. Box 36600, Tucson, AZ 85470. Phone: (602) 797-1439.

461st/484th Bomb Groups
Members of the 461st and 484th Bomb Groups (World War II) will hold a reunion October 12–15, 1990, at the Marriott Hotel in Nashville, Tenn. **Contact:** Bud Markel, 1122 Ysabel St., Redondo Beach, CA 90277. Phone: (213) 316-3330.

485th Bomb Group
The 485th Bomb Group will hold a reunion September 5–9, 1990, at the Stouffer Dayton Plaza Hotel in Dayton, Ohio. **Contact:** Robert S. Deeds, 4643 286th St., Toledo, OH 43611. Phone: (419) 726-0650.

485th Tactical Missile Wing
Members of the 485th Tactical Missile Wing are planning to hold reunions in two locations (CONUS and Europe), and they need some organizational people who would serve as contacts. The events are scheduled for July 20, 1990, at the Offutt AFB, Neb., Officers' Club, and July 20–22, 1990, at Florennes AB, Belgium. **Contacts:** Maj. Tom Deppe, % CONUS Reunion, 2505 Cornelia St., Omaha, NE 68147. SMSgt. Dave Ponds, % European Reunion, Box 1592, APO New York 09123.

488th Bomb Squadron
The 488th Bomb Squadron (World War II) will hold a reunion September 26–30, 1990, at the Westward Look Resort in Tucson, Ariz. **Contact:** Col. W. W. Johnston, USAF (Ret.), 1762 Camino Crocta, Tucson, AZ 85718. Phone: (602) 299 1974.

530th Fighter Squadron
Members of the 530th Fighter Squadron will hold a reunion April 27–29, 1990, in Mount Pleasant, S. C. **Contact:** F. H. Wilbourne, 4118 Keagy Rd., Salem, VA 24153. Phone: (703) 387-0562.

782d Bomb Squadron
Members of the 782d Bomb Squadron, 465th Bomb Group, 55th Bomb Wing, 15th Air Force, stationed in Pantanella, Italy, between 1943 and 1945 will hold a reunion September 27–29, 1990, in Orlando, Fla. **Contact:** William F. Bruce, Jr., 1683 Eggert Rd., Buffalo, NY 14226. Phone: (716) 834-8144.

801st/492d Bomb Groups
Members of the 801st and 492d Bomb Groups "Carpetbaggers" who served in Alconbury, Watton, and Harrington, England (1943–45), will hold a reunion September 20–22, 1990, in Memphis, Tenn. **Contacts:** John P. Walker, 2355 Penbrook Pl., Cordova, TN 38018. Phone: (901) 388-8003. Sebastian H. Corriere, 4939 N. 89th St., Milwaukee, WI 53225. Phone: (414) 464-8264.

820th Bomb Squadron
The 820th Bomb Squadron, 41st Bomb Group, 7th Air Force (World War II), will hold a reunion May 3–6, 1990, at the Arlington Hotel in Hot Springs, Ark. **Contact:** William W. Childs, 3637 Patsy Ann Dr., Richmond, VA 23234. Phone: (804) 275-6012.

42d Bomb Group
Seeking members of the 42d Bomb Group who served in World War II who are interested in holding a reunion. **Contact:** Harry E. Goldsworthy, 2040 Parkwood Circle S., Spokane, WA 99223.

43d Weather Wing
I would like to hear from members of the 43d Weather Wing who served in Tokyo and would be interested in holding a reunion. **Contact:** Norman C. Gibbons, P. O. Box 396, Purdy, MO 65734.

61st Troop Carrier Squadron
I am looking for former members from the 61st Troop Carrier Squadron, 314th Troop Carrier Group (World War II), for a reunion planned for the fall of 1990 in Indianapolis, Ind. **Contact:** Lew Johnston, 2665 Chestnut St., San Francisco, CA 94123. Phone: (415) 567-4717.

71st Troop Carrier Squadron
For the purpose of planning a reunion, I would like to hear from members of the 71st Troop Carrier Squadron, 434th Troop Carrier Group, who served in Aldermaston, England, between 1943 and 1945. **Contact:** Rupert D. Gamble, 5625 Dominica, Corpus Christi, TX 78411. Phone: (512) 853-6303.

155th Photo Recon Squadron
For the purpose of organizing a reunion, I would like to hear from members of the 155th Photo Reconnaissance Squadron (night) who served in World War II (ETO). **Contact:** John P. Stephens, 3855 River Rd., Moss Point, MS 39563.

505th/5th Troop Carrier Groups
For the purpose of organizing a reunion this summer, I would like to hear from former members of the 619th Troop Carrier Squadron, 5th Troop Carrier Group, and the 505th Troop Carrier Group or any detachment that served in Vietnam or Thailand. **Contact:** MSgt. John C. Boydston, USAF (Ret.), 10622 Bryant St., Space 104, Yucaipa, CA 92399-3047. Phone: (714) 797-7394.

Bob Stevens'

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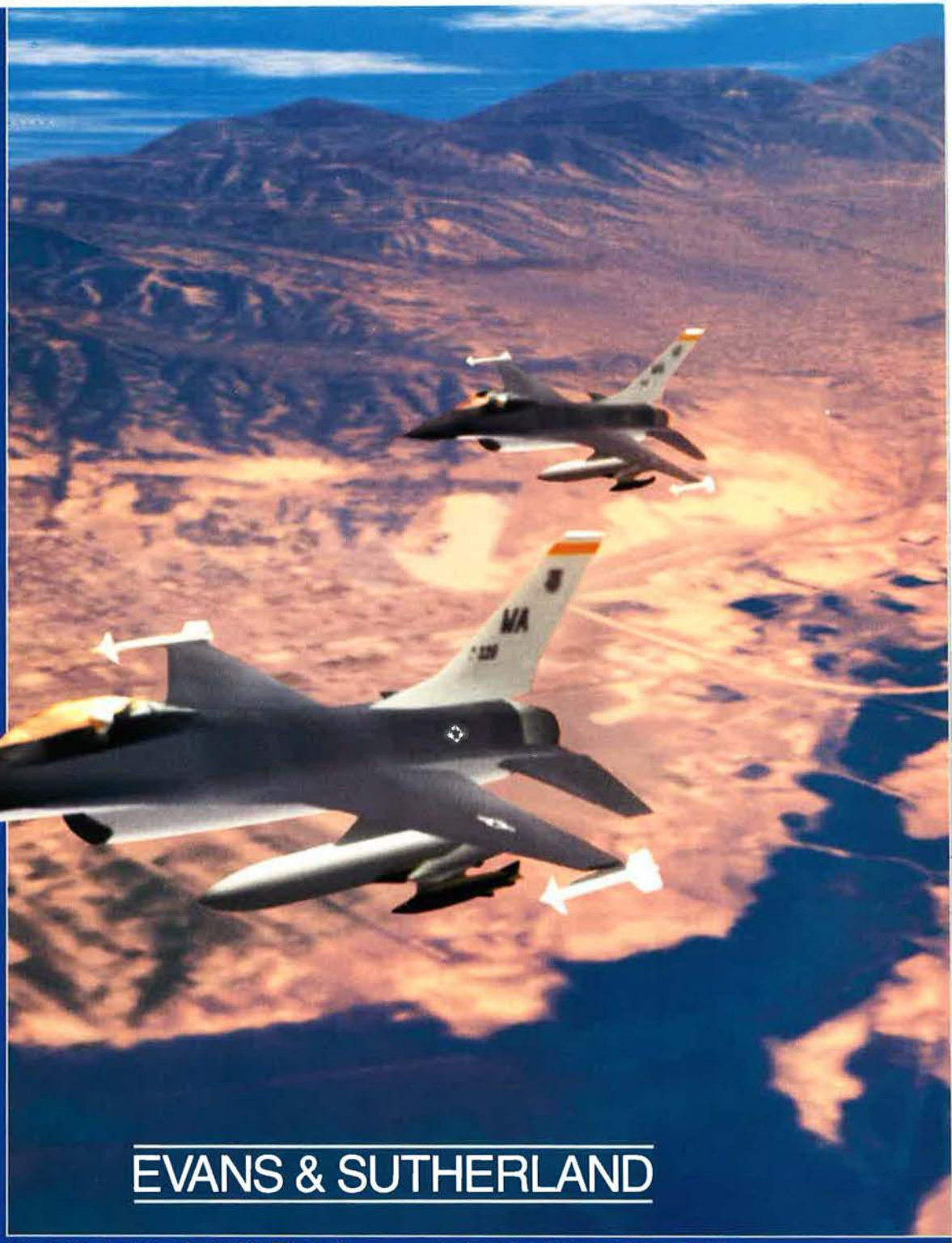

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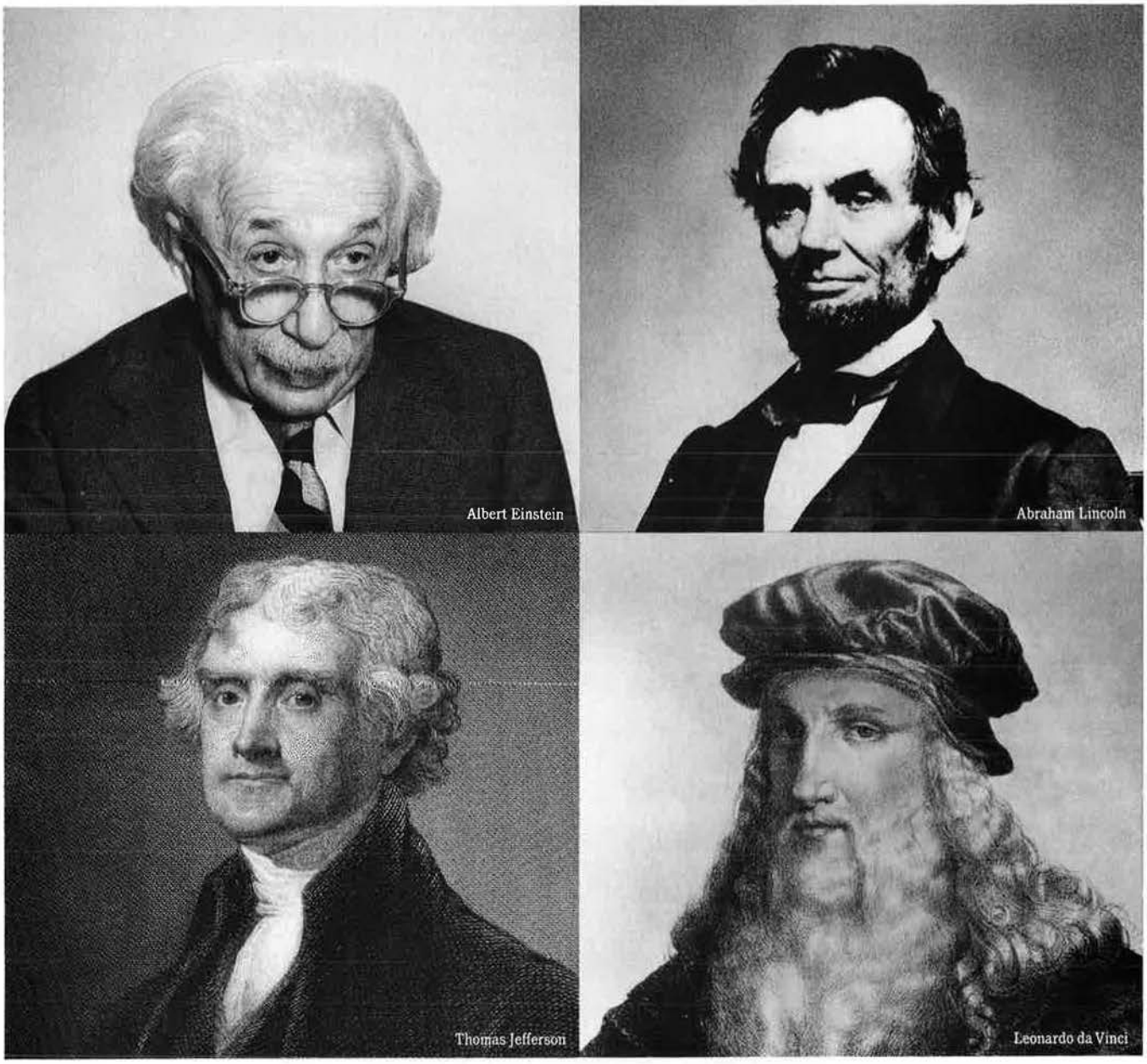

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