MARCH 1989/$5

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

SOVIET AEROSPACE ALMANAC

CAN WE PROTECT OUR PILOTS FROM DATA BOMBARDMENT?

Massive amounts of information, when processed and prioritized, give us the advantage against powerful adversaries in high threat combat environments.

In Northrop's Crew Systems Integration Laboratory, engineers of various disciplines are applying emerging technologies to perfect the Pilot-Vehicle Interface. Creating systems that improve the flight crew's ability to make the right choices, instantly.

Each new design is analyzed in a realistic, computer-driven reconfigurable cockpit. This powerful tool emulates control, display, and operational logic applicable to advanced aircraft. Reducing the time to design and build a display format from hours to only minutes.

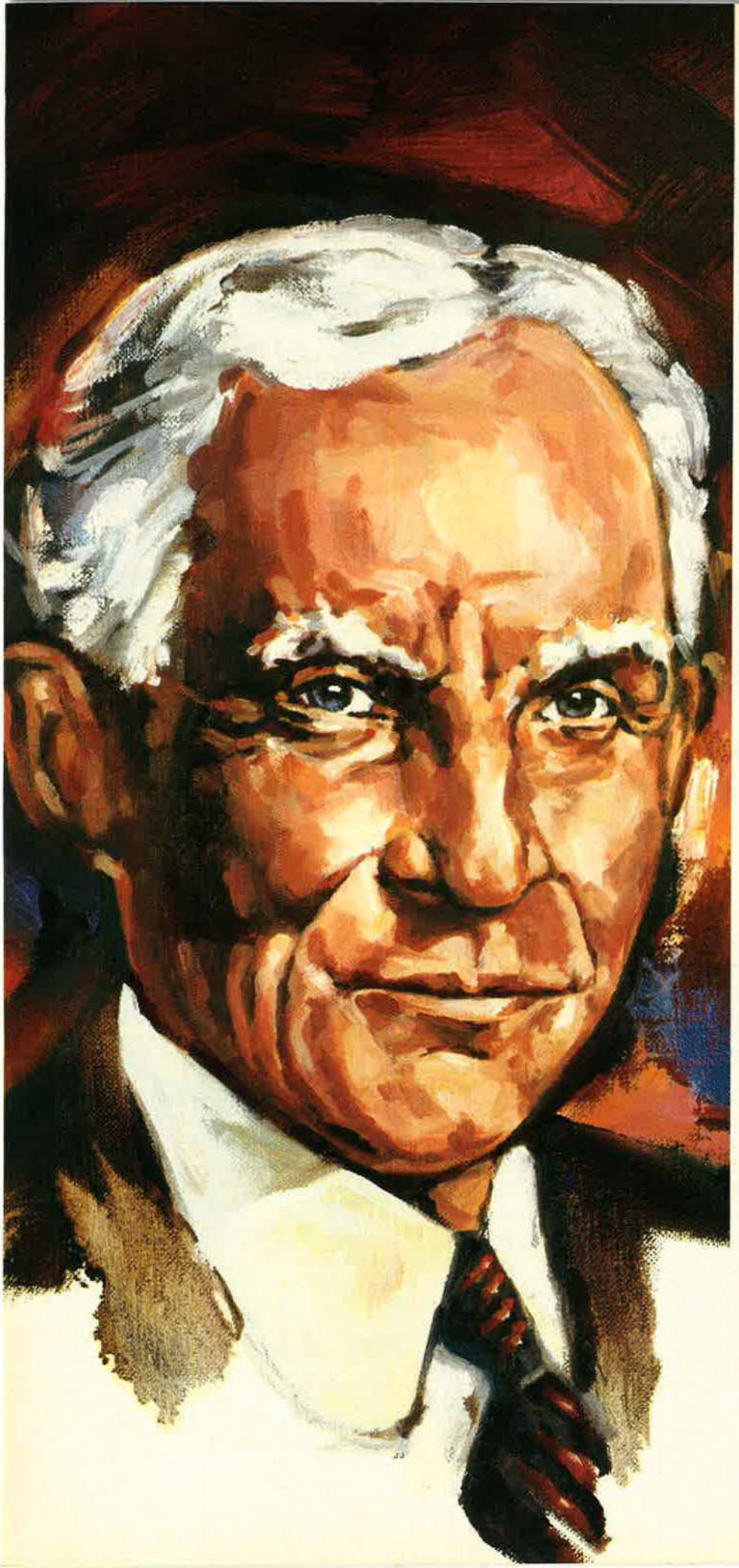
Pilots "fly" these designs in simulated missions, allowing each concept to be evaluated before commitment to final system architecture.

This is the way Northrop is designing and building advanced aircraft today. Ensuring the highest situational awareness for flight crews tomorrow.

NORTHROP

Making advanced technology work

Aircraft Division, Northrop Corporation
One Northrop Avenue, Hawthorne, CA 90250-3277



"Thinking always of trying to do more brings a state of mind in which nothing seems impossible."

Henry Ford
American Industrialist
1863-1947

Ford Aerospace goes that extra mile to meet customer needs.

Delivering quality. We develop C^3I systems that withstand the ultimate test. Efficient, survivable, secure computer networks. Speeding vital, real-time data to decision-makers.

Driving weapons technology. We provide some of the world's most cost-effective, reliable missiles and electro-optical systems. Sidewinder. Chaparral. Pave Tack. F/A-18 FLIR Pod. Meeting future threats with continuous improvement.

Pioneering in space. We build innovative communications and weather satellites. And control centers for manned space missions and planetary exploration. Bringing benefits of space down to earth.

Securing America's future with advanced technology.

Ford Aerospace

- Command, Control, Communications and Intelligence
- Tactical Weapons Systems
- Space Systems
- Technical Services

INTERSTATE ELECTRONICS IS PLAYING WITH A FULL DECK

. . . and then some.

Hartman Systems' militarized CRT displays now fully integrated into Interstate Electronics.

Interstate Electronics now offers the full range of display technologies for military spaceborne, airborne, shipboard, and land-based applications.

Long a leader in military display technology, Interstate Electronics offers the broadest range of display sizes and performance capabilities available. Whatever your requirement. Regardless of environment.

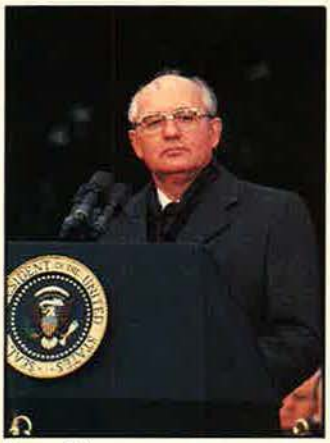
Contact: Director of Marketing,
Display Systems, Interstate Electronics Corporation,
P.O. Box 3117, Anaheim, CA 92803.
TEL (714)758-0500. TWX 910-591-1187. FAX (714)758-4148.

INTERSTATE ELECTRONICS CORPORATION
A Figgie International Company

MARCH 1989
VOLUME 72, NUMBER 3

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



Page 56

Page 106

About the cover: Lt. Vasili Logvin enters his MiG-21's cockpit at an airfield in the Leningrad Military District. This year's Soviet Aerospace Almanac begins on p. 40. (Photo by TASS/Sovfoto)

Special Section: Soviet Aerospace Almanac

Features

Departments

AIR FORCE Magazine (ISSN 0730-6784) March 1989 (Vol. 72, No. 3) is published monthly by the Air Force Association, 1501 Lee Highway, Arlington, Va. 22209-1198. **Phone** (703) 247-5800. Second-class postage paid at Arlington, Va., and additional mailing offices. **Membership Rate:** $21 per year; $48 for three-year membership. **Life Membership:** $300. **Subscription rate:** $21 per year; $25 per year additional for postage to foreign addresses (except Canada and Mexico, which are $8 per year additional). Regular issues $2 each. Special issues (Soviet Aerospace Almanac, USAF Almanac issue, and Anniversary issue) $5 each. **Change of address** requires four weeks' notice. Please include mailing label. **POSTMASTER:** Send change of address to Air Force Association, 1501 Lee Highway, Arlington, Va. 22209-1198. Publisher assumes no responsibility for unsolicited material.

An Editorial

A Game for Suckers

By John T. Correll, EDITOR IN CHIEF

J. PETER Grace is back. In 1983, Mr. Grace headed a private sector task force that published a report touting huge savings to be achieved by the elimination of waste in the federal government. His analysis was regarded as simplistic, though, and his advice was generally ignored. Now, Mr. Grace is running a direct-mail campaign promoting the same ideas that he was unable to sell six years ago.

He assures us that we can "cut over $424 billion in wasteful spending over three years" and "almost eliminate the entire federal deficit." This, he says, is possible "without raising your income taxes" or making "painful cuts in social or defense programs." Mr. Grace does not list the waste-cutting actions that lead to such a happy circumstance, but in 1983, he proposed to get sixty-seven percent of his savings from defense.

No one with a real grasp of the situation believes that the deficit can be wiped out so easily or that it can be done in any case without some penalty, either in taxes or in federal programs.

Public opinion, however, is drifting in favor of economic policies that would be amazingly consistent with Mr. Grace's philosophy. Polls show that only about ten percent of the voters want their taxes raised to resolve the deficit. A declining number of them support reductions to social programs. About sixty percent believe the best approach would be to cut defense.

Those who want sensible solutions—and who prefer to think rather than drift—should pay attention to facts that describe our circumstances more accurately than do Mr. Grace's exhortations. *The Economic and Budget Outlook: Fiscal Years 1990–1994*, published in January by the Congressional Budget Office, is instructive.

CBO estimates that federal revenues in 1989 will be 19.2 percent of GNP while outlays will consume 22.2 percent. The ratio should narrow a bit in the years ahead, but not enough to close the gap. A surge in GNP would increase revenues, but with unemployment at a fourteen-year low and productive capacity almost fully committed after a six-year boom, a surge is not likely to occur.

In 1988, according to CBO's figures, the federal government spent $1.1 trillion in gross outlays, distributed as follows: defense, 25.9 percent; entitlements and other mandatory spending, 44.8 percent; nondefense discretionary spending, 15.7 percent; and net interest on debt, 13.5 percent.

The government has no choice about paying the interest it owes, and artificially erected legal fences protect entitlement programs. That leaves defense and other discretionary federal programs as the targets for any reduction.

Over the past twenty-five years, CBO's data show, nondefense discretionary spending has declined, and defense spending has declined sharply. Meanwhile, entitlement programs have skyrocketed.

Between 1986 and 1989, defense spending declined by 11.4 percent after inflation. Just over a year ago, the "budget summit" between the White House and Congress took $230 billion out of the five-year defense plan. As readers of this magazine know, that was accomplished with harsh reductions in military force structure, manpower, modernization, and readiness.

The fiscal turbulence has been nearly as harmful as the cuts themselves. The Pentagon barely has time to begin on one new course when it is forced to shift to another one because of different financial assumptions.

Following the guidelines of the budget summit, former Secretary of Defense Frank C. Carlucci put together an FY '90 budget based on two percent real growth. Even if that budget had been approved as submitted, it would have amounted to only 5.4 percent of GNP. It now appears, however, that defense will be held to zero percent real growth, an inflation-adjusted freeze. If so, the Pentagon must pull another $96.3 billion from its five-year plan.

To put that number in perspective, consider the loss of ninety-six defense elements like these, each of which accounts for spending of about $1 billion: a year's operating and support costs for five tactical fighter wings; twenty-four F-15E dual-role fighters; fifty F-16 fighters; eleven Peacekeeper missiles; or 1,600 advanced medium-range air-to-air missiles.

The deficit is not a consequence of spending ourselves poor on national defense. We allocate significantly less of our GNP and a smaller share of our federal spending to defense than we did in the 1950s and 1960s. The deficit, which CBO projects at $141 billion this year, cannot be eliminated by defense cuts unless we strip the armed forces bare.

It is a fantasy to believe that there is an easy, painless solution to the deficit. Those who persuade themselves otherwise are expecting to get something for nothing, and that is a game for suckers. ■

NEVER SAY 'SAY AGAIN' AGAIN.

COLLINS ATHS.

The Collins CP-1516/ASQ Automatic Target Handoff System (ATHS) helps ensure clear, quick, C^3I communications. It facilitates air/air and air/ground interoperability, and provides target steering cues on HUDs or CRT displays.

Instead of vulnerable voice communications, Collins ATHS uses digital data bursts to minimize jamming and to reduce enemy detection while speeding the transfer of accurate battle information.

The system uses any MIL-STD-1553B or ARINC 429 transceiver to resolve target location and exchange target information between force elements. It's totally transparent to the system architecture.

ATHS provides data for such HUD symbols as target I.D., range and steerpoint.

Now flying on U.S. Army OH-58D and AH-64s, the 10 lb. Collins ATHS can be easily integrated into aircraft and ground vehicles. And it's interoperable with TACFIRE and the Battery Computer System.

For more information contact: Collins Government Avionics Division, Rockwell International, Cedar Rapids, Iowa 52498. (319) 395-2208. Telex 464-421 COLLENGR CDR.

COLLINS AVIONICS

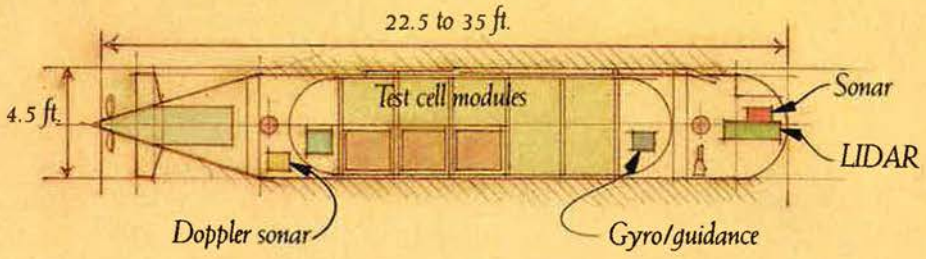
Rockwell International

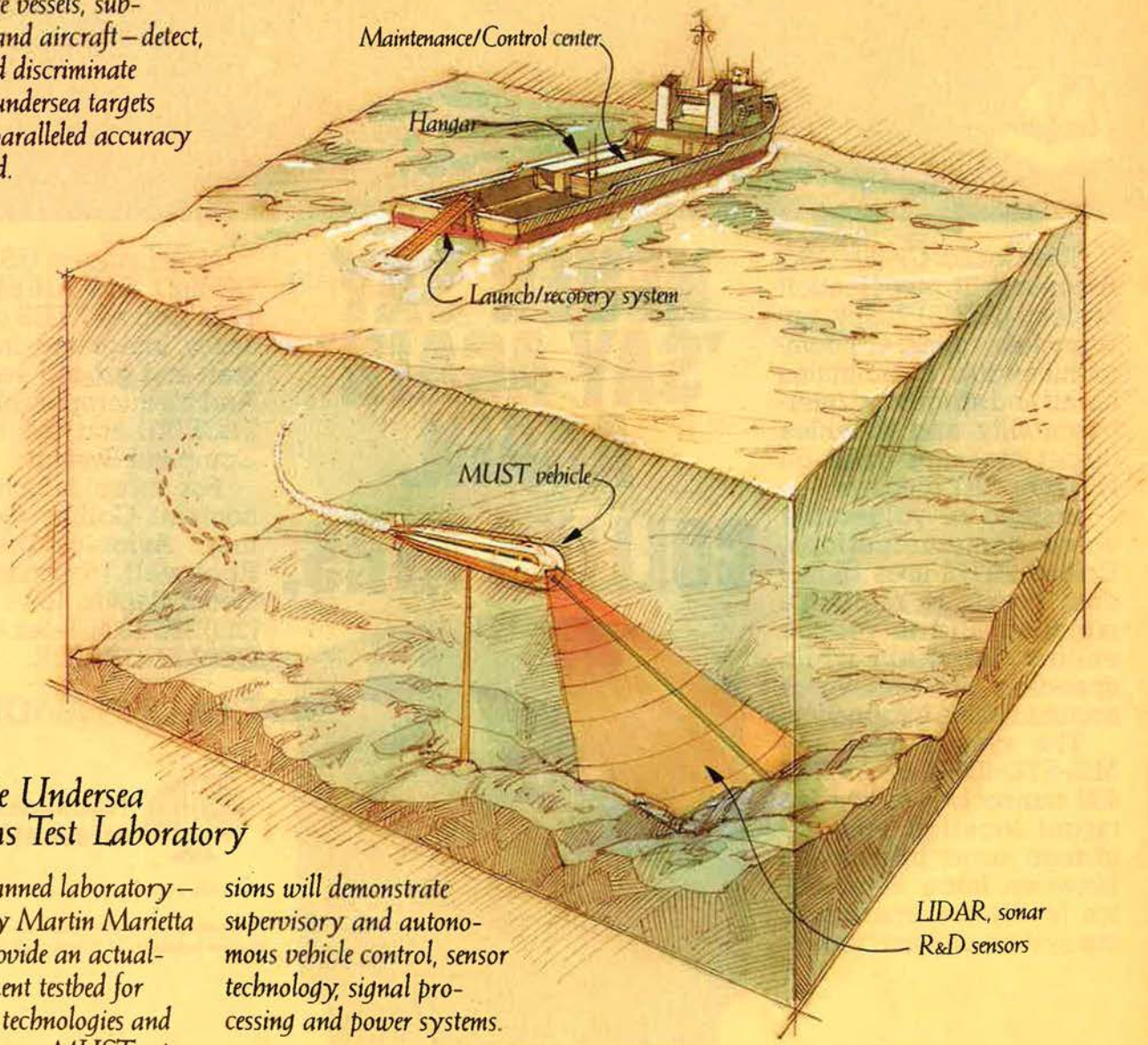
...where science gets down to business

Aerospace / Electronics / Automotive
General Industries / A-B Industrial Automation

Exploring new depths in sonar and signal technology.

Since Martin Marietta entered naval systems development, one focus has been underwater technology and its application to undersea warfare. This work is directed at developing, testing and demonstrating advanced sensory, control and signal processing systems and underwater laser systems to help the Navy – its surface vessels, submarines and aircraft – detect, track and discriminate between undersea targets with unparalleled accuracy and speed.



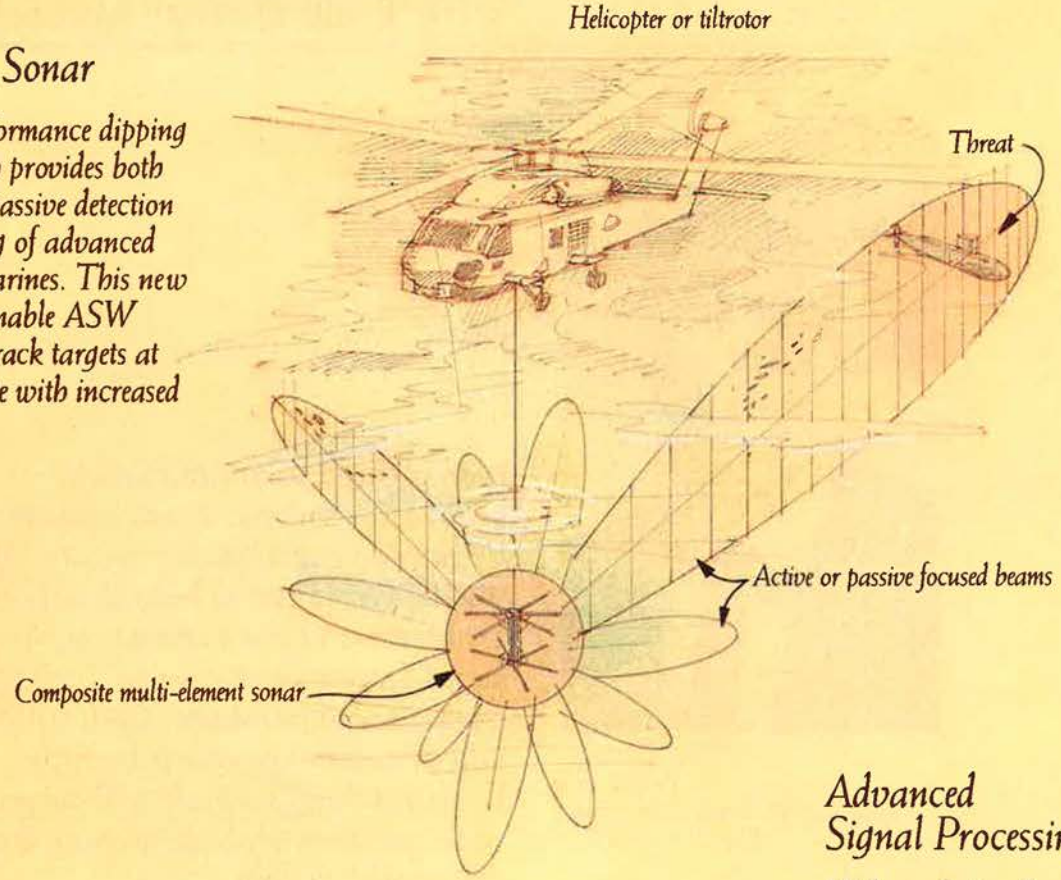


Mobile Undersea Systems Test Laboratory

An unmanned laboratory – funded by Martin Marietta – will provide an actual-environment testbed for undersea technologies and applications. MUST missions will demonstrate supervisory and autonomous vehicle control, sensor technology, signal processing and power systems.

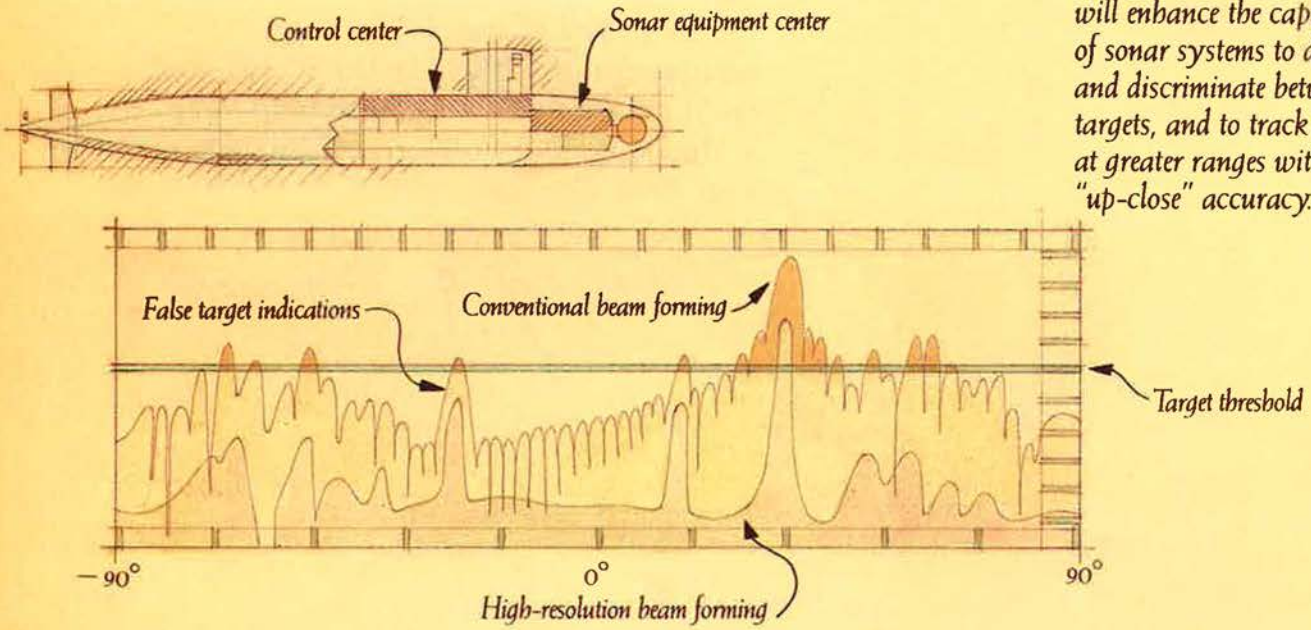
Airborne Sonar

A high-performance dipping sonar which provides both active and passive detection and tracking of advanced threat submarines. This new sonar will enable ASW aircraft to track targets at greater range with increased efficiency.



Advanced Signal Processing

High-resolution, beam forming algorithm and parallel processing systems we are developing for submarines will enhance the capability of sonar systems to detect and discriminate between targets, and to track them at greater ranges with "up-close" accuracy.



MASTERMINDING TOMORROW'S TECHNOLOGIES

MARTIN MARIETTA

6801 Rockledge Drive, Bethesda, Maryland 20817, USA

Litton leads the way with Total Quality Management

Larry Frame
President
Guidance & Control Systems
Litton Industries

I am pleased to announce an innovative service to our customers. Beginning immediately we are offering timely assistance to help in solving your problems and answering your questions about Litton Guidance & Control Systems navigation equipment. Call, toll-free, and a member of our Integrated Logistics Support Staff will respond to your question with an answer within two working days.

The toll-free number is **1-800-544-0879** and you can call any time, day or night.

We're proud of our navigation equipment, the finest in the world, and we'll do anything we can to help keep it that way. Our collective knowledge is at your disposal.

Larry A. Frame

Litton
Guidance & Control Systems

Airmail

Defending Air Bases

I emphatically support Major General Ellis's view ("More Hands for Base Defense") in your December issue. The need is critical, and failure to provide this training will result in tragedy. My experience in Vietnam as a nineteen-year-old communications-electronics maintenance technician at an isolated two- or three-man site located fifteen miles from the Laotian/Cambodian border and as a Security Police "augmentee" at a main air base contributes to my belief.

Knowing how to fold your underwear does not help you when you must fight to survive, are forced into an escape and evasion situation, or are captured. I hadn't fired the M16 since basic, and my three hours of augmentee training (firing the M16 and M60 machine gun and firing one slap flare) did not make me a warrior.

The numerous instances when augmentees failed to report when the air base was under attack, or reported in their underwear knowing they couldn't be deployed to the perimeter, were an indication of our lack of combat capability. The large number of M16 firing pins found in the solvent barrel, when it was drained so the solvent could be replaced, meant there wasn't going to be the rate of outgoing fire that we had believed.

The confusion and terror amid the cacophony and maelstrom of battle were a reality for which we were unprepared. We cannot, in good conscience, place our people in such peril without providing them at least a chance of survival and mission accomplishment.

CMSgt. Larry J. Koerber, USAF
RAF Uxbridge, England

Regarding the article written by Maj. Gen. George Ellis in your December '88 issue, I could not agree more that appropriate training—both in our own and in other specialties—is of paramount importance. Yet in my four years as a medical technician, I have seen no sign of any existing program for the training of medical personnel in basic perimeter defense procedures or in squad- to company-level infantry tactics and combat operations—training that will be sorely needed should the balloon go up. What is even more distressing is not seeing any inclination at any level of command to initiate such a program—at least not in CONUS.

I have been told that this type of training program does exist, though informally, by agreement between medical and Security Police or Combat Control Team personnel at several bases in "high-threat" areas such as USAFE and PACAF. If it is thought that there is no need for such training for CONUS personnel, then it is time to revise current thought on the subject. There are at least two important reasons to develop such a program for CONUS personnel.

The first is that many medical personnel stationed in CONUS are slated for deployment to "high-threat" areas in a wartime situation. Even in the best of deployment situations—enough advance warning to deploy personnel before the start of hostilities—it is ludicrous to expect the personnel already assigned to these areas to have the time, resources, or manpower available to train several dozen to several hundred deployed personnel in basic installation defense and small-unit tactics and operations.

The second reason is the simple fact that CONUS bases can no longer be considered safe from attack, as they were in past wars. In the area of base security, the Soviet *Spetznaz* (special operations) forces should be of particular concern to us. Their "diversionary troops"—whose specific mission entails infiltration, command-level assassination, and sabotage—can be expected, by conservative estimates, to field several thousand troops.

As a point of reference, imagine what several thousand Army Special Forces or Navy SEAL personnel could accomplish behind enemy lines in wartime. The idea that CONUS installations—especially command headquarters and strategic-airlift staging areas such as Travis AFB or Dover AFB—will not be targeted for attack may very well be an overly optimistic assessment, with deadly and disastrous consequences.

If such courses as the Army's EFMB (Expert Field Medicine Badge) or Army and Marine Corps small unit infantry training were made mandatory for, or even more accessible to, Air Force personnel (especially those slated for deployment), we might all have a better chance of surviving and winning.

Additionally, there is still a need for assigned medics—trained in all aspects of field medicine, including battlefield surgery—to be assigned to Security Police units, as well as to any other ground unit that may enter combat. The self-aid/buddy-care system is a vestige of American military experience since the Air Force became an independent service. American military experience in the past forty years has been in relatively low-intensity "brushfire" conflicts. Either the combat engagement has been on US terms (Grenada), or American numerical—and especially air—superiority made fast helivacs and airevacs possible. In a conventional war in Europe, none of these favorable preconditions can be expected. An example may be necessary to illustrate the possible results of such a situation.

In February 1968, the US air base at Tan Son Nhut in Vietnam was attacked on the first night of the Tet celebration by a Viet Cong force of approximately battalion strength. The 377th Security Police Squadron stationed at the base had only a few qualified medics and relied on the self-aid/buddy-care system. It was be-

Do you have a comment about a current issue? Write to "Airmail," AIR FORCE Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Letters should be concise, timely, and legible (preferably typed). We reserve the right to condense letters as necessary. Unsigned letters are not acceptable, and photographs cannot be used or returned.

AIR FORCE Magazine

Publisher
Charles L. Donnelly, Jr.

Associate Publishers
Charles E. Cruze, Richard M. Skinner

Editor in Chief
John T. Correll

Executive Editor
Robert S. Dudney

Senior Editor
James W. Canan

Aeronautics Editor
Jeffrey P. Rhodes

Staff Editor
Colleen A. Nash

Contributing Editors
John L. Frisbee
Brian Green
John R. "Doc" McCauslin
Gen. T. R. Milton, USAF (Ret.)
Bob Stevens
John W. R. Taylor

Managing Editor
Richard M. Skinner

Assistant Managing Editor
Francine Krasowska

Director of Production
Robert T. Shaughness

Art Director
Guy Aceto

Research Librarian
Pearlie M. Draughn

Editorial Assistants
Grace Lizzio, Daniel M. Sheehan

Administrative Assistant
Ronda M. Ryan

Advertising Director
Charles E. Cruze
1501 Lee Highway
Arlington, Va. 22209-1198
Tel: 703/247-5800
Telex: 44-0487 COURTESY
Telefax: 703/247-5855

Director of Marketing Services
Patricia Teevan—703/247-5800

Assistant Director of Marketing Services
Elizabeth B. Smith—703/247-5800

AREA ADVERTISING MANAGERS
East Coast and Canada
By Nicholas—203/357-7781

Midwest
William Farrell—312/446-4304

West Coast
Gary Gelt—213/295-3050

UK, Benelux, France, Scandinavia, Germany, and Austria
Richard E. Ewin
David Harrison
Overseas Publicity Ltd.
46 Keyes House
Dolphin Square
London SW1V 3NA, England
Tel: (44) 1-834-5566
Telex: 24924 OPLIM G
Telefax: (44) 1-630-5878

Italy and Switzerland
Dr. Vittorio F. Negrone, Ediconsult Internationale S.A.S. Piazzo Fontane Marose 3
16123 Genova, Italy
Tel: (010) 543659
Telex: 211197 EDINTI
Telefax: 10-566-578

BPA Circulation audited by Business Publication Audit

Airmail

lieved that, in the event of heavy casualties, the nearby base medical facilities would be able to provide for casualty evacuation and treatment.

Due to the immense influx of casualties in the early hours of the Tet offensive, no such capacity existed for the evacuation of SP casualties to base medical facilities. As a result, the few assigned field medics were overwhelmed, the self-aid/buddy-care system collapsed, and the 377th SPS was wiped out. Most of the fatalities died from injuries that immediate battlefield medical intervention could have taken care of—compromised airways, arterial bleeding, and sucking chest wounds. Instead, the fatality-to-casualty ratio was horrendously high.

The implementation of appropriate training programs will prevent disasters such as this from occurring on a much larger scale, should conventional war occur in Europe or elsewhere.

Sgt. Gary M. Coghlan,
USAF
David Grant USAF Medical Center
Travis AFB, Calif.

Land-Use Compatibility

The article "Closing in on the Airfields" (by C. V. Glines, January '89 issue, p. 74) was of special interest to me. As a civilian, I perform transportation planning for a private consulting firm. Land-use compatibility and the impacts of new development are both major topics in the field. Currently, there are a number of aviation projects, civilian and military, being considered.

First of all, I'd like to add and emphasize the idea that planning of this type should be continuous, coordinated, and comprehensive. It's also important to realize that without collaborative relationships between military authorities and civilian planners, very little can be done to alleviate the adverse environmental effects of airfield noise on the surrounding areas or to offset limitations encountered due to expansive regional development.

Since aviation installations across the country are experiencing the potential problems associated with growth, a vast amount of resource information is being compiled and made available for planners who suddenly realize that their old regional airport is now in the middle of what looks like the central business district of a small town. Of course, growth along these lines doesn't occur overnight; but if it's not effectively managed or efficiently planned, all parties involved could lose.

The Departments of Defense (DoD), Housing and Urban Development (HUD), and Transportation (DoT) and the Environmental Protection Agency (EPA) have implemented policies and programs to address this issue. One such example is the "Matrix of Noise Control Actions," which is contained in the Federal Aviation Administration's Advisory Circular 150/5020-1. There are many other pertinent sources of information.

The essential concept that planners must contemplate is that the analysis, evaluation, and recommendations to alleviate these impacts must reflect a responsibility to, and be in the best interest of, the public. Planners should also be supportive of the course of action that is feasibly and ethically defined, regardless of their perspective.

Charles R. Everett, Jr.
Louisville, Ky.

"Closing in on the Airfields" was well written by Colonel Glines. He wrote about College Park Airport and its conflict with the Green Line of the Metrorail System. Being President of the College Park Pilots Association, I am deeply involved in the situation. The proposed alignment of the Green Line is being driven by politics and not by economic, historical, environmental, or safety reasons. The Prince Georges County Executive, Parris Glendening, and the Metro administration are very closely aligned and have a very narrow concept of how the Green Line should be built. Consequently, they are ignoring to a great degree the historical, environmental, and safety aspects of the project.

With the Friends of College Park Airport, we are trying to encourage a better environment for the Green Line, not trying to stop its construction. If the line is built on the surface as planned, we are looking at the demise of College Park Airport. If a plane should overrun in landing or abort a takeoff, the Metro track is vulnerable, being at the end of the runway.

Symposium

An AFA National Symposium, "Systems/Logistics/Acquisition," will be held April 27–28, 1989, at Stouffers Hotel, Crystal City, Arlington, Va. Representatives from Hq. AFSC and Hq. AFLC will participate. For more information, call Jim McDonnell at 1-800-727-3337, ext. 5810.

STU III / SECTEL™ 1500

Say 'hello' to 9.6 Kbps secure voice/data

For faster computer data transfer. Faster fax. More natural voice. And it lets you talk to any STU-III securely. So, if you work with sensitive information, call 602/441-4300 or write Motorola GEG, PO Box 2606, Scottsdale, AZ 85252.

MOTOROLA

The Federal Aviation Administration (FAA) won't acknowledge the threat this presents. We are trying to convince them to alter this position. The National Transportation Safety Board recorded fifty-seven major overrun accidents in 1986—this doesn't include unreported incidents. We don't want College Park Airport to be included in a future statistic, wherein an airplane has collided with a Metro train or struck the 700-volt third rail, electrocuting the occupants of the airplane.

[Building] the Green Line [below grade] would cost approximately $5 million additional; but [overall, it would save] $12 million by precluding a highway underpass that could easily be rerouted to the south—not crossing the Metro rail at all. If the FAA would enforce its own FAR Part 77 and Part V Assurance, the problem would evaporate and Metro could continue with its project.

We are committed to preserving the heritage and continued safe operation of College Park Airport, the cradle of aviation!

Erwin B. Nase, President
College Park Pilots Association
College Park, Md.

USAF in Space

I have been concerned, as I am sure many Air Force veterans are, over the ever-diminishing role of the Air Force in the United States space program. Since the original seven astronauts, the Navy has played a growing and predominant leadership role in each and every spaceflight.

What has happened over these pioneering aerospace years? Has the Air Force [conceded] its primary mission role to the Navy?

To illustrate this point, the most recent shuttle flight was configured along these lines:

- Rear Admiral Truly, USN, was in charge of the overall NASA launch program.
- Captain Young, USN, played a key role in the operational aspects of the launch.
- Commander Hauck, USN, was in charge of the flight. . . .

Exactly where does the Air Force stand vis-à-vis Navy, NASA, etc., on manned aerospace programs of the future?

Wayne J. Guidry
Sun City West, Ariz.

• *For more on this subject, see Senior Editor James Canan's article "Space Comes Into Its Own" on p. 20 of this issue.*—THE EDITORS

The NATO Alliance

Thanks for your excellent article on NATO *["Alliances Are Not Eternal," January '89 issue]*. The bottom line says it all: "If we persist in emphasizing our differences . . . we may do more damage than we ever thought was possible."

When he took over the presidency of our country in 1981, President Reagan was confronted with a challenge similar to [NATO] Secretary General Wörner's. "The Great Communicator" met that challenge by turning the focus away from the destabilizing issues and by emphasizing our nation's positive attributes.

The sad commentary on the current "NATO bashing" is that the major differences causing the strains are, more often than not, peripheral economic issues—burden-sharing, tilting of the trade balance, and the proposed European cartel. Of course, the rhetoric of "The Great Salesman," Gorbachev, has done much to confuse a concerted NATO stand on the threat.

Certainly, NATO has been through its share of hills and valleys, with one nation needing a little more assistance at any one time. But this is what an alliance is all about—sharing and taking up the slack when needed. On the other hand, if it's really economics we're worried about, from a business perspective, the corporate president doesn't run from the organizations where the action takes place. He rolls up his sleeves, puts his best people there, and works harder for the next contract.

There's a lot to be said for the political, economic, psycho-social, and military benefits of NATO. If only we could hear these positive arguments as clearly and loudly as we hear the negative concerns.

Col. Fran Hendryx,
USAF (Ret.)
Montgomery, Ala.

CAS Compromise

A vehement argument continues in AIR FORCE Magazine over plans for an A-10 replacement. The argument has so far generated some light and a lot of heat. The truth is that several groups are partially right, and only some compromise solution can meet the nation's needs.

The Air Force and other advocates of sophisticated aircraft are correct [in saying] that the modern battlefield will require very high performance electronics and sensors. Such aircraft will be expensive, but in small wars and crises a few very capable systems are more important than many less effective ones. Political, logistics, and basing restrictions will often limit the total aircraft that can be used in small conflicts.

The groups pushing for so-called "Blitz" or "Mud" fighters are correct [in saying] that the CAS mission does require very large numbers of aircraft in a large war. Simplicity, supportability, and the ability to take a lot of punishment are vital for close-in combat support.

The Air Force needs highly effective aircraft for the peacetime active-duty forces, but also needs reserve forces with combat aircraft specifically designed to be built in large numbers in the event of a major war. These Mobilization Combat Aircraft (MCA) would be capable of performing a number of combat missions, including CAS, and can also be used for support to smaller allies. Limited peacetime production would be operated by special Reserve or Air National Guard training squadrons until needed for supply to our smaller allies.

With all the controversy around the need for a new Close Air Support aircraft, I think the Mobilization Combat Aircraft concept is very timely.

Lt. Col. Michael E. Rogers,
USAF
Tullahoma, Tenn.

Shallow?

The ATF article in the January '89 issue *["The ATF and Its Friends," by Robert S. Dudney, p. 46]* was too shallow for this maintainer. R&M is now equal to cost, schedule, and performance and therefore should get equal billing. The only real treatment [of maintenance] author Dudney provided was in a photo caption, and I know there's more going on for those who keep 'em flyin'. You can do it, as evidenced by "The Knuckle-Busters" (p. 96) in the same issue.

Col. Thomas A. Klimas,
USAF
Springfield, Va.

Helicopter Neglect

In response to recent articles concerning Air Training Command (ATC) and its "modern" approach to UPT (dual track, etc.), I'm compelled to ask why (as usual) ATC's helicopter training (UHT) was never mentioned in your December issue? Currently, the Air Force helicopter force is heavily overmanned. The helicopter pilot-retention rate is the highest in the Air Force. Naturally, no pilot bonus for helicopter pilots is in the works.

The undermanned fixed-wing situation, of course, could be helped

A 9G Ride

• EAGLE COUNTRY

Have you ever dreamed of flying in the world's hottest fighter aircraft? The F-15 Eagle's superior dogfight capabilities will keep you at the edge of your seat as the F-15s go head-to-head against F-14s, F-16s, and F/A-18s. This one is for anyone interested in aviation.

2150 85 Min. $59.95

• NAVAL COMBAT AIRCRAFT

All action footage puts you on board the top types which are Western naval air power today. You'll ride in the cockpit of the most advanced aircraft in the world including: F-8 Crusader, F/A-18A Hornet, F-14A Tomcat, F-4 Phantom II, E-2C Hawkeye, and many more. Also included is a detailed look at the instruments and weaponry as we witness anti-submarine, ground attack, and interceptor runs.

2340 60 Min. $59.95

• FALCON DOMAIN

The F-16 Fighting Falcon was designed to out-fight any enemy aircraft in the sky and is armed to dominate. In this full-color panorama, you get a detailed look at the systems, weapons, and "magic" which make the F-16 a 21st century fighter plane. You'll be strapped in the cockpit during gut-wrenching dogfights as the pilots take the F-16 to the edge. From the LANTIRN infrared night attack system to the high-powered ride with the "Thunderbirds," Falcon Domain is a stunning film to add to your collection.

2178 90 Min. $59.95

• TOP GUNS: THE REAL STORY

This is a thrilling look at the fighter pilots of the 80's. Set to a surging musical score and gut-wrenching cockpit footage, you'll experience the excitement from the Top Gun Training School to the life or death struggle in the air. Breath-taking!

2754 60 Min. $29.95

• CHOPPER WARS

"To the grunts, they were a Godsend- to the enemy they were beasts from hell- the 'Choppers'." You will now experience the action of one of the most devastating weapons used in Vietnam, including the tactic known as "Recon by Fire"

2762 60 Min. $29.95

• AIR WAR IN VIETNAM

The most awesome display of aerial fire-power ever was unleashed in Vietnam. *Air War in Vietnam* uses the pick of air combat footage to tell the story from the first U.S. advisor to the massive U.S. bombings. Also included is captured North Vietnamese footage of their anti-aircraft defenses.

2012 60 Min. $59.95

• THUNDERBIRDS

The magnificent Air Force Thunderbirds put on a spectacular aerial show in this specially produced thirty-minute highlight film. You'll be strapped into the cockpit and get a look at the hottest pilots and planes in the business. WOW!

2716 30 Min. $24.95

• Sky Warriors

Spectacular newly declassified footage highlights this action packed film detailing America's first line of defense. Experience the thrill of cockpit flight of the F-14, F/A 18, A-6 intruders as well as rare glimpses of their Soviet counterparts. Also see close up the much maligned and controversial Aegis system. Don't miss this!

2734 Appprox. 50 min. $39.95

MiG Alley

• HELL OVER KOREA

A gripping account of the savagery of bloody Ridge, T-Bone, Punch Bowl and the Battling 24th with their back to the wall at Pusan. A Handful of P-51s flew 24 hour air strikes to slow five North Korean divisions sweeping across the 38th.

2215 100 Min. $39.95

• FIGHTING SABRE JETS

When the Mig-15 jets were suddenly introduced into the Korean war, our air superiority was threatened. America's answer was the F-86 Sabre Jets. Take this gut wrenching ride and get a ringside seat of the Korean air war.

2184 118 Min. $39.95

Classic Air Battles

• THE RED BARON

This is the story of Manfred Von Richthofen, WWI's premier ace who shot down 80 allied planes! This Ace of Aces was the greatest aerial tactician of World War I. Included are interviews with the last surviving pilots who flew with and against him. Excellent WWI dogfight footage, crashes, and The Red Baron's last flights are highlighted in this compelling story of the most legendary personality in the annals of aviation.

2569 60 Min. $29.95

• Those Magnificent Fighting Flying Machines

This thrilling history of the fighter plane includes fascinating footage of aerial dogfights and will thoroughly entertain anyone with an interest in combat or aviation

2462 60 Min. $29.95

• B-17: The Flying Fortress

Narrated by Edward Mulhare. Featuring incredible combat footage, this award-winning film tells the story of the daring daylight bombings that changed the course of WWII.

2045 90 Min. $19.95

Send $2.95 and receive your FUSION CATALOG, or receive FREE with your order.

TO ORDER, please send check, money order or credit card number (no cash) to:

FUSION VIDEO

17214 So. Oak Park Ave. - Dept. AF903 - Tinley Park, IL 60477

ALL CASSETTES ARE VHS ONLY.

1-800-338-7710 Inside Illinois 312-532-2050

Name _____

Address _____

City _____ State _____ Zip _____

☐ **YES!** Please send me a FUSION CATALOG with my order.
☐ I am enclosing $2.95 for a FUSION CATALOG.

CASSETTE NUMBERS

Bill my credit card: ☐ Visa ☐ Master Charge

Account Number Expiration Date

Authorization Signature of Cardholder

Video Cassette Total $ _____

Shipping & Handling $3.95*

TOTAL Amount $ _____ Illinois residents add 7% sales tax.

**Canada orders add $5.00 for shipping and handling.*
**All other foreign countries add $10.00 for shipping and handling*
FUSION VIDEO is a division of FUSION INDUSTRIES, INC. 1A3B

For Faster Service Call Our 24-Hour, Toll-Free Hotline: 1-800-338-7710

THE HOLIDAY INN® GOVERNMENT AMENITIES PROGRAM

FREE ROOM UPGRADE
10% DINNER DISCOUNT
FREE CONTINENTAL BREAKFAST

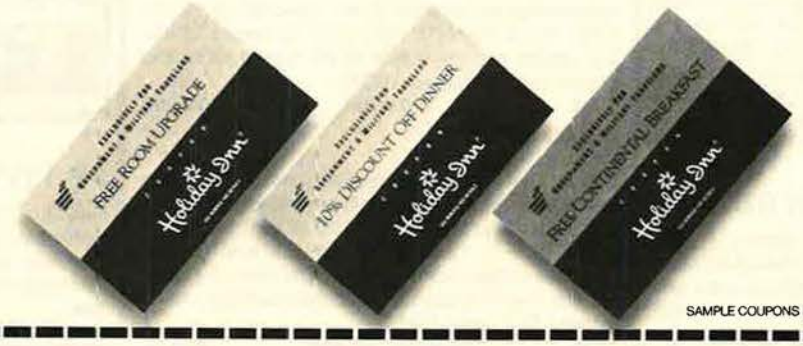
On your next official trip, get the most for your per diem dollars through the Holiday Inn Government Amenities Program. At more than 700 participating Holiday Inn and Holiday Inn Crowne Plaza® hotels, you can simply present the appropriate Government Amenities coupon and enjoy a free continental breakfast, a 10% dinner discount and a free room upgrade (based on availability at check-in).

To order your Amenities coupons, just fill out the form below, or **call 1-800-635-2059,** Monday–Friday, 8 A.M.–5 P.M. Central Time. Coupons are valid through December 31, 1989.

All federal, state and local government employees, military personnel, and federal cost-reimbursable contractors are eligible for the Government Amenities Program.

And more than 1,300 participating Holiday Inn hotels in 41 countries offer guaranteed government rates. Most extend these low rates to state and local government employees as well as cost-reimbursable contractors.

For more information on the Government Amenities Program or to make guaranteed government rate reservations, just **call 1-800-HOLIDAY** or your travel agent.



SAMPLE COUPONS NOT FOR USE

MAIL TO: **Holiday Inns, Inc.**
7201 Wisconsin Avenue, Suite 703, Bethesda, MD 20814

Number of coupon sets desired _____

NAME (AND MILITARY RANK) _____

TITLE _____

AGENCY OR COMPANY _____

OFFICE ADDRESS _____ MAIL STOP _____

CITY _____ STATE _____ ZIP _____

OFFICE TELEPHONE ( ) _____

THE FIRST CHOICE OF GOVERNMENT AND MILITARY TRAVELERS WORLDWIDE.

Holiday Inn®

Stay with someone you know℠

A-1-89

somewhat by training many of our experienced helicopter pilots to fly fixed wing. Cheaper than a full-blown UPT student. This idea has been initiated with minimal results for no apparent reason—the Military Personnel Center just can't swing a deal to send very many helicopter pilots.

It is obvious that we don't utilize our pilot resources very well. Why could we not start with the Navy approach? Train *all* pilots in a basic fixed-wing and then send them to their respective track. With the advent of the tiltrotor, a little background in fixed and rotary wing would be desirable, and when certain shortages in pilots existed, one could easily move pilots around to help out. In a different area concerning ATC, the flight simulator was mentioned. Funny thing, the only helicopter simulator for "operational" pilots left is for the H-53.

The only thing I haven't been able to figure out lately is, how could the Air Force let a bunch of low-life helicopter pilots like me get away with a leather jacket?

Capt. Fred Smith,
USAF
Fort Rucker, Ala.

The TB-25 Remembered

The article in the January edition on the evolution of Air Force pilot training *[see "Always Good—And Often Superb," by James W. Canan, p. 46]* had a bit of misinformation regarding the termination of multiengine training at Reese AFB. I was an instructor pilot at Reese from 1956 through 1959, and it was indeed the last base to offer the multiengine training program. The program did not end with the 1957 hailstorm, however. The storm certainly did occur, and those of us who witnessed it will not forget the damage it did to the base and to the fleet of around 100 B-25s situated on its ramp.

The old "TB" birds, alas, had fabric control surfaces, and all but a handful of them that were hangared for maintenance were put out of commission. (Little, if any, other damage was sustained.) The storm hit late in the week, on a Thursday or Friday. By today's standards, the recovery was even more amazing than the storm. Enough control surfaces to put the fleet back into operation were flown in from depots and installed on the aircraft over the following weekend. The instructors and maintenance pilots reported to the flight line as the repaired birds came on line and test-flew them around the traffic pattern, literally as soon as they were completed. The training schedule was resumed on the next Monday, with most of the damaged fleet back in commission.

The program was continued at Reese until 1959; I think the last class was 59-H. As each class graduated and the B-25s were replaced by T-33s, the -25s were flown to Davis-Monthan for storage, sale, or destruction. I had the honor to fly one of the last of those deliveries with the Group Commander, Col. Travis Hoover, who many years before had flown an earlier version of the bomber off the USS *Hornet* as a Doolittle Raider. The flight to Davis-Monthan was less exciting for him, I suspect, but in a different way perhaps as emotional an experience.

Lt. Col. Robert G. Applebaugh,
USAF (Ret.)
Arlington, Va.

Record Straightening

Recently you ran an article on Reconnaissance Air Meet '88 *[see "Photo Finish," by Gail F. Phillips, December '88 issue, p. 98]*, the worldwide reconnaissance competition. As a member of the 26th Tactical Reconnaissance Wing, overall winners, I must take exception to your article. As the AGS squadron commander and also an AFA member, I'm disappointed.

The article covered the competition and some of the competitors, but there were no pictures of the 26th TRW personnel and little mention other than the final standings. The team members made it happen. They sacrificed individual trophies for team, and they were consistently good performers.

The intelligence folks from the Army, the operations personnel, and maintenance personnel did what it takes to be "The Best of the Best." The recognition of that job was not evident in your article.

We at the 26th AGS and 26th TRW think our folks did a superb job. They took on the herculean task of picking their jets and preparing them while maintaining a normal flying commitment. They then deployed from Europe to Shaw, whence they staged into Bergstrom. From there, this crew of young maintainers, aircrews, and intelligence folks proved that they are the "Tip of the Sword," USAFE's finest, by winning not just the overall trophy but many subcategories.

They were the Best Active-Duty Maintenance team, had the Best Overall Active-Duty Aircrew, and were within striking distance of many other winners.

They competed against more experienced aircrews, maintainers, and intelligence folks, and they competed against wings that were able to pick their best aircraft and folks from more than 1,000 people.

We, especially myself, are extremely proud of their efforts and their results. Congrats again, folks!

Maj. John G. Hurd,
USAF
Hq. 26th TRW, USAFE
Zweibrücken AB, Germany

Higher and Faster?

Please advise your Aeronautics Editor, Jeffrey P. Rhodes, that his article "Higher, Faster, Farther" (January '89 issue) is incorrect on p. 87 in citing Maj. Robert H. White as having set the absolute record for altitude in an aircraft launched from a carrier airplane.

Mr. Rhodes, citing the NAA as his source, credits Major White as having set the record at 314,750 feet on July 17, 1962. At that time, this achievement was true; however, Major White's endeavor stood for only thirteen months. According to the 1973 edition of *Air Facts and Feats* and *The 1989 Guinness Book of World Records*, the true record, 354,200 feet (67.08 mi.) was set by Joseph A. Walker in a North American X-15A at Edwards AFB, Calif., on August 22, 1963. This record has stood for more than twenty-five years.

For those interested, X-15 No. 2, which is now on display at the Air Force Museum in Dayton, Ohio, was almost destroyed on November 9, 1962, in a crash landing. After being rebuilt and modified with a lengthened fuselage, this aircraft was redesignated X-15A-2, and on October 3, 1967, Maj. William J. Knight took it to the highest speed attained for any of the three X-15 aircraft built by North American—4,534 mph (Mach 6.72). This was the 199th, and final, flight of the X-15 program.

I truly enjoy reading AIR FORCE Magazine, and I love reading air and space aviation records. However, gentlemen, when you use the title, term, or phrase "Absolute Aviation World Record," please get your facts straight.

Rick Abbott
Caldwell, Idaho

• *Reader Abbott is partially correct. Joe Walker twice exceeded Major White's altitude of 314,750 feet, once on July 19, 1963 (347,800 feet), and on August 22, 1963 (354,200 feet). However, the Fédération Aéronautique Internationale, the official sanctioning*

body of aviation records (unlike Guinness), considers any altitude above 100 kilometers (or sixty-two miles) "space," not "atmosphere." While the August 22 flight is considered the "unofficial" absolute record, it is far short of the 234,672.5 ***miles*** *achieved by the* Apollo-8 *crew, who hold the absolute altitude mark for spacecraft. Also, Major Knight set the unofficial speed record on the 188th, not the 199th, flight of the X-15 program. Finally, as a result of our editing error, Major White's middle initial was listed incorrectly; the correct initial is "M."* —THE EDITORS

Proud Shield

Regarding your article on Proud Shield '88 (January '89 issue, p. 35), I would like to try to set the record straight. I was assigned to the 4th ACCS at Ellsworth AFB, S. D., between April 1981 and May 1983 as an EC-135 A/G/C Instructor Navigator.

The 4th ACCS (an EC-135 squadron) and the 28th AREFS (a KC-135 squadron) held a flyoff/computer navigational competition for the right to participate in Bomb Comp '81. My crew, E-111P (P for PACCS), was one of the four finalists and eventually won the local competition to fly in Bomb Comp '81.

Along with our sister crew in the 28th AREFS, we helped the 28th BMW win the Busy Razorback '81 competition (a Fifteenth Air Force preliminary contest for Bomb Comp '81). The next year, crew E-111P again won the right to participate in Giant Voice '82.

The crew members for each year were: '81: Maj. James McCann, Pilot; Capt. Jeffery Moore, Copilot; Capt. William Heisel, IN; and SSgt. Robert Hillegeist, Boom Operator. For '82: Maj. James McCann, Pilot; 1st Lt. Gerald Lauth, Copilot; Capt. William Heisel, IN; and SSgt. Robert Hillegeist, Boom Operator.

The EC-135 that flew in Proud Shield '88 has every right to be proud of their accomplishment, but they were not the first EC-135 crew to fly in this competition.

William G. Heisel
Papillion, Neb.

Incorrect Score

This letter is in response to the misprint of a date in your note of "December Anniversaries," on p. 36 of the December '88 issue.

I do not believe that December 18, 1953, was the correct date for Project Score, the Atlas missile that boosted a satellite and transponder into earth orbit to transmit President Eisenhower's—and man's—first voice and Christmas message from space.

In 1953, America was still involved in a "police action" in Korea, and we were in the Stone Age of modern technology. If my memory hasn't failed me, I think our technology was equal to something akin to throwing high-speed, semi-spherical rocks at the North Koreans.

The first man-made satellite to orbit the earth was Sputnik. It was launched by the USSR in October 1957. I think your date for Project Score should have been December 18, 1959.

Ronald V. Regan
Casselberry, Fla.

• *Reader Regan came closer than we did. The correct date for President Eisenhower's Christmas message was December 18, 1958.*—THE EDITORS

Schwable Squabble

Reference "Aerospace World," p. 43, January '89 issue: The retrospective on the late Brig. Gen. Frank Schwable was correct as to his record in World War II. I checked by rereading Sherrod's *History of Marine Corps Aviation in World War II.*

The write-up was in error concerning Schwable's duty assignment during the Korean War. He was not the Commander of the 1st Marine Air Wing; he was the Wing Operations Officer.

Col. John M. Verdi,
USMCR (Ret.)
Northport, Ala.

OTS Output

In your December '88 issue, on p. 44, "Front Door to the Force," you stated that the Officer Training School (OTS) graduated 4,550 in 1980 and 912 in 1988 and expected 1,200 in 1989. Just for the record, the correct figures are as follows: 4,598 in 1980, 943 in 1988, and 1,267 expected in 1989.

Jane Cappe
Registrar, USAF OTS
Lackland AFB, Tex.

Bombsights and Gunsights

Early involvement in the development of aircraft weapon systems has stimulated my interest in this material. As a result, I have collected over the past four decades several Army Air Corps bombsights used prior to and during World War II. Among these is a Norden M-7 with associated C-1 Autopilot, a Sperry S-1, and a Sperry O-1, which I understand is somewhat rare. I also have a Sperry K-9 gunsight system of the type used in the revolving turrets aboard the B-17, B-24, B-25, and B-26.

I am attempting to compile a short history of this equipment and would like to communicate with anyone having similar interests, to exchange notes, or technical or historical information. Bombardiers who are familiar with the above bombsights would, I feel sure, have some worthwhile stories to tell.

C. J. Watkins
415 Plantation Dr.
New Bern, N. C. 28562-9504

War Work

I am researching the aircraft manufacturing plants built by the government during World War II. I would like to know the Air Force and Navy plant numbers and locations and which manufacturer ran them.

Dean Carlson
21141 Whitehorse Lane
Huntington Beach, Calif. 92646

Eighth Air Force History

For a book about Eighth Air Force bomber crews in World War II, I would greatly appreciate hearing from anyone willing to share with me reminiscences and photos (which I will return).

Dave Lande
4455 W. 4th St.
Appleton, Wis. 54915

Bombing of Kassel

I am seeking data and information for the publication of a book on the bombing of Kassel, Hesse(n), West Germany. Contributors will receive a free copy of publication or reimbursement for expenses. Pilots, navigators, operations, intelligence, et al. are encouraged to submit papers, files, journal entries, photos statistics, etc. Send a note to the address below.

Karl-Michael Sala
3668 Vistawest Dr., Box 1028
West Jordan, Utah 84084
Phone: (801) 569-8857

Upper Heyford

Would anyone who served with the 42d Bomb Wing from Loring AFB, Me., during the 1950s, please write to me? I am doing a historical project on SAC at RAF Upper Heyford, and I'm trying to contact any of the flying units that served temporary duty there during the 1950s.

Richard Green
76 Quartercroft
Pyramid Close
Weston Favell
Northhampton NN3 4DP, England

Roll Call

I am seeking Carl T. Earles, whose home town was El Paso, Tex. His last known address (in 1944) was AAF Station 498, Ebrington Manor, Ebrington, England, 70th RD, Eighth Air Force. Carl was one of the 21,193 enlisted people who volunteered from the Air Forces in England to the Army for the rugged life of the infantry and artillery when the manpower shortage in the Army field forces became serious in early 1945. Please contact me at the address below if you have information about him.

Maj. Richard C. Harris, Jr., USAF (Ret.)
4813 Burton Ave. SE
Albuquerque, N. M. 87108-3419
Phone: (505) 255-6577

I would like to get in touch with a John Bondus (or Bondhus) who was a navigator with the 1st Foreign Transport Group (Fireball) out of Miami, Fla. He was from Fergus Falls, Minn.

Walt Corrigan
7116 S. E. 30th Ave.
Portland, Ore. 97202
Phone: (503) 777-2286

During March through June 1943, in aviation cadet class 44-A at the San Antonio Aviation Cadet Center, there was a cadet of great ability and even greater military potential by the name of Jones Brown. Jones was part of my group, which moved on to Pine Bluff, Ark., in July 1943 to begin flight training, and we shared Jack Hicks as a flight instructor. Jones had a problem with depth perception and, to his and our great regret, was dropped from pilot training.

I have now published an autobiography, which includes Jones's case in some detail, and would like to send him or his family a copy. Anyone knowing Jones Brown or having any information about him, even a serial number, would make a lifelong friend by calling or writing me.

James L. Brewer
RFD 3, Box 534
Grant, Ala. 35747
Phone: (205) 728-4677

I am looking for men who served on Tinian during World War II with my father-in-law, Nick Perone. Before he was shipped to Tinian, he trained with the 578th Materiel Squadron, 77th Service Group, in Smoky Hill, Salina, Kan. On Tinian, he was part of the 484th Squadron, 505th Bomb Group, 313th Bomb Wing.

Nick was a tech sergeant and repaired B-29s and B-25s. Your readers may remember him for the shower he built out of airplane parts. I have contacted members of the 505th Bomb Group Association, but have only heard from pilots, engineers, etc. I would like to hear from other aircraft mechanics who were on Tinian, especially those who worked with Nick.

Jacki Perone
59 W. Judith Dr.
Hammonton, N. J. 08037

Collectors' Corner

I am trying to obtain a set of the metal wings worn by flight engineers prior to the decision to change to universal enlisted aircrew wings. Please contact the address below.

Frank Kelley
833 E. Steed Dr.
Midwest City, Okla. 73110

I was in the USAF Security Service after basic and tech school training (1962–66). I am interested in knowing if any AFA members or their friends were in this command prior to its becoming the Electronic Security Command. I would like to obtain paraphernalia of the old era, primarily the full-color enamel crests with clutchbacks. I need one for my American Legion cap, and I would be willing to pay for the pin. Also, I am seeking several old A2C enameled chevrons.

Please contact me at the address below.

Rev. Clarence S. Duncan II
811 Auk St., Apt. 1
Kenai, Alaska 99611-6864
Phone: (907) 283-3142

I am interested in hearing from anyone who collects or trades aircraft memorabilia. I have a "like-new" operational Norden MK-9 bombsight complete with horizontal stabilizer.

Thomas A. Blower
6517 Greentree Rd.
Bethesda, Md. 20817

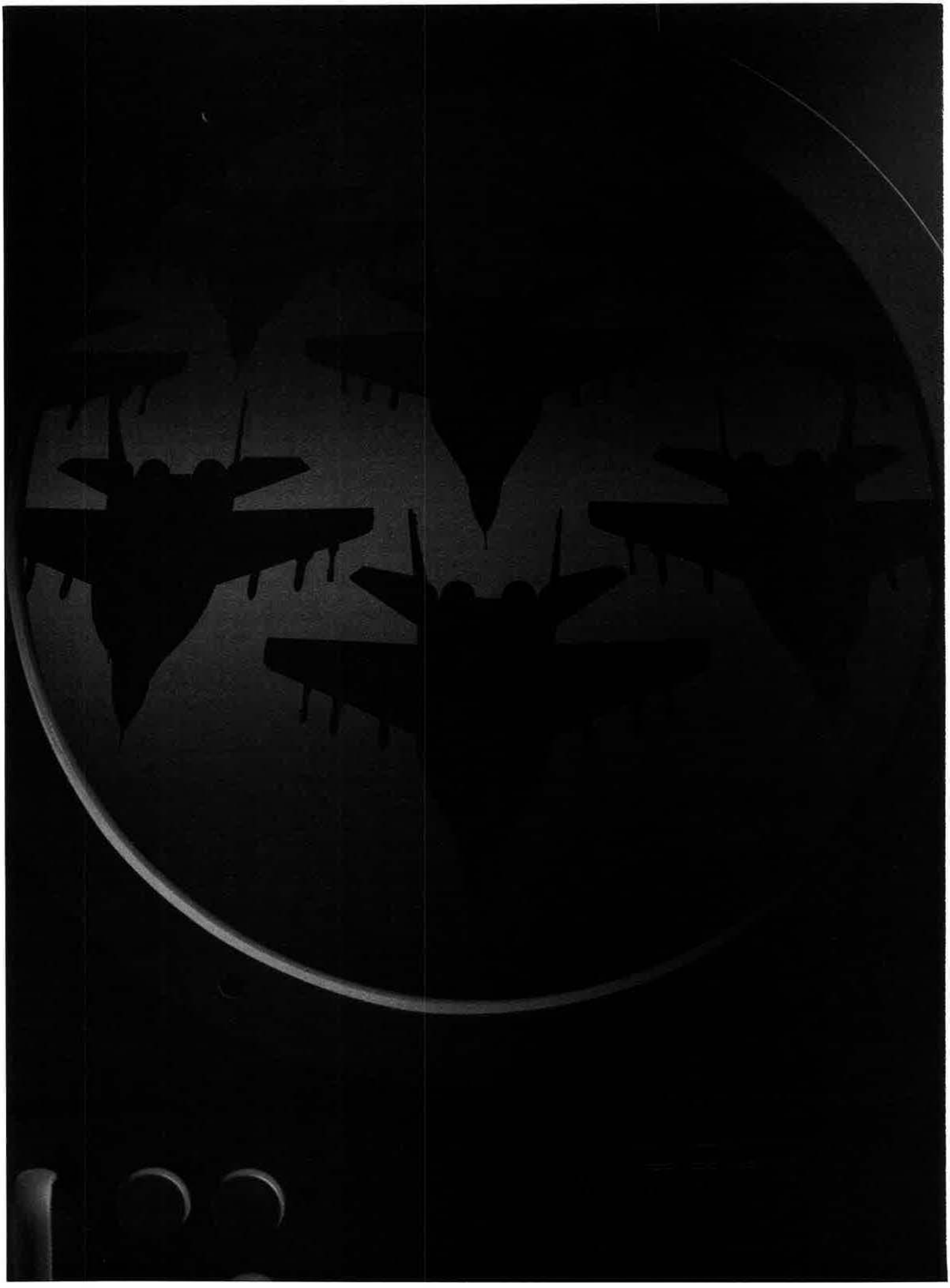
I am interested in patches from the USAF and ANG, as well as from the air forces of all other nations.

I have a large selection of patches for trading and would be eager to hear from other squadron patch collectors.

John W. Miller
14974 Bramblewood Dr.
Houston, Tex. 77079-6335
Phone: (713) 558-3243

I am interested in buying patches to build up my collection. If you have any to sell or know anyone who does, please contact me at the address below.

Joseph D. McLain
4159 Constellation Rd.
Lompoc, Calif. 93436-1230
Phone: (805) 733-3461



A FEW MINUTES IN THE DARK CAN BE DEVASTATING.

The enemy's out there. Just waiting for a moment when you can't see them. Because when your power goes out, their power comes on. Protecting C3 capabilities means protecting your Mission Critical power supply, and nothing's better than Powerware.®

That's why the Air Force recently awarded Exide a significant requirements contract. Over the next five years, we'll install and maintain Powerware systems at crucial Air Force facilities around the world.

All of the Powerware products in the contract are available to the Department of Defense.

Call us today at 1-800-554-3448 and find out why an Exide Powerware system is your best defense against power failure. Because if the power goes down and the lights go out, the last thing you'll see is nothing.

EXIDE ELECTRONICS

Space Comes Into Its Own

By James W. Canan, SENIOR EDITOR

In a major shift of thinking, USAF now regards space as a mission rather than a place. Furthermore, it has put space operations on a par with air operations.

Washington, D. C. Space is finally coming into its own in the Air Force. For the first time ever, it now has the status of a full-fledged mission and is no longer officially regarded as merely "a place" for supporting strategic and tactical missions in the air.

The word from the top is that space operations are to be put on a par with air operations in Air Force planning, programming, and budgeting. This has not always been the case, to put it mildly, in a service long dominated by fighter and bomber pilots.

As Air Force Chief of Staff Gen. Larry D. Welch explained it to AIR FORCE Magazine: "Secretary Aldridge and I agreed that the Air Force was long overdue in considering space as a mission that contributes to virtually every other mission. It was time to integrate space into everything we do. So the great drive now is to institutionalize space as a mission, not only in the Air Staff but in the MAJCOMs."

Edward C. "Pete" Aldridge, Jr., was General Welch's top-level teammate in scoring one for space. They coauthored a new statement of Air Force space policy that went out to the Air Staff, major commands, and special operating agencies last December 2, just two weeks before Mr. Aldridge resigned as Secretary of the Air Force to become president of McDonnell Douglas Electronic Systems Co., a newly established company in McLean, Va.

The statement began: "We have recently completed an intensive review of the role of the Air Force in space. That review concluded that space operations can have a decisive influence on future terrestrial conflict. Therefore, we must make a corporate commitment to integrate spacepower throughout the full spectrum of Air Force capabilities."

To those who may have assumed that the Air Force has always put a premium on space, given USAF's obvious and increasing activity in that arena, all this may seem puzzling. But the fact is that the Air Force, contrary to outward appearances, has always been somewhat space-shy. Only grudgingly has USAF been willing to shell out for the increasingly sophisticated and costly space systems that can, if overbought, eat up a whole year's hardware budget in no time.

Those systems are the communications, early-warning, surveillance, reconnaissance, navigation, and weather satellites on which US strategic and tactical forces now intrinsically depend. They are the stuff of command control communications and intelligence (C^3I) and battle management, without which forces would be confused and firepower fragmented. But they are not the stuff of combat itself. They are bloodless and "don't go 'bang,' " as one space-systems advocate expressed it in explaining their relative lack of appeal to Air Force leaders whose preferences run more to bombers, fighters, and missiles.

The big, burly booster rockets that hurl these systems into space on plumes of flame are certainly charismatic. But they, too, have nothing to do with war itself and are throwaways. They are also terribly costly, and the Air Force has been forced by Congress to spend more on them than it wanted to in recent years to resuscitate the US space program, which more than a few Air Force leaders came to regard as a pain in the neck.

The heart of the problem, however, has been the tentative nature of the Air Force's approach to space. To mollify those who cry out against "militarizing space," the service has been at pains not to seem too warrior-like in that approach. This helps explain why USAF has heretofore insisted that space is a passive place, not an active mission, and why those who disagreed with that, including some general officers, urged USAF to stop regarding the militarily appealing "high ground" above the atmosphere as an R&D arena and start treating it as an operational arena. One such officer was the late Gen. Jerome F. O'Malley, who expressed that view during a stint on the Air Staff as a three-star nearly a decade ago.

Over the years, as the gut questions about the Air Force's identification with space have gone unresolved, the service has shown its ambivalence in the matter.

General Welch addresses this, saying: "For a lot of reasons, space has always been a matter of intense interest to the Air Force, but has always been held off-line. We've sort of had two staffs. One worked space and one worked everything else. There has been an 'us versus them' atmosphere, a division.

"So it is important to note that the Air Force has now institutionalized space."

The space policy statement promulgated by General Welch and Secretary Aldridge sets forth the following tenets:

- "Spacepower will be as decisive in future combat as airpower is today."
- "We must be prepared for the evolution of spacepower from combat support to the full spectrum of military capabilities."

Air Force Maj. Gen. Thomas S. Moorman, Jr., Director of Space and Strategic Defense Initiative (SDI) programs with the Assistant Secretary of the Air Force for Acquisition, declares that the Air Force leadership has now "truly endorsed the heritage of space as a core Air Force mission—and this is a key difference between the blue-ribbon study [on space] and the stack of previous assessments conducted predominantly by space people.

"It is important to note that the blue-ribbon panel which supported

HAVE QUICK OR HAVE NOT

HAVE IT... FROM THE PEOPLE WHO PUT MORE ANTI-JAM MARGIN IN MORE PLACES FOR LESS MONEY. Only one company can make this claim. MAGNAVOX. We fielded the first tactical anti-jam system 25 years ago. And we've kept the improvements coming. Today, Magnavox ECCM gives you the most Db's per dollar with Have Quick, Have Quick II, and Have Quick IIA.

Ask any one of our 20,000 system users. Find out what it takes to deliver an MTBF of 2,800 hours ... in an F-15. Discover how the Magnavox "slice system" adds performance — without Group A modifications. Learn what our inherent data capabilities can do for you.

Then you'll know why Have Quick is the Tri-Service standard. Have Quick. Have Quick II. Have Quick IIA. For the Air Force, the Army, the Navy, the Marines and NATO.

For ECCM protection that breaks the noise barrier ... there's Have Quick today. Get it from the A/J leader...

A Subsidiary of Magnavox Government & Industrial Electronics Co.
1313 Production Road, Fort Wayne, IN 46808 USA
Telex 22-8472 • TWX 810-332-1610

Magnavox
Electronic Systems Company


AEROSTRENGTH
GETTING SATELLITES OFF TO A FLYING START.
Hercules Aerospace is adding a unique dimension to America's unmanned space launch capability. Along with providing solid propulsion for Delta II and Titan IV space boosters, we are co-developing with Orbital Sciences Corporation the revolutionary Pegasus™ air-launched space booster that places small satellites into orbit at significantly lower cost than ground-launched systems.
Launched from an aircraft, Pegasus will employ Hercules solid rocket motors to place in orbit scientific and commercial payloads that weigh up to half a ton. Payload capacity is enhanced by our lightweight composites that make up the vehicle's motor cases, delta wing, fins and payload fairing.
Supplying solid propellant boosters for space transportation is just one of the strengths of Hercules.
Our solid propulsion systems are also mainstays of America's tactical and strategic missiles. Hercules powders and propellants are used extensively in a wide range of ordnance. And we lead the nation in the production and use of graphite fiber.
Today, over 75,000 commercial and military aircraft rely on our Simmonds® electronic subsystems for fuel measurement, engine ignition, flight control or instrument display. And Hercules defense electronics range from ECM jammers and MMW seekers to integrated support systems and automated test equipment.
Hercules Aerospace Company
Wilmington, Delaware 19894
HERCULES
A Hercules Incorporated Company

the Chief consisted of not only space experts within the Air Force but also operators from our flying commands—SAC, TAC, and MAC. So the first principle of that panel—that 'spacepower will be as decisive in future combat as airpower is today'—was a conclusion reached by airpower advocates and is, in my view, incredibly farsighted. It clearly will be the basis for some fundamental doctrine and strategic studies over the next few years."

Mr. Aldridge can take great credit for the corporate Air Force's willingness to welcome space fully into the fold. Throughout his nearly eight years as Under Secretary and then Secretary of the Air Force, he acted and spoke out steadfastly in behalf of the service's stewardship of space. He was also instrumental in the USAF-led military space program's solid comeback from the *Challenger* disaster of January 1986 and the surrounding series of accidents to unmanned space boosters and their vital payloads.

Mr. Aldridge saw space as the key to the Air Force's future and was concerned about the staying power of the service's commitment to it. He feared that USAF would back away from programming and funding vital space systems as defense budgets became tighter and tighter.

Last year, as Secretary of the Air Force, Mr. Aldridge assessed the situation at one point as follows:

"The Air Force has had a thirty-year history of space leadership. But it's not yet complete. Yes, we have a massive space-launch complex system, a worldwide space-tracking network, a competent space acquisition agency, and an effective space operational component [Air Force Space Command] in Colorado Springs.

"But what we have *not* had is an all-Air Force commitment to space just like we have for air superiority, airlift, air defense, and strategic bomber and missile missions.

"There has been an invisible barrier that has existed between the 'them' in the space community and the 'us' in the rest of the Air Force."

Even as he spoke, Secretary Aldridge had long since moved to do something about his concerns. In early 1987, he and General Welch agreed on the need to summon all Air Force four-stars to Washington for an exhaustive briefing and brainstorming session on space. That meeting came to pass in April of the year, immediately following the regularly scheduled Corona conference of four-star commanders at Homestead AFB, Fla.

"At the end of the meeting," Mr. Aldridge now recalls, "we came to the conclusion that the Air Force didn't have its act together about space. We decided we were not being aggressive about space, but that the other services were. So we agreed to take action."

General Welch put together a team to determine (1) where the Air Force was going in space and (2) where it should be going in space and what it would need to do to get there. The first part was assigned to a steering group led by Air Force Vice Chief of Staff Gen. Monroe Hatch and made up of the Vice Commanders of all operational commands, along with Lt. Gen. Donald Kutyna, Commander of Air Force Space Command. The second part was assigned to a group of officers under the direction of Maj. Gen. Harold Todd, Commandant of the Air War College.

"The whole purpose," recalls Mr. Aldridge, "was to determine the role of the Air Force in space and the role of space in the Air Force."

One major conclusion of the study was that "the future of the Air Force is inextricably tied to space," Mr. Aldridge says. Another: "The Air Force should not be the exclusive agent for space activities. If others have missions requiring satellites, they should be free to build them.

"But because the Air Force has such a tremendous space acquisition and launch infrastructure, it should be the service of preference in building multimission, multiservice satellites, such as Milstar."

As a result of the top-level analysis, the Air Force has moved to permeate its ranks with space experts. Formerly, officers graduating from USAF's three-year-old undergraduate space training course at Lowry AFB, Colo., were assigned almost exclusively to Air Force Space Command. Now they are being dispersed throughout the staffs of all operational commands.

Blue-suiters are being brought up to speed on space at the Pentagon, too. "The word around the Air Staff these days is, 'You'd better know something about space,'" notes Mr. Aldridge.

Evidence of this is perhaps most striking in the Pentagon shop of Lt. Gen. James McCarthy, Air Force Deputy Chief of Staff for Programs and Resources, who has set up a panel of officers to handle space just as other XO panels handle airlift or whatever.

At two Corona meetings of top Air Force commanders last year, space came in for special attention. Coordination of space matters at the Pentagon is being refined. Space training courses are being expanded.

In short, says Mr. Aldridge: "Space is now incorporated in the organizational structure of the Air Force." He is persuaded that the barrier between the space community and the rest of the Air Force "has been eliminated."

The new Air Force space policy divides USAF's role in space into four parts, as follows:

- **Space Control.** This means acquiring and operating antisatellite (ASAT) capabilities, providing battle management and C^{3}I, and integrating and using ASAT and space surveillance systems.
- **Force Application.** Should the US political leadership ever decide to deploy an SDI-type ballistic missile defense (BMD) system, the Air Force would acquire and operate the system's space-based segment and assets, see to its battle management and C^3, and integrate its forces.

This section of the policy statement also makes it clear that the Air Force intends to be in charge of any US warfighting in or from space, saying: "The Air Force will acquire and operate space-based weapons when they become a feasible and necessary element of our force structure."

- **Force Enhancement.** USAF will continue to acquire and operate space-based systems for navigation, meteorology, tactical warning and attack assessment, nuclear detection, and multiservice and defense-wide communications.

This section says: "The Air Force will continue to support the multiservice approach to conducting space surveillance and providing mission-unique, space-based communications. The Air Force will acquire and operate a space-based wide-area surveillance, tracking, and targeting capability and will provide space-based means for space surveillance."

- **Space Support.** "The Air Force will continue its long-standing role as the provider of launch and common-user, on-orbit support for the Department of Defense."

The policy statement concludes: "Based on its heritage, expertise, and infrastructure, the Air Force remains uniquely capable of conducting Department of Defense space activities. Just as we have in the past been the major provider of air forces for this nation's defense, the Air Force will in the future be the major provider of space forces for this nation's defense. It is the responsibility of each Air

Force member to make this goal a reality."

Such assertive confirmation of the Air Force's commitment to space should serve to quiet, at least for now, critics both outside and inside the service who have expressed doubts about that commitment in the past. Mr. Aldridge recalls that the Air Force was accused of not having charged ahead strongly enough at various times in support of such space systems as its F-15 ASAT missiles, Global Positioning System (GPS) navigation satellites, Milstar communications satellites, and space-based radars.

The main reason for the criticism was the tendency of the Air Force to cut back or put off funding for all those space systems each year in establishing overall procurement and development priorities. It was no secret that the soaring cost of the Milstar program—paid for by the Air Force but intended to be of enormous benefit to all the services—provoked considerable sentiment against it on the Air Staff. It was seen there as siphoning off money that could be better spent on, say, F-15 fighter procurement.

This attitude made some top officials in space and C³I circles in the Office of the Secretary of Defense rail in private against USAF. The OSD staff also came after the Air Force in 1987 for the service's allegedly lukewarm support of the ASAT program.

In fact, the Air Force gave up on that program only after Congress repeatedly refused to allow further testing of the ASAT in space. In an empty gesture, Congress then lifted the testing ban.

Now the ASAT matter is again on the agenda, but the Air Force is less intimately and immediately involved. OSD has set up a triservice program to devise a family of progressively more potent ASAT weapons. It has assigned the Army to take the lead in building the first one—a ground-launched, and maybe ship-launched, missile like the one that the Army has already developed and partially tested, called ERIS (Exoatmospheric Reentry-vehicle Interceptor Subsystem), in the SDI program for defense against ballistic missiles.

ASAT advocates expect better fortune on Capitol Hill this time around. To carry the day, they are counting on a multiservice lobbying effort, which was lacking before, to convince the lawmakers that the Soviet space threat grows more ominous even as US space assets become ever more costly, more vital to national security, and more in need of an ASAT weapon to protect them against attack. In any case, some space buffs at the Pentagon hopefully suspect that congressional resistance to ASAT weapons as potentially destabilizing has been worn down and that anti-ASAT solons will find the ERIS-type ASAT more familiar, and less threatening, than they did its fighter-launched forerunner.

The Navy will lobby for an ASAT, but is not all that wild about the Army's kingpin status in the program. The Navy had laid claim to become the lead service on grounds that it has the greatest need for such a weapon—to shoot down, if war comes, the ubiquitous Soviet radar ocean reconnaissance satellites (RORSATs) and electronic ocean reconnaissance satellites (EORSATs) that orbit over the seas like clockwork to keep track of US warships for targeting purposes. Lately, some of those spy satellites have been launched into much higher orbits, and so have some other types of Soviet satellites.

So it may be just as well that the US fighter-launched ASAT weapon has given way to one described by former Defense Secretary Frank C. Carlucci, just before he left office last January, as capable of "reaching higher altitudes" within "shorter response times."

The Air Force seemed unruffled by the Defense Acquisition Board's tapping of the Army. USAF has no objection to either of the other services building an ASAT weapon. As General Welch explains: "I think we'll have a proper division of labor on ASATs. The Army has long-standing interest in landbased systems for defending CONUS. In any event, the command and control of all ASAT systems will still fall to the Air Force."

The Air Force reserves the right to be in charge of all ASAT mission planning, launching, and battle management, no matter which service builds the weapon itself. Its stance toward the Army, in the words of one USAF officer, is: "If they want to build a bullet, fine. But fire it? No."

This is said to have nothing to do with service parochialism, but rather with the reality that the Air Force already operates the satellites and other systems that would be essential to ASAT battle management and command and control. Moreover, claims USAF, it would naturally fall to North American Aerospace Defense Command (NORAD) and Air Force Space Command as a component of US Space Command to do the surveillance, tracking, and post-attack assessment that an ASAT force would require as combat support.

Laser weapons may someday emerge as ASATs. The Air Force and the Navy are developing such directed-energy weapons in the new triservice ASAT program. Work on lasers powerful enough to be lethal weapons has been a major thrust of the SDI program and may yet bear fruit in a missile-defense system. But many defense aficionados, such as former Defense Secretary Harold Brown, have long claimed that the high-energy laser would first find a home in the military as an ASAT weapon. It is feared that the Soviet Union, which has long possessed a fairly primitive but nonetheless operationally ready, hit-to-kill ASAT, now has lasers that can range far higher.

As part of the US ASAT program, USAF plans to upgrade and expand its space-surveillance systems and its means of identifying and targeting hostile spacecraft. It will set up a new program office, says General Moorman, "to apply our years of expertise in meeting the challenges of surveillance, battle management, C³, and systems integration."

He adds: "I believe that, this time, the renewed activities to develop an operational ASAT capability will be fruitful. I base my optimism on the fact that we not only have broad DoD interest in doing so, based on a clear recognition of the Soviet space threat, but also a strong operational pull from USCINCSPACE."

General Moorman's reference was to Air Force Gen. John L. Piotrowski, Commander in Chief of the unified US Space Command. As "the CINC who will operate an ASAT system," General Piotrowski "has had a significant impact on DoD and the Congress with his persuasive advocacy and compelling rationale for building one," General Moorman declares.

It is doubtful that anyone hails the Air Force's embrace of space more heartily than does General Piotrowski. He has been saying all along that spacepower will be as critical to the success of future military operations as seapower and airpower are today.

General Piotrowski has long emphasized that "space is a joint arena, and the systems that operate there serve all our warfighting commanders."

He also has long contended that, as he once put it, "space is central to the future of the United States Air Force." Now it is clear that the Air Force as a whole has come to agree. ■

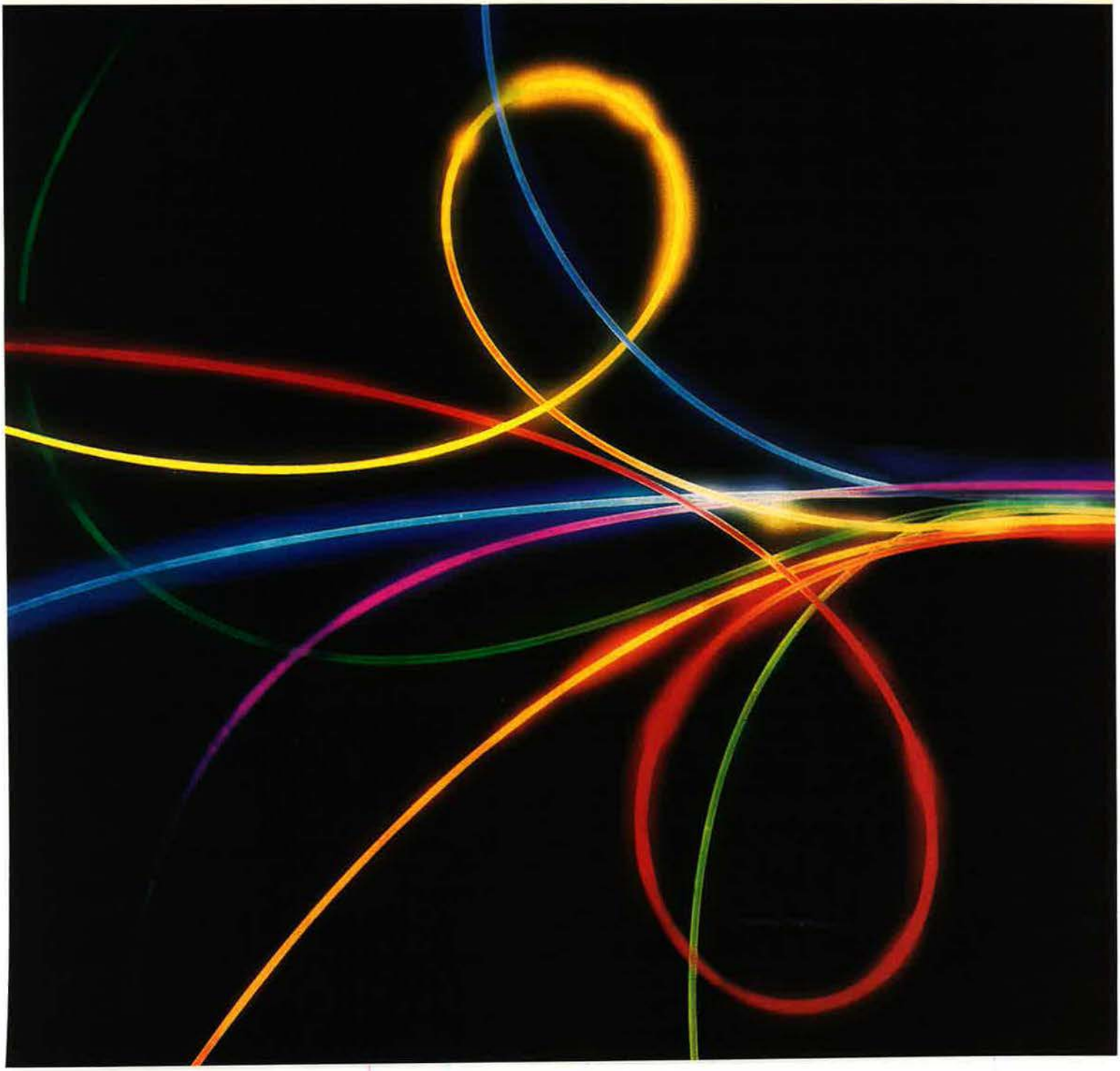
WE BEND THE SPECTRUM TO YOUR WILL.

From DC to light, Sanders signal exploitation lets you shape the electromagnetic spectrum into a full range of both passive and active systems.

Sanders signal processing systems use the latest digital and analog techniques, software and hardware to give you the most advanced capabilities available today. Sanders provides surveillance, tactical systems and countermeasures for the U.S. Armed Forces and government agencies, plus allied governments. You'll find our systems at shore sites, on ships, submarines and land vehicles, as well as aircraft and spacecraft.

When you seek the most capable processing equipment for any kind of signal, you'll find nobody is more flexible than Sanders at finding cost-effective ways to bend the spectrum to your will.

Sanders
A Lockheed Company



Capitol Hill

By Brian Green, CONGRESSIONAL EDITOR

Washington, D. C.

Carlucci on Congress

Outgoing Secretary of Defense Frank Carlucci, in his final annual report to Congress, said that reform of the budget process could save up to $10 billion a year. He blasted Congress for "duplication of effort" and micromanagement that "precluded the Department [of Defense] from receiving the necessary level of defense resources on a timely basis."

Secretary Carlucci was critical of the vague delineation of responsibilities between the Armed Services and Appropriations committees, giving rise to persistent turf battles that disrupt the legislative process. He said that micromanagement "hindered our flexibility in allocating resources and executing programs in ways designed to improve efficiency and effectiveness."

He identified biennial budgeting, multiyear procurement, stable and economic production rates, and modest real growth as keys to achieving the savings.

Aspin on Strategic Modernization

Rep. Les Aspin (D-Wis.), Chairman of the House Armed Services Committee, proposed a long-range approach to planning and financing strategic modernization. His plan includes a planning horizon of up to ten years, a "money pot" into which all strategic program and operations funding would be placed, and a spending freeze for strategic forces. He pegged strategic funding in FY '89 at $31 billion.

Representative Aspin maintained that such a broad view would permit innovative trade-offs and compromises, avoid the partisan deadlocks over strategic programs that created a logjam in the ICBM modernization program, and avoid funding peaks and valleys that won't fit into constrained defense budgets. The one compromise profile he discussed in some detail gave highest priority to the Midgetman SICBM—a program closely identified with congressional Democrats and one not funded in the FY '90 Reagan defense budget. Skeptics note that very few compromise agreements in Congress endure for a decade, and that such a long-term, broad approach omits a near-term commitment to deployment of particular strategic programs, potentially reducing US leverage at strategic arms negotiations.

"Cat-Scam" Legislation

Several bills have been introduced to repeal or modify the Medicare Catastrophic Coverage Act of 1988. The act imposes an annual fifteen percent tax surcharge, up to a maximum of $800, to finance federal insurance for the costs of catastrophic illness. People who receive only Social Security income are exempt from the surcharge. The first tax bites will be felt in April. The measure is very controversial among retired military people who will pay the maximum surcharge.

Two measures, one sponsored by Rep. Harris Fawell (R-Ill.) with fourteen cosponsors, and one sponsored by Rep. Don Ritter (R-Pa.), would repeal the measure. Another, introduced by Rep. Marilyn Lloyd (D-Tenn.), would limit application of benefits and premiums to those voluntarily enrolled in the catastrophic coverage plan. A fourth measure, introduced by Reps. Bill Archer (R-Tex.) and Rod Chandler (R-Wash.), would delay implementation of the Act by one year and establish a bipartisan commission to review it.

FY '90 and '91 Budget Introduced

The final Reagan Administration defense budget sent to Congress calls for DoD budget authority (BA, the amount that can be obligated to be spent) of $305.6 billion in Fiscal Year (FY) 1990 and $320.9 billion in FY '91. Total BA requested, including defense spending by the Department of Energy and other defense-related agencies, is $315.2 billion and $330.8 billion in FY '90 and '91 respectively. The BA requests represent successive two percent real (*i.e.*, adjusted for inflation) increases. DoD outlays (the amount actually spent in a given fiscal year) are projected at $293.8 billion in FY '90 and $304.7 billion in FY '91. The two-year budget plan contains no major program cancellations or force reductions, unlike the FY '89 spending package. The new five-year defense plan (FYDP) reflects $313 billion in cuts over the FYDP proposed in January '87.

The budget submission includes a 3.6 percent military pay raise in FY '90 (not the 4.1 percent reported earlier by a Pentagon spokesman), a 3.2 raise in FY '91, 2.0 and 3.0 percent civilian pay raises, and real increases in procurement spending of three and six percent. R&D spending is slated to grow about four percent over the two-year span. The Air Force share of the budget request is $100.5 billion in FY '90, up about three percent from the FY '89 level of $94.6 billion and $106.6 billion in FY '91.

The new Bush Administration defense team is widely expected to revise this budget proposal, probably downward. Because of the slow pace of the Pentagon transition, however, the content or form of any amendment to the Reagan proposal remains unclear.

Few Capitol Hill pundits believe that two percent growth will be approved by Congress. Most believe that the downward trend in defense budgets will continue and that the best DoD can hope for in the foreseeable future is an inflation-adjusted freeze.

Defense Subcommittees

The new Democrats on the Senate Appropriations Committee Defense Subcommittee are Sen. Dale Bumpers (D-Ark.), Sen. Frank Lautenberg (D-N. J.), and Sen. Tom Harkin (D-Iowa). All three have the reputation of being skeptical of Pentagon policies and program requests.

Sen. Phil Gramm (R-Tex.) has been named to fill the Republican opening on the committee. He will serve on the full committee but not the subcommittee. Sen. Arlen Specter (R-Pa.) took over the subcommittee seat. Senator Specter is generally considered a tougher critic of DoD than is Senator Gramm. ■

Superior Simulation Technology.

USAF Weapon System Trainers from CAE Electronics.

Incorporating the most advanced simulation technology available today, six CAE C-5B Weapon System Trainers (WST) have made a key contribution to the outstanding success of the U.S. Air Force's Military Airlift Command Aircrew Training System.

Delivered to Altus, Travis and Dover Bases, all six CAE WSTs were ready-for-training on schedule and on budget.

Now operating up to 20 hours per day, seven days a week, with 99% plus availability, the WSTs feature CAE's digital control loading and sound systems, weather radar, and self-diagnostic Computerized Test System. CAE WSTs are the world's first military simulators built to FAA Phase II standard, bringing a new dimension of fidelity and precision to USAF training. Ask any C-5B pilot about the difference CAE makes.

Superior aircrew proficiency demands superior training technology. Why risk getting anything less from your investment, or your aircrews?

With over 35 years of leadership in the evolution of customized flight, tactics and mission simulation technology, we're ready for the next generation of aircrew training systems.

CAE ELECTRONICS LTD.

cae

A subs diary of CAE Industries Ltd.

C.P. 1800 Saint-Laurent, Québec, Canada H4L 4X4 Tel. (514) 341-6780 TLX 05 824856 TWX 610-422-3063 FAX (514) 341-7699

Aerospace World

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Washington, D. C.

★ What many people figured could never happen is on the verge of becoming a reality. The Department of Defense's Commission on Base Realignment and Closure announced on December 29 that it had selected 145 DoD installations for closure, partial closure, or realignment. No bases or installations have been closed since 1977.

Secretary of Defense Frank Carlucci approved the entire list on January 5 and said he would request $1 billion in FY '90–91 DoD budgetary funds to implement the moves quickly. The list was forwarded to both the House and Senate Armed Services Committees, which will have forty-five days from March 1 to accept or reject the entire list. No changes can be made.

If the recommendations are approved (which is expected), closures and reductions can begin in 1990. All actions must be completed by September 30, 1995. The twelve-man commission was restricted to a six-year payback period on bases to be closed—that is, the cost of closing a base had to be fully recovered through savings within six years.

Eighty-six bases are to be closed, five partially closed, and fifty-four installations realigned. These moves are expected to result in annual savings of $639 million and a twenty-year net present value of $5.5 billion.

The Air Force got off relatively lightly, with only five bases—Norton, George, and Mather AFBs in California, Chanute AFB, Ill., and Pease AFB, N. H.—selected for closure. Plans are already under way to convert Pease to a commercial airport. Five other bases—Cannon AFB, N. M., March AFB, Calif., McChord AFB, Wash., Mountain Home AFB, Idaho, and Sheppard AFB, Tex.—were selected for consolidations that will result in significant increases in personnel.

Somewhat surprisingly, Loring AFB, Me., which was thought to be high on the list for closure, was unaffected. Loring was left off because closing the base, which is near the Canadian border, would not have paid for itself within the mandated six years.

A small number of Navy installations was selected for closure or realignment—or simply not building, as in the case of the planned new naval station at Hunters Point in San Francisco, Calif. The Army bore the brunt of the closings, with seventy-two bases or facilities to close completely and four more to close partially. Other facilities, such as the Defense Mapping Agency facility in Herndon, Va., and the Salton Sea Test Base in California, were also included in the Commission's recommendations.

Lockheed was selected to build the Navy's new Long-Range Air Antisubmarine Warfare Capable Aircraft (LRAACA). Although similar in appearance to the Navy's current P-3 patrol plane, LRAACA will have only about twenty percent commonality with its predecessor. Requirements call for 125 aircraft. Deliveries to the Navy are scheduled to begin in 1994.

★ The Navy plans to replace its venerable Lockheed P-3C Orion patrol/antisubmarine warfare aircraft with a much-improved variant of the P-3. The Defense Acquisition Board (DAB) agreed with the Navy's recommendation of Lockheed's design for the new Long-Range Air Antisubmarine Warfare Capable Aircraft (LRAACA) in early January. Lockheed Aeronautical Systems Co., Burbank, Calif., was then given a $52 million contract to begin full-scale development (FSD).

LASC's LRAACA proposal was chosen over a McDonnell Douglas propfan design based on its MD-87 airliner and an entry from Boeing based on its 757-200 commercial transport last October, but FSD could not begin until the DAB gave its approval. In the interim, Lockheed was given a $200,000 contract for engineering analysis.

The Navy will require 125 LRAACA through 2001. The total potential value of the program is approximately $4.9 billion. Lockheed will build two prototypes, one for airframe test followed by avionics testing, and a second aircraft to be used for Navy technical and operational evaluation. Full production is scheduled for 1992, with the first delivery to the Navy in 1994. Initial operational capability with the aircraft is set for 1995.

The aircraft will be powered by four 5,000-horsepower-class General Electric GE38 turboprop engines with Hamilton Standard five-blade composite propellers. The aircraft will have only about twenty percent commonality with its P-3 predecessors. LRAACA's primary structures will take advantage of new alloys that have improved corrosion and crack resistance.

The aircraft will make use of the Navy's Update IV avionics suite while still having room for future growth. LRAACA's air-conditioning system will allow crew members to work in comfort and will provide increased cooling for the avionics. The new aircraft will also offer a forty percent reduction in cabin noise over the P-3.

The new patrol aircraft will be able to carry 150 sonobuoys internally, with provision for 150 more in preloaded wing pods. LRAACA will have a 200-inch-long weapons bay and provision to launch AGM-84 Harpoon antiship missiles.

★ Another of this column's periodic roundups of missile happenings:

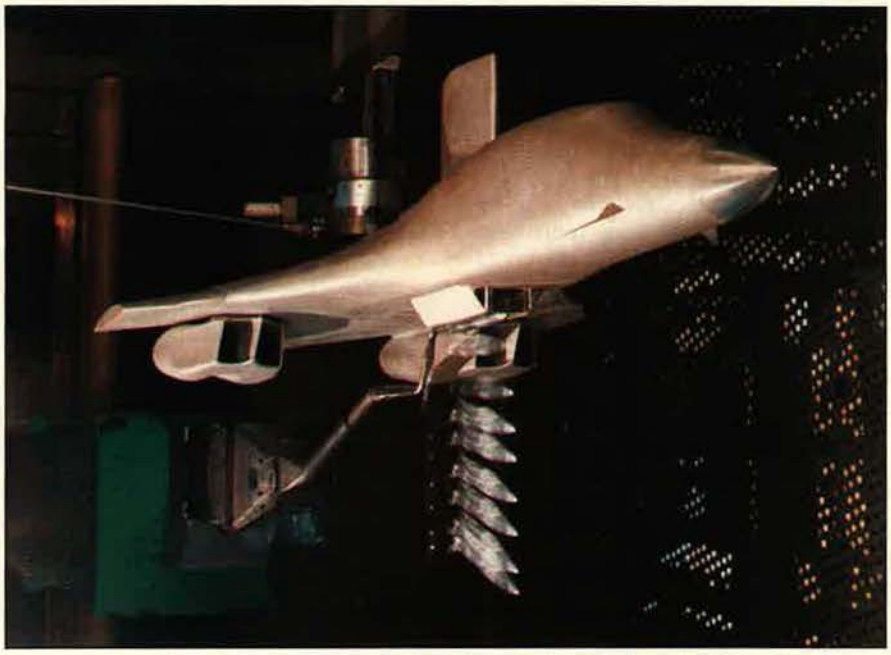
The Northrop AGM-136A **Tacit Rainbow** successfully completed its first test launch from a B-52 on January 10. The eight-foot-long missile was launched from a Boeing-built rotary launcher designed specifically for Tacit Rainbow (also a first). It homed in on and attacked a radar emitter at the Naval Weapons Center test range at China Lake, Calif.

Another antiradiation missile, the Boeing **Seek Spinner,** successfully carried out its first free flight in early December. The missile, based on the Boeing Brave 200 unmanned aerial vehicle, was launched from a container, flew along a preselected path, and performed a high-speed dive. The flight lasted one hour and twenty minutes. Tests of the propeller-driven Seek Spinner for the Air Force were funded in 1987.

Hughes won the first round of head-to-head competition with Raytheon for construction of AIM-120A advanced medium-range air-to-air missiles **(AMRAAMs).** Air Force Systems Command's Armament Division at Eglin AFB, Fla., awarded Hughes a $172.9 million contract for long-lead funding of 534 AMRAAMs (fifty-nine percent of the 906-missile FY '89 buy), while Raytheon received a long-lead contract of $106.5 million for the remaining 372 AIM-120As.

This Lot III buy was almost 400 AMRAAMs fewer than anticipated, because the Air Force wanted to wait until aerodynamic problems encountered on captive-carry flights on F-15s and control section waterproofing problems with the missile were solved.

The aerodynamic problem (basically, abnormal fin flutter) will be solved by the use of a stronger attachment pin. This, in turn, may necessitate the use of a wrench to reattach the fin when the missile is removed from storage, a requirement the Air Force sought to avoid. The corrosion problem in the control section will be fixed either by a change in coating of the affected parts or by changing the plating used on them.



This multiple-exposure picture shows the trajectory of a Boeing AGM-131A Short-Range Attack Missile II (SRAM II) as it is released from a B-1B weapons bay in the wind tunnel at AFSC's Arnold Engineering Development Center, Arnold AFB, Tenn. Engineers used 1/10-scale models and varied wind speeds and angles for the test. Test pilots once performed such tests in actual flight; the missile, whose trajectory was unpredicted, risked hitting the aircraft.

The third successful guided firing of a Raytheon-built AIM-120 was carried out on December 9 over the Gulf Test Range at Eglin. The missile was fired from an F-16C traveling at Mach .94 at 21,000 feet. The QF-100 drone was flying at Mach .87 at 23,000 feet. The missile scored a direct hit. The overall AMRAAM success rate is running at approximately eighty percent.

The Navy has nearly completed pad tests of the Lockheed UGM-133A Trident II, or D5, sea-launched missile. Shown is an early test missile being launched from Cape Canaveral AFS, Fla.

Hughes delivered the first production AGM-65F and AGM-65G **Maverick** missiles to the Navy and Air Force, respectively, in late December. The F-model software has been adapted for effectiveness against ships. The G-model will be used by the Air Force against high-value land targets. Both versions use infrared guidance and a 300-pound blast/fragmentation warhead. The AGM-65G also has a digital autopilot.

The Defense Acquisition Board approved concept definition of a **conventionally armed cruise missile** for the Air Force and Navy on December 20. The Navy will act as the lead service on the effort, and work will begin later this year. The Navy's project is called the advanced sea-launched cruise missile (ASLCM), while the Air Force initiative is called the long-range conventional cruise missile (LRCCM). The two missiles will be similar in size and will have a range of approximately 2,000 miles. The missiles will not be fielded until after the year 2000.

The Navy has successfully carried out two more test launches of the Lockheed UGM-133A **Trident II,** or D5, sea-launched ballistic missile.

Both the December 16 and January 9 tests were carried out from Launch Complex 46 at Cape Canaveral AFS, Fla. The missiles hit in the Eastern Missile Test Range in the Atlantic. These were the fourteenth and fifteenth successes in seventeen valid test launches. One other shot was ruled a "no test." There will be one more pad launch before a series of test firings from the USS *Tennessee* (SSBN-734) later this year.

Success Note of the Month: Since Army production lot-acceptance testing of Martin Marietta-built AGM-114 **Hellfire** antitank missiles began in December 1987, there have been 107 direct hits in 107 tests. The missiles are randomly selected from each monthly production lot of approximately 400 Hellfires, and the rounds are vibrated and subjected to temperature extremes before being launched. Rockwell is the lead producer of AGM-114s.

Finally, Israel Aircraft Industries and Lockheed Missiles & Space Co. have teamed to work on any programs resulting from IAI's ongoing **Arrow** antitactical ballistic missile (ATBM) program. The US Strategic Defense Initiative Organization (SDIO) awarded IAI a $158 million contract last year to develop, manufacture, and flight-test the Arrow ATBM concept. Twenty percent of the funding for the experiment is being provided by the Israel Ministry of Defense. The test will be conducted on an Israeli test range some time before 1991.

★ **HONORS**—Two aerospace-related projects, the **Bell-Boeing V-22 Osprey** tilt-rotor aircraft **and Martin Marietta's *Magellan*** spacecraft, were among the ten projects honored by the National Society of Professional Engineers in its twenty-third annual **Outstanding Engineering Achievement Awards** competition. The V-22 is the world's first production aircraft able to take off and land like a helicopter and fly like an airplane. *Magellan,* scheduled for launch this April from the Space Shuttle *Atlantis,* will orbit Venus and send images back to earth.

The Air Force Academy's **Wings of Blue parachute team captured its seventeenth national collegiate title** during competition in late December. There were eighty-five participants from colleges all over the US in the meet. Cadet Jim Travis, a senior, took first in all three individual events (style, accuracy, and free-fall) to claim the Overall Collegiate Parachuting Champion award.

The new **Visitor's Center** at the Air Force Academy **was awarded the "Secretary of Defense Blue Seal Award" as 1988's most outstanding design in military construction.** Two other Air Force projects, the unaccompanied enlisted housing complex at Fairchild AFB, Wash., and the aircraft maintenance facilities at Offutt AFB, Neb., were honored with two of the nine "Excellence in Design" awards that were also presented. The entries were judged on design, appropriate use of materials, cost-effectiveness, and environmental compatibility.

★ **PURCHASES—Loral Systems Manufacturing Co.'s ALR-56M was chosen** over Litton's ALR-74 **to be the Air Force's new Advanced Radar Warning Receiver** (ARWR) in late December. Air Force Systems Command's Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio, awarded a $20.4 million contract for nineteen ARWRs that will be fitted to F-16C/D and RF-4C aircraft. Contract options call for 673 ARWRs, spares, and a warranty through FY '92. The ARWR is a passive electronic system able to detect enemy radar emissions and to display to the pilot the radar type and its approximate range and bearing. This contract is the first major "award without discussions" made under Air Force Systems Command's new streamlined source-selection policy.

In mid-December, the **Air Force ex-**

Last December 10, Maj. Gen. John E. Griffith, director of operations and logistics for US Transportation Command at Scott AFB, Ill., celebrated his fortieth consecutive year of active duty in the Air Force. He enlisted as a private in 1948 and was commissioned in 1956 after graduating from Officer Candidate School. He says he is still having fun and has no immediate plans for retirement.

—USAF photo by 1st Lt. Eric W. Schnaible

TSgt. James Austin (right), 38th Tactical Missile Wing's ground defense deputate, tallies the results of a shooting match with a French soldier from a nearby caserne. The 38th TMW, based at Wüschheim AS, Germany, sponsored the meet, which drew more than 150 participants from local NATO military units, Polizei corps, and Seventeenth Air Force and USAFE law-enforcement units to compete in .38-caliber, M16, and 9-mm events.

ercised its last production option with McDonnell Douglas **for six more Delta II medium-launch vehicles.** The contract option, for $119 million, brings the number of Delta IIs ordered under a 1987 contract to twenty. The boosters will be built at the company's plant in Huntington Beach, Calif., and assembled at the facility in Pueblo, Colo., before they are shipped to Cape Canaveral AFS, Fla. The Delta IIs will be used primarily to launch Global Positioning System (GPS) satellites.

The Navy selected **General Dynamics's Electric Boat Division,** Groton, Conn., over Newport News (Va.) Shipbuilding and Drydock Co. **to build SSN-21, the lead boat in the new *Seawolf* class of attack submarines** on January 9. The $726 million contract calls for completion of SSN-21 in May 1995. The two companies will compete for each of the other twenty-eight submarines now called for by the *Seawolf* program. SSN-21 was designed by Newport News SBDD, and the reactor was designed by Electric Boat. Construction of the current *Los Angeles*-class attack boats will end in FY '91.

★ **DELIVERIES**—The **first operational** McDonnell Douglas **F-15E** Eagle **was delivered to Seymour Johnson AFB, N. C.,** on December 29. The aircraft is the first of twenty-four F-15Es that will be delivered to the 4th Tactical Fighter Wing's 336th Tactical Fighter Squadron by October in order to meet the Air Force's initial operational capability date. The 4th TFW will eventually receive seventy-two of the dual-role fighters. In a related note, McDonnell Douglas received an $880 million contract in mid-December for forty-two F-15Es. The aircraft are to be delivered by May 1991.

The first operational McDonnell Douglas F-15E Eagle roars skyward with its afterburners lit on one of its first flights after being delivered to the 4th Tactical Fighter Wing at Seymour Johnson AFB, N. C. The 4th TFW will eventually receive seventy-two of the dual-role fighters.

The **Air Force Air Defense Weapons Center** at Tyndall AFB, Fla., **accepted the first** of two **E-9A** airborne platform telemetry relay aircraft on December 9. The aircraft, a highly modified de Havilland Dash-8, will be used for low-altitude, over-the-horizon telemetry gathering during missile tests and also for sea surveillance in order to keep boats out of the Gulf Test Range during tests. The aircraft is equipped with a five-beam, electronically steerable, seventy-five-square-foot phased-array telemetry antenna capable of automatically detecting, tracking, and relaying data simultaneously from five distinct sources traveling at speeds of Mach 5 or greater. The Sierra Research Division of LTV developed the E-9's sensor suite.

The 475th Weapons Evaluation Group, based at the Air Force Air Defense Weapons Center at Tyndall AFB, Fla., recently received the first of two E-9A airborne platform telemetry relay aircraft. The de Havilland Dash-8's sensor suite was developed by the Sierra Research Division of LTV.

Boeing Military Airplanes Simulation and Training Systems division handed over six B-1B cockpit procedures trainers (CPTs) to the Air Force on December 16. Five of the trainers, which provide aircrews with initial familiarization on the B-1B's systems, are located at Dyess AFB, Tex. Three of the CPTs have been in use since 1987 and have already accumulated 10,000 training hours. Boeing will also deliver five weapon system trainers (WSTs), two mission trainers, and software support. The WSTs will have a state-of-the-art visual system and a six degrees of motion capability. The sophisticated WSTs will be delivered this summer.

The **first components manufactured by** the Indonesian company **IPTN were delivered to General Dynamics** in late December. The components made by IPTN relate to the thirty-five-percent offset of the flyaway price that was granted in exchange for the Indonesian purchase of a dozen F-16s. If all options are exercised, IPTN will deliver 3,476 F-16 components by 1996.

With the completion of the FY '86 deliveries of the AGM-88 High-speed Antiradiation Missile **(HARM)** in late December, **Texas Instruments marked its sixth consecutive year of on-time delivery** of the missile. TI has delivered well over 5,000 HARMs to the US Navy and Air Force and the Federal Republic of Germany, with deliveries being made at the rate of approximately 210 a month.

Space shuttle processing got a little

easier in late December, as **Lockheed Missiles & Space Co. delivered a handheld instrument that measures alignment and surface smoothness of thermal protection tiles** on the orbiters.

The new device, which uses a laser to measure the gap and surface match of each tile to an adjacent one, will reduce by half the 50,000 measurements required at the Shuttle Processing Center at the Kennedy Space Center in Florida to ready an orbiter for its next mission.

The **Soviet Union rolled out the new Antonov An-225 Mriya ("Dream") heavy lift transport** on November 30, and it made its first flight on December 21. The huge, six-engine, twin-tailed transport is a fifty percent scale-up of the An-124 Condor and is to be used primarily to carry the *Buran* space shuttle and Energiya launch booster components in piggyback fashion. If placed on a football field, the An-225's fuselage would stretch from one goal line to the far eight-yard line (275 feet), while its wingspan would go from the goal line to the far three-yard line (290 feet). The An-225 has a gross weight of 1,322,750 pounds. Although it is now the largest plane in the world, it is still not as tall as, nor does it have the wingspan of, the Hughes H-4 (the "Spruce Goose"), now in a Long Beach, Calif., museum.

GE's Over-the-Horizon Backscatter (OTH-B) radar enables these two Air Force operators to monitor the entire east coast of North America from the radar's operations center in Bangor, Me. Tactical displays like that at right show aircraft and flight plans within the radar's 180-degree, 1,600,000-square-mile coverage area. OTH-B will be turned over to the Air Force this fall.

★ **MILESTONES—Grumman Melbourne Systems Co. successfully carried out the first radar flight of** the Air Force/Army Joint Surveillance and Target Attack Radar System **(Joint STARS)** platform on December 22. The 6.4-hour flight of the E-8A (a modified Boeing 707-320) marked the start of the fourth phase of the two-year, full-scale development flight program. The first radar flight achieved the objective of verifying the digital steering commands that point the E-8's underslung phased-array antenna beam and the integrity of the high-power radar transmission elements in flight. The Joint STARS wide-area ground surveillance radar will be able to detect, locate, classify, and track both moving and fixed objects in all weather conditions. A total of twenty-seven test flights are planned.

Employees of the Planning Research Corp.'s Systems Services division and members of the Air Force Flight Test Center's 6510th Maintenance and Supply Group preflight an A-7 as part of the A-7 Seek Eagle program. AFFTC is believed to hold the A-7 safe flying record (fourteen years) for USAF, Navy, and the Air National Guard.

The **US Air Force Museum** at Wright-Patterson AFB, Ohio, **set a new attendance record** of 1,493,984 people **in 1988.** This marked the third consecutive year a record number of visitors passed through the turnstiles at the hangar-like buildings near Dayton. The previous records were 1,343,396 people in 1987 and 1,062,768 in 1986. The museum first hit the 1,000,000-attendee mark in 1972.

Air Force Space Command's new **Space and Warning Systems Center was activated** in late December. The center provides software development and computer operations for command and control centers in the underground Cheyenne Mountain (Colo.) complex, as well as other facilities operated by the North American Aerospace Defense Command and US Space Command. The center will have more than 450 military and civilian employees assigned there. They will be supported by more than 350 contractor employees.

The **A-7 Corsair II fleet at the Air Force Flight Test Center** (AFFTC) at Edwards AFB, Calif., **passed a safety**

milestone of epic proportion on December 1. AFFTC has now gone fourteen years without the loss of an A-7 or having an aircraft suffer foreign-object damage (FOD). This is believed to be the longest continuous safe flying period ever achieved by an Air Force, Navy, or Air National Guard unit flying the aircraft. The nine A-7s at Edwards have been flown on 15,064 sorties and have recorded 22,450 flight hours over the period. Much of the credit for the record goes to the employees of the Planning Research Corp. Systems Services division and the members of the 6510th Maintenance and Supply Group of AFFTC.

General Electric Aerospace successfully demonstrated the 180-degree capability of the East Coast Over-the-Horizon Backscatter **(OTH-B) radar** system late last year. The demonstration verified that the system can simultaneously detect and track targets off the entire east coast of the US. The radar, designated AN/FPS-118, is designed to provide long-range (500 to 2,000 miles from the antenna), wide-area surveillance (from Iceland to Cuba) of aircraft and cruise missile threats approaching North America. The East Coast OTH-B is located at three sites in Maine and will be accepted by the Air Force this fall. The West Coast OTH-B is under construction in Idaho. The Air Force also plans to locate an AN/FPS-118 in Alaska and one in the central US. These installations will cover the 500-mile gap between the east and west coast radar coverage and the North American landmass.

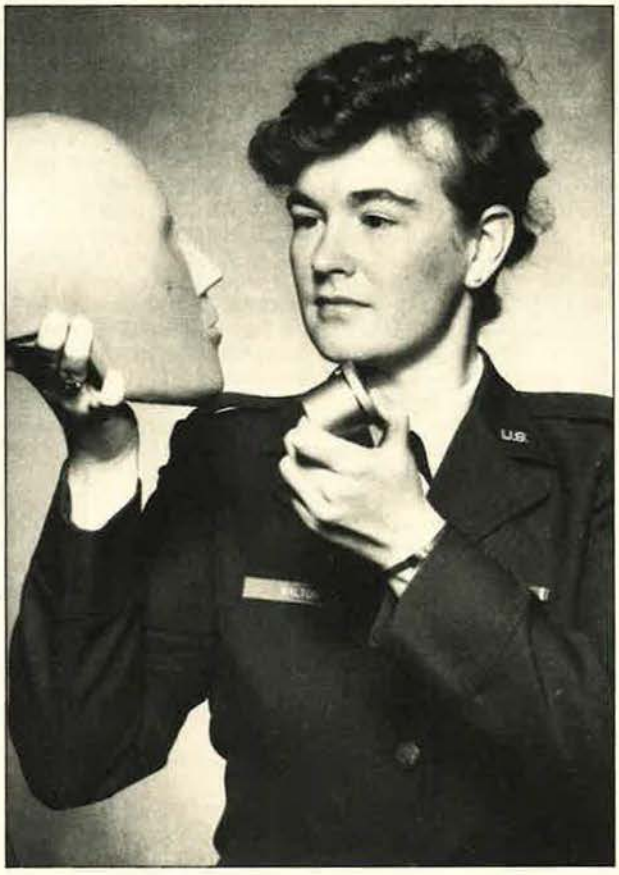
With the conversion of the 507th Tactical Fighter Group at Tinker AFB, Okla., **from F-4Ds to F-16A/Bs, the Air Force Reserve now has its first all-F-16-equipped wing.** The 507th TFG and its sister group, the 944th TFG at Luke AFB, Ariz., are part of the 419th Tactical Fighter Wing at Hill AFB, Utah. When conversion at Tinker is completed later this year, the 419th TFW will have sixty-six of the General Dynamics-built fighters.

★ **NEWS NOTES**—Congress has authorized the **Air Force to begin paying aviator continuation pay of up to $12,000 per year to eligible pilots** who agree to remain on active duty through their fourteenth year of active commissioned service. The bonus will be paid in varying amounts to fixed-wing pilots who are currently entitled to flight pay, who have completed their initial active-duty service commitment for undergraduate pilot training, and who have less than thirteen years of total active-duty service.

The **Department of Defense in-**

March Anniversaries

- *March 4, 1924:* The Army Air Service takes on a new mission—aerial ice breaking. Two Martin bombers and two DH-4s bomb the frozen Platte River at North Bend, Neb., for six hours before the ice clears.
- *March 5, 1939:* Using a hook trailing from their Stinson Reliant, Norman Rintoul and Victor Yesulantes demonstrate a nonstop airmail system by picking a mailsack off a pole in Coatesville, Pa.
- *March 30, 1939: Flugkapitän* Hans Dieterle sets a new world speed record of 463.97 mph in the Heinkel He-100V-8 at Oranienburg, Germany.
- *March 5, 1944:* British Brig. Gen. Orde Wingate's raiders, popularly known as Chindits, land at "Broadway," a site near Indaw, Burma, in a daring night operation. General Wingate would be killed nineteen days later in an airplane crash.
- *March 16, 1944:* The National Advisory Committee for Aeronautics proposes that a jet-propelled transonic research airplane be developed. This ultimately leads to the Bell X-1.
- *March 25, 1944:* Fifteenth Air Force closes the Brenner Pass between Italy and Austria. This mission, against the Aviso viaduct, is the first operational use of the VB-1 azon radio-controlled bomb.
- *March 2, 1949:* Capt. James M. Gallagher sets the B-50 *Lucky Lady II* down at Carswell AFB, Tex., after completing the first nonstop, round-the-world flight. The 23,452-mile flight took ninety-four hours and one minute and required four midair refuelings. The crew would later receive the Mackay Trophy.
- *March 4, 1949:* The US Navy's Martin JRM-2 flying boat *Caroline Mars* carries a record 269 passengers from San Diego to San Francisco, Calif. Also on this date, crews flying in the Berlin Airlift pass the mark of 1,000,000 tons of cargo hauled.
- *March 15, 1949:* Military Air Transport Service establishes Global Weather Central at Offutt AFB, Neb., for support of Strategic Air Command.
- *March 1, 1954:* The US successfully explodes its first hydrogen bomb in the Marshall Islands. The second hydrogen bomb would be exploded nineteen days later.
- *March 18, 1954:* Boeing rolls out the first production B-52A Stratofortress at its plant in Seattle, Wash. Production would continue until 1962.
- *March 3–13, 1969:* Air Force astronauts James McDivitt and David Scott, along with civilian Rusty Schweickart, carry out the first in-space test of the Lunar Module while in earth orbit during *Apollo-9*. The flight also marks the first time a crew transfer is made between space vehicles using an internal connection.



"Alas, poor Lieutenant Yorick. . . ." Lt. Christina Walton, project officer at the Air Force Weapons Laboratory at Kirtland AFB, N. M., strikes a pose from* Hamlet *with a sensor developed for the Strategic Defense Initiative's Wideband Angular Vibration Experiment. The Department of Transportation will install a smaller version of the sensor in the heads of test dummies to measure crash impact.

creased its share of contract awards to small, disadvantaged businesses **(SDBs)** from $4.3 billion in FY '87 to $4.8 billion **in FY '88.** The improvement is attributed mostly to stepped-up efforts to increase opportunities for SDBs. In a similar vein, **Air Force Logistics Command awarded $217.2 million** (or 2.4 percent of AFLC's total contract dollars) **to disadvantaged businesses.** AFLC awarded more than $1.7 billion to small business concerns in FY '88.

On another AFLC note, **most B-1B program management responsibilities were transferred to the Oklahoma City Air Logistics Center** at Tinker AFB, Okla., on January 1. Some tasks, including fixes for the bomber's ALQ-161 defensive avionics system, will remain with Air Force Systems Command's Aeronautical Systems Division at Wright-Patterson AFB, Ohio. ASD was responsible for the plane's development. The **B-1B birdstrike modification effort,** which strengthened areas of the plane's wings and fuselage, **was completed** by an Oklahoma City ALC field team on December 21.

Nine days after Navy F-14 Tomcats shot down two Libyan MiG-23s over international waters, **the Libyan government returned the body of Air Force Maj. Fernando Ribas-Dominicci,** whose F-111 was downed during Operation Eldorado Canyon, the 1986 attack on terrorist strongholds in Libya. The body of Major Ribas-Dominicci, who was thirty-three, was turned over to US officials at a military airfield outside Rome. After positive identification, the pilot's body was buried in his native Puerto Rico. There has been no word on the fate of Major Ribas-Dominicci's weapon systems operator, Capt. Paul Lorence.

Nose art is making a comeback in the Air Force, but one of the most recognizable unit markings from World War II is being put on current Army helicopters. **The famous shark's teeth and eye markings from the Flying Tigers** (the American Volunteer Group that was later absorbed by Fourteenth Air Force) **is being applied to** the McDonnell Douglas **AH-64 Apache attack helicopters of the 4th Battalion, 229th Attack Helicopter Regiment** now deploying to West Germany. The 4th/229th got permission from the Flying Tigers Association to use the markings, and the unit was activated as the "Flying Tigers Battalion." The 4th/229th is the third Apache unit to be stationed in Europe.

★ **DIED**—Retired Navy **Adm. A. Melville "Mel" Pride,** Naval aviation pioneer and one of its longtime leaders, on December 24. He was ninety-one.

A member of the small group of aviators who made the first test landings and takeoffs on the Navy's first carrier, the USS *Langley* (CV-1), in 1922, Admiral Pride is credited with developing the tailhook-and-wire cable arresting gear, which is still used today. During World War II, he was the first skipper of the light carrier USS *Belleau Wood* (CVL-24) and helped plan the invasion of Okinawa. Admiral Pride then served as chief of the Navy's Bureau of Aeronautics from 1947 to 1951. As commander of the Naval Air Test Center at NAS Patuxent River, Md., he was believed to have been the first admiral to pilot a jet. He retired in 1959.

Soviet **Col. Valentin P. Glushko,** the "father" of Soviet rocket engines, in early January, according to a January 12 announcement by the Soviet news agency, TASS. He was eighty-two.

Senior Staff Changes

PROMOTIONS: To be **General:** Michael J. **Dugan.**

To be **Major General:** James G. **Andrus;** Malcolm B. **Armstrong;** John L. **Borling;** Stephen B. **Croker;** Gerald A. **Daniel;** Lawrence E. **Day;** Thomas E. **Eggers;** Howell M. **Estes** III; Frederick A. **Fiedler;** Richard E. **Hawley;** John E. **Jackson,** Jr.; Arlen D. **Jameson;** Jeffrey D. **Kahla;** Donald L. **Kaufman;** Vernon J. **Kondra;** Paul E. **Landers,** Jr.

John D. **Logeman,** Jr.; Bruce J. **Lotzbire;** Billy G. **McCoy;** Burton R. **Moore;** John M. **Nowak;** Gary W. **O'Shaughnessy;** David C. **Reed;** Peter D. **Robinson;** Richard M. **Scofield;** John D. **Slinkard;** Joseph K. **Stapleton;** Kenneth E. **Staten;** William A. **Studer;** Robert F. **Swarts;** Sam W. **Westbrook** III; Frank E. **Willis.**

RETIREMENT: M/G George E. **Ellis.**

CHANGES: L/G Jimmie V. Adams, from Vice Cmdr., Hq. TAC, and Vice CINC, USAFLANT, USLANTCOM, Langley AFB, Va., to DCS/P&O, and Cmdr., AFCOS, Hq. USAF, Washington, D. C., replacing L/G (Gen. selectee) Michael J. Dugan . . . **M/G Joseph A. Ahearn,** from Dep. Dir., Engineering and Services, DCS/L&E, Hq. USAF, Washington, D. C., to Dir., Engineering & Services, DCS/L&E, Hq. USAF, Washington, D. C., replacing retired M/G George E. Ellis . . . **B/G (M/G selectee) Gerald A. Daniel,** from Cmdr., 65th AD, USAFE, Sembach AB, Germany, to Cmdr., 16th AF, USAFE, Torrejon AB, Spain, replacing deceased M/G Winfield S. Harpe . . . **L/G (Gen. selectee) Michael J. Dugan,** from DCS/P&O, and Cmdr., AFCOS, Hq. USAF, Washington, D. C., to Cmdr., AAFCE, and CINC, Hq. USAFE, and AF Component Cmdr., USEUCOM, Ramstein AB, Germany, replacing retiring Gen. William L. Kirk . . . **B/G Brett M. Dula,** from IG, Hq. SAC, Offutt AFB, Neb., to Dep. Dir., Legis. Liaison, OSAF, Washington, D. C., replacing B/G John R. Hullender . . . **Col. (B/G selectee) Phillip J. Ford,** from Cmdr., 384th BMW, SAC, McConnell AFB, Kan., to IG, Hq. SAC, Offutt AFB, Neb., replacing B/G Brett M. Dula . . . **B/G John R. Hullender,** from Dep. Dir., Legis. Liaison, OSAF, Washington, D. C., to Ass't Dir., Inst. for Nat'l and Strategic Studies for Joint Operational Studies, NDU, Washington, D. C.

B/G James M. Hurley, from Dep. Dir., Pers. Plans, DCS/Pers., Hq. USAF, Washington, D. C., to Dir., Pers. Plans, DCS/Pers., and Dep. Dir., Personnel Readiness, AFCOS, Hq. USAF, Washington, D. C., replacing retiring B/G Maralin K. Coffinger . . . **B/G James L. Jamerson,** from Cmdr., 56th TTW, TAC, MacDill AFB, Fla., to Ass't DCS/Ops., Hq. USAFE, and Ass't Dep. Dir., Ops., EACOS, Ramstein AB, Germany, replacing B/G (M/G selectee) Bruce J. Lotzbire . . . **B/G (M/G selectee) Bruce J. Lotzbire,** from Ass't DCS/Ops., Hq. USAFE, and Ass't Dep. Dir., Ops., EACOS, Ramstein AB, Germany, to DCS/Ops., Hq. USAFE, and Dep. Dir., Ops., EACOS, Ramstein AB, Germany, replacing M/G John A. Corder . . . **Col. (B/G selectee) Richard B. Myers,** from Cmdr., 1st TFW, Hq. TAC, Langley AFB, Va., to Ass't DCS/Plans, Hq. TAC, Langley AFB, Va., replacing B/G Ben Nelson, Jr. . . . **B/G Ben Nelson, Jr.,** from Ass't DCS/Plans, Hq. TAC, Langley AFB, Va., to Cmdr., 56th TTW, TAC, MacDill AFB, Fla., replacing B/G James L. Jamerson . . . **Col. (B/G selectee) Glenn A. Profitt II,** from Cmdr., 23d TFW, TAC, England AFB, La., to Cmdr., 65th AD, USAFE, Sembach AB, Germany, replacing B/G (M/G selectee) Gerald A . Daniel.

SENIOR EXECUTIVE SERVICE (SES) RETIREMENT: Robert L. **Blocker.**

SES CHANGE: Roger M. Darnell, from Dep. Ass't to the Cmdr. for Int'l Log., Hq. AFLC, Wright-Patterson AFB, Ohio, to Dep. Dir., Directorate of Mat. Mgmt., Warner Robins ALC, AFLC, Robins AFB, Ga., replacing Charles R. Wallace. ■

★★★★

MILITARY AIRCRAFT

VIDEO REPORT

The MILITARY AIRCRAFT VIDEO REPORT is a quarterly video magazine featuring action-packed films from the exciting world of military aviation. Each program is hosted by USAF Medal of Honor recipient Colonel Joe Jackson and contains exclusive video material shot, edited, and produced by an Emmy award-winning staff.

★ MILITARY AIRCRAFT VIDEO REPORT, Volume 1, Number 1,

features the following films:

KING OF THE WILD WEASELS: See rare Vietnam air-combat footage, including MIG shootdowns, and learn about the Hanoi Hilton from veteran pilot Leo Thorsness, a Medal of Honor recipient.

F4 INTERCEPTORS: THE "RED HAWKS": Join the F4 jocks of the 142nd Fighter Interceptor Group as they go to preflight briefings, suit up, and take off for aerial combat with afterburners blazing.

FORTRESS REMEMBERED: See the last of the flyable B-17s on their 50th anniversary along with rare World War II combat footage and interviews with Ed Wells, father of the B-17; General Curtis LeMay; and some of the men who flew the legend.

TOMCAT TALES: In this inside look at the twin-tailed F-14 Tomcat, one of the World's top interceptors, you'll sit in the cockpit and fire Phoenix missiles with the Navy's finest.

Volume 1, Number 1: Color, 60 minutes, #R227, $39.95

★ MILITARY AIRCRAFT VIDEO REPORT, Volume 1, Number 2,

features the following films:

BLUE ANGEL HORNETS: For the first time on videocassette, the famous Blue Angels put their new F/A-18s through breathtaking close-up maneuvers.

TANKERS AWAY: Everything from B-52s to F4s comes close enough to touch during an aerial-refueling mission on a KC-135 tanker.

MIG MASTER RETIRES: See rare footage of the F8 Crusader on its supersonic first flight, and look in on the often-forgotten Crusader III.

THE SUPER SUBCHASER: Enjoy a close-up look at the S-3 Viking as it shoots from the carrier deck, drops sonobuoys, and goes on the attack.

ALSO IN THIS REPORT: the lastest on the F15E, A7 upgrade project, and Navy F-16s.

Volume 1, Number 2: Color, 70 minutes, #R228, $39.95

★ MILITARY AIRCRAFT VIDEO REPORT, Volume 1, Number 3,

features the following films:

HARRIER IN ACTION: Step into the cockpit of the AV-8B Harrier for great air-to-air footage including a shootdown with a sidewinder missile and a look at the British Sea Harrier.

CANADIAN AIR DEFENSE: Climb aboard for air combat Canadian style. You'll see CF-18s blasting off in an air-defense scramble and flying high over frozen tundra; air-sea rescue units; and anti-submarine patrols.

FLY MARINE: Enjoy a front-row seat as the US Marine Corps' F4 Phantoms, A4 Skyhawks, A6 Intruders, Harriers, and even Sea Cobras perform gut-wrenching air-combat maneuvers.

A-10 WARTHOGS: See the fabulous "Warthog" in action over the Arizona desert. This aircraft has never met its match in the world of close air support.

ALSO IN THIS REPORT: a look back at the B-58, and the latest on the A-6F, the E6 Tacamo, and a program to refurbish and sell Chinese MIGs.

Volume 1, Number 3: Color, 70 minutes, #R229 $39.95

★ MILITARY AIRCRAFT VIDEO REPORT, Volume 1, Number 4,

features the following films:

CARRIER AIR WING IN ACTION: See the aircraft carrier Carl Vinson launch F-14s with afterburners blazing; sit in the cockpit for an arrested landing, and enjoy the spectacle of incredible night takeoffs and landings.

FLYING THE LATEST F-16: See why the F-16 Falcon is becoming the most-popular fighter plane in the World as you sit with the pilot during nine "G" turns and see the new F-16C in action.

A VISIT TO THE BONEYARD: At Davis-Monthan Air Force Base, storage facility for America's retired military aircraft, everything from F-106s to B-52s is parked in the desert.

KC-10 PROFILE: Look in on the latest addition to the Air Force tanker fleet as it refuels thirsty F-15s, B-52s, and F/A-18s; and find out what it's like to sit in the cockpit while taking on fuel.

ALSO IN THIS REPORT: the latest on British AWACS, RF-4C Upgrades, and the C5A Wing Project.

Volume 1, Number 4: Color, 70 minutes, #R230, $39.95

★ MILITARY AIRCRAFT VIDEO REPORT, Volume 2, Number 1,

features the following films:

RIDE WITH THE THUNDRBIRDS: Climb aboard the F-16s of the Air Force Thunderbirds as special in-cockpit and wing-mounted cameras put you where the action is.

F-15 INTERCEPTORS: See the F-15 Eagle at its best as the Green Dragons of the 318th Fighter Interceptor Squadron battle Marine F/A-18 Hornets, while gun-camera video puts you in the pilot's seat as you zero in on a target.

TALONS OF THE HAWK: The British Aerospace Hawk—the World's most-advanced trainer-has joined the US Navy. Enjoy some spectacular aerial footage as you learn how to fly it.

THE REIGN OF THE STRATOJET: Though often forgotten by historians, the B-47 led the way in swept-wing bombers. See it come back to life in rare footage from the glory days of the Strategic Air Command.

ALSO IN THIS REPORT: the latest on the B1-B, the Bell/Boeing V-22 Osprey, and the AC-130 gunship.

Volume 2, Number 1: Color, 70 minutes, #R231, $39.95

★ MILITARY AIRCRAFT VIDEO REPORT, Volume 2, Number 2,

features the following films:

ALASKAN BEAR HUNT: Climb aboard an F-15 Eagle of the Alaska Air Command as it intercepts Soviet bombers miles above the Arctic icepack.

AIR FORCE TOP GUNS: "Red Flag", the Air Force equivalent of the Navy's "Top Gun" program, is as close to actual combat as you can get. See amazing air-combat footage from wing-mounted cameras.

RETURN OF THE SABRE: Take a ride in a Korean War vintage F-86 Sabre, rebuilt by a man who found it as a derelict in a junkyard. If you love old warbirds, you'll enjoy this story.

CARRIER ACTION IN THE KOREAN WAR: Travel back in time via rare archival footage to the unsung exploits of Navy flyers during the Korean War.

ALSO IN THIS REPORT: the latest on the B2 "Stealth" Bomber, Apache Attack Helicopter, KC 135R, and 30th anniversary of the F4 Phantom.

Volume 2, Number 2: Color, 70 minutes, #R232, $39.95

Phone orders call:
1-800-358-1000, Ext. 700

Please send me the following
MILITARY AIRCRAFT VIDEO REPORTS @ $39.95 each:

☐ Vol. 1, No. 1 #227 ☐ Vol. 1, No. 4 #230
☐ Vol. 1, No. 2 #228 ☐ Vol. 2, No. 1 #231
☐ Vol. 1, No. 3 #229 ☐ Vol. 2, No. 2 #232

SPECIAL OFFERS: SUBTOTAL $_____

☐ **Save $17.00 (including shipping).**
Order any three of the
MILITARY AIRCRAFT VIDEO REPORTS
and pay only **$109.00.**
Check three boxes above and enter amount here: $_____

☐ **Save $56.00 (including shipping).**
Order all six
MILITARY AIRCRAFT VIDEO REPORTS
and pay ONLY **$199.00:** $_____

SHIPPING & HANDLING: $ 3.00

(IL residents add 7% sales tax) TOTAL: $_____

SPECIFY VIDEO FORMAT: ☐ Beta ☐ VHS

☐ My check is enclosed. Charge my ☐ VISA ☐ MasterCard

NAME

ADDRESS

CITY STATE ZIP

ACCOUNT NUMBER-VISA & MASTERCARD ONLY

AUTHORIZED SIGNATURE OF CARDHOLDER EXP. DATE

MAKE CHECKS PAYABLE TO: **INTERNATIONAL HISTORIC FILMS, INC.**
Box 29035, Chicago, Illinois 60629

SCIENCE/SCOPE®

Combat pilots will soon be able to automatically locate, lock-on and launch four missiles with less work load and in less time than it takes to manually aim and fire one. Rapid Fire, under development by Hughes Aircraft Company for the U.S. Air Force, scans an area, picks out likely targets, and then locks-on up to six Maverick missiles automatically, one at each of the selected targets. Rapid Fire searches an area through the infrared seeker of one of the onboard missiles and discriminates likely targets from background clutter by analyzing such things as shape and size. The system will be capable of operating with Hughes' IR Maverick air-to-ground missiles produced for the U.S. Air Force, Navy, and Marine Corps.

Revolutionary computer architectures have the potential to achieve massive parallel processing capabilities beyond that of the fastest conventional supercomputers. Under development by Hughes for the U.S. Army Strategic Defense Command, these new architectures are designed to mimic the brain's vastly complex neurobiological structure. Using this technology, a new generation of computers may provide the solution for real-time processing problems like automatic target recognition, weapons allocation, automatic speaker identification and multi-sensor data fusion.

Voice and data communication to and from vehicles virtually anywhere in North America will soon be possible through a satellite system under development by Hughes and seven other companies that form the American Mobile Satellite Consortium. The system would allow drivers unrestricted contact with any telephone anywhere in the world. Current cellular telephone systems require drivers to be within range of special two-way radio towers, leaving about 15 percent of the United States population without service. Initial customers for the new system will be trucking companies, fire fighters, search and rescue teams, and personnel working in remote areas. The service will also be available to aviators and mariners.

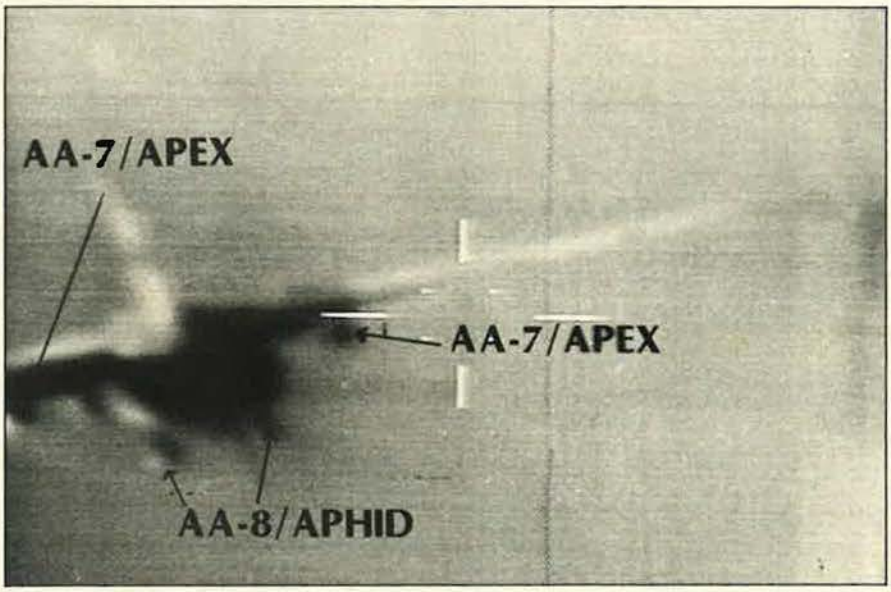
U.S. Marine Corps and Army Ranger gunners used the Hughes-built Thermal Weapon Sight (TWS) to demonstrate the nighttime firing of the Stinger missiles at White Sands Missile Range in New Mexico. Four missiles were fired and they scored four hits. The TWS is a developmental passive infrared sensor that allows soldiers to locate targets in darkness or during obscured battlefield conditions. A TWS user can see at significant distances with absolutely no light.

A new satellite system will provide the United Kingdom with high-power direct broadcast television service. In an agreement with British Satellite Broadcasting (BSB), Hughes will provide the London-based company with a two-satellite system of HS 376 spacecraft, which will be turned over to BSB after the satellites have been launched and tested in orbit. Hughes will handle all aspects of providing a fully up and operating system, expected to be in service by late 1989. The satellites' high-signal strengths will enable users to receive broadcasts through small antenna dishes one foot in diameter.

For more information write to: P. O. Box 45068, Los Angeles, CA 90045-0068

HUGHES

Subsidiary of GM Hughes Electronics



On January 4, two Libyan MiG-23 Floggers were shot down by an element of Navy F-14 Tomcats operating from the USS John F. Kennedy (CF-67) over international waters. The Libyan aircraft approached the Tomcats in a hostile manner; the Navy aircraft, acting in self-defense, fired AIM-7 and AIM-9 air-to-air missiles to down the MiGs. The overlays on this computer-enhanced photo, taken from video data recorded aboard the lead F-14, show the Floggers armed with Apex and Aphid air-to-air missiles.

Index to Advertisers

Colonel Glushko founded the Gas Dynamics Laboratory in 1929 and was responsible for the development of many launch vehicle and missile engines. His engines powered two of the stages on the SS-6 derived booster that put *Sputnik 1* in orbit in 1957. His RD253 design powers the first stage of the current Proton booster.

Mrs. **Josephine "Joe" Daniels Doolittle,** wife of aviation legend and Air Force Association patriarch Gen. James H. Doolittle, on December 24, her seventy-first wedding anniversary. She was ninety-three. An active participant in her husband's career, Mrs. Doolittle learned to fly and accompanied her husband on a number of flights. She also had her own career, serving as a spokesperson on radio for service wives during World War II and as a volunteer in hospitals—work she continued until 1984. She was buried in Arlington National Cemetery. She is survived by General Doolittle, two sons, nine grandchildren, and fourteen great-grandchildren.

Retired British **Maj. Gen. Robert E. "Roy" Urquhart,** commander of the 1st Airborne Division during the ill-fated Operation Market Garden in September 1944, on December 15. He was eighty-seven. Operation Market Garden was an overly ambitious attempt by British and US forces to capture five bridges in Holland in one bold stroke to allow penetration into the Ruhr basin. After being dropped six miles from the town of Arnhem, General Urquhart's force of more than 10,000 men (which had been split) actually captured the Arnhem bridge, but could not hold it because they could not be reinforced. After a bitter nine-day struggle, the remaining 2,613 men retreated. More than 1,200 soldiers were killed and 6,450 captured. Actor Sean Connery portrayed General Urquhart in the 1977 movie "A Bridge Too Far."

Herbert Morrison, the radio announcer who vividly described the crash of the German dirigible *Hindenburg* at NAF Lakehurst, N. J., in 1937, on January 10. He was eighty-three. As the lone radio broadcaster on the scene, Mr. Morrison's emotional description is permanently linked to the newsreel footage of the crash. He was a reporter for Chicago radio station WLS at the time. Mr. Morrison served in the Army Air Forces in World War II and was later the first news director at station WTAE in Pittsburgh. He retired after developing a broadcast section for the university relations department at West Virginia University. ■

Sparrow. One missile, many missions.

There isn't a more versatile missile anywhere. Or one more adaptable to new missions.

The latest example: Sparrow capabilities are currently being added to the Air Defense F-16s of the U.S. Air Force. This same Raytheon-produced updated AIM/RIM-7M version of the Sparrow is already the air-to-air defense system on hundreds of domestic and international F-4s, F-14s, F-15s, and F-18s.

The Sparrow also has important roles with naval and ground forces. The RIM-7M version, which has a slightly different wing and fin configuration, gives the NATO Seasparrow the ability to protect surface units from advanced aircraft and sea-skimming anti-ship missiles. The Seasparrow is also produced in a deck-space-saving vertical launch configuration for full-hemisphere defense coverage.

On land, either the AIM-7F or the AIM/RIM-7M version of the Sparrow, combined with a Skyguard radar, provides a transportable ground-to-air defense that needs less than six seconds between target designation and first missile away.

The Sparrow's versatility brings with it another advantage: where there is multi-service use, there are cost reductions in training, logistics, and support.

Raytheon's mastery of radar and electronics fundamentals has made the combat-proven Sparrow the practical answer to a variety of defense needs. In fact, a total of 20 countries now use Sparrow for air-to-air, sea-to-air, or ground-to-air defense.

For more information, write: Raytheon Company, Government Marketing, 141 Spring Street, Lexington, Massachusetts 02173.

Raytheon

Where quality starts with fundamentals

The USSR insists that its thinking has changed, and perhaps it has. At least one objective, however, is still high on the list.

—Illustration by Cathy Drennan/Photographs by Paul Kennedy

THE KREMLIN'S STRATEGY TO DE-NUCLEARIZE NATO

BY WILLIAM E. ODOM

IDENTIFYING Soviet strategy today is not so easy as it was in the "pre-*glasnost*" era. Many voices from the Soviet Union can be heard, and they do not all say the same things. Finding the underlying theme is possible, but it takes more effort.

The public rhetoric serves to obscure matters. For example, one can read pieces in *Kommunist* insisting that the Soviet military has overestimated the American threat, that military instruments have been used too often and too early, and that force has been used in cases where political and diplomatic instruments would have been more effective. In the same journal, however, there are articles by senior general officers who genuflect before the altar of a new "defensive" military doctrine, based on "reasonable sufficiency," but then proceed to repeat old formulas about threats, arms races, and the need to be able to deliver crushing retaliatory blows if the USSR is attacked.

Sweep away the verbal debris, however, and at least one clear Soviet thrust can be seen. The concept of nuclear deterrence that lies at the core of Western security strategy is now the target of a broad Soviet campaign taking place on three major fronts.

- Western public attitudes toward security in general—and the morality of nuclear weapons in particular—are under increasing assault by a Soviet ideological campaign aimed at stripping Western deterrence theory of its very legitimacy.
- The military relevance of nuclear weapons in the defense of Western interests is being called into question and undermined by new technology and weapons, not only in the Soviet Union but also in the West.
- The operational utility of the Western nuclear deterrent confronts pressures from persistent Soviet arms-control gambits that, if successful, would enhance Soviet abilities to deal with Western nuclear forces in a European theater campaign.

The three endeavors share a common tie: They all point toward even-

To understand Soviet diplomacy, the West should carefully examine how the pieces fit together. Hidden within General Secretary Mikhail Gorbachev's peace offensive are some tricks and surprises.

tual denuclearization of the Atlantic Alliance. The Western aim of rigging the Soviet Union and the US for mutual nuclear suicide is held up to scrutiny, or "unmasking," to use a Soviet cliché.

This facet of Soviet strategy is not inconsistent with what is proclaimed to be a new departure in Soviet doctrine. With respect to that doctrine, it is important to note what has and has not changed.

Former Marshal Sergey Akhromeyev, the recently retired Chief of Staff of the Soviet Armed Forces, defined the new "defensive" doctrine as meaning that the USSR would defend against an attack for about twenty days, during which time Moscow would try to negotiate peace. Should that effort fail, Moscow's forces would begin a counteroffensive to win the war. If this is really the sum and substance of the change, it is more a change of war plans than of doctrine. The older doctrine of the "offensive" still would be needed for the counteroffensive.

General Secretary Mikhail Gorbachev and his civilian analysts, however, are pressing for more than a change of war plans. They are building a case for a reduction in Soviet forces that would be needed to mount an offensive.

The first hard evidence of Gorbachev's apparent ambitions was seen in his announcement at the United Nations late last year that Soviet conventional forces will undergo a unilateral cut of 500,000 troops and 10,000 tanks over the next several years. The military effect of this initiative hinges on which forces are actually thrown on the scrap heap. Whether the Soviet leader is willing—or able—to actually carry out his pledge is also far from certain. Strong forces in the USSR are certain to try to resist or water down his proposals. In other words, Soviet policy is still far from resolved in all its features.

The Unwinnable War

On one point, however, there does seem to be unanimity of Soviet civilian and military opinion: Nuclear weapons are not only bad, they cannot have political utility of any sort.

Marshal Nikolai Ogarkov, in the years when he held the post of Chief of the General Staff, played down future operational use of nuclear weapons by insisting that new kinds of conventional weapons are so destructive and effective that he could conceive of a global war in which nuclear weapons were not used at all. One can find no retraction of that view since it was expressed in 1984. On the contrary, we have seen the Soviet politicians and negotiators, including Gorbachev at the October 1986 Reykjavik summit, press for the complete elimination of nuclear weapons. The change is reflected in a number of ways.

—Illustration by Cathy Drennan

Gorbachev now says that Clausewitz's dictum—that war is a political instrument—does not apply to nuclear conflict. He asserts that "humankind" interests transcend "class" interests.

At the level of USSR ideology and foreign policy, Gorbachev holds that the old Clausewitzian dictum—that war is a political instrument—simply does not apply in the case of nuclear weapons. In fact, he goes further with this ideological revision to alter traditional Marxist-Leninist theory about class struggle. He now asserts that there are "humankind" interests that transcend "class" interests.

The most important of these, of course, is prevention of nuclear war. To defend this new category of interests, Gorbachev maintains, the socialist and imperialist governments can and must cooperate. Moreover, within the context of peaceful coexistence, Gorbachev has redefined the international class struggle within the party program to take into account this new formula.

This ideological revision is more important than may have been recognized in the West. Consider what it means for the Soviet concept of peace. The sources of war, in the classic Marxist definition, are private property and class conflict that ensues from such ownership of property. In this view, true peace can come only with the destruction of private property and elimination of the basis of class struggle. Traditionally, when Soviet officials have referred to "peace-loving forces," they have meant those forces contributing to the weakening and eventual destruction of capitalist states.

Yet now here is Gorbachev telling the world that peace requires cooperation with imperialists, not the destruction of imperialism, when it concerns prevention of nuclear war and pursuit of other humankind interests. In light of this formula, how are Communists everywhere to regard the leader of "world imperialism," the US President? Is he a "peace-loving" force? How can true peace be established as long as he and the center of imperialism survive?

Perhaps it is little wonder that Gorbachev's rival in the Politburo, Yegor Ligachev, when speaking to party activists in Gorki not long ago, disparaged the idea of humankind interests and added that such notions are merely confusing Soviet friends abroad about the true nature of class struggle and peace. This explicit attack on Gorbachev's revision of ideology probably figured centrally in the General Secretary's recent shakeup of portfolios in the Politburo that pushed Ligachev aside, if not out.

Another episode exposes the significance of this revision. As reported in *Izvestia,* Soviet official V. V. Zagladin plainly states that the Soviet Union once had assumed that nuclear war, however terrible and undesirable, was nonetheless winnable. Today, he insists, Moscow proceeds on a new assumption that nuclear war is not winnable.

This is logically consistent with Gorbachev's ideological revision.

Gorbachev's ideological position on nuclear weapons is acceptable to military planners. It is compatible with—even supportive of—trends in the military-technical aspect of doctrine worked out a decade ago.

For the time being, Soviet military writers remain silent on the issue. But if Ogarkov's vision of nonnuclear war expresses the view of disciples of Soviet military science and doctrine on the General Staff, it follows that the Soviet military itself would not be sad to see nuclear weapons banned or reduced in number. Developments in the Soviet military provide a broader basis for this inference.

A third cycle in Soviet doctrinal evolution began in the late 1970s and continues today. It is similar to other changes that took place in the 1920s and late 1950s. While it is not as dramatic as the previous two, it nonetheless foreshadows significant changes.

Focus on New Technologies

Stimulating the present cycle, as in the earlier periods of change, is the emergence of new technologies. Microcircuitry and the modern semiconductor have had a dramatic impact on many aspects of military weaponry, computations, and communications. Directed-energy technology has had a similar impact on many aspects of military equipment and operations. Soviet researchers are also pursuing a major investigation of the uses of genetic engineering. Here, however, the payoff is more problematic.

In the mid- to late 1970s, we began to see fundamental changes in several Soviet military activities. One is a sharp new emphasis on these technologies. A surge of writing appeared on the possible use of the technologies, particularly of semiconductors and lasers. Military writers showed concern about "smart" conventional munitions with laser guidance, about laser weapons, and about the myriad forms of conventional weapons made possible with small computers and microelectronic devices. They also observed the US Army's doctrine of AirLand Battle, with its emphasis on the exploitation of these technologies.

Next, big changes were seen in ground force organization, in air defense, in frontal aviation, and in command and control. Concurrently, we began to see changes in tactical and operational doctrine. The idea of deeper, faster penetrations appeared with the Operational Maneuver Group. It involved immediate commitment, on D-day, of division- and army-sized formations to depths of 150 to 500 kilometers. Previously, such breakthroughs were not anticipated until after seven to ten days of combat. A new level of command, the High Command, seemed designed to manage two or three fronts in a single "theater strategic operation." The speed of the offensive was doubled in Soviet estimates.

At the same time, the conventional phase of that operation was envisaged as lasting longer. Some writers spoke of attacking NATO theater nuclear forces with conventional means during this phase with such success that NATO might lose interest in crossing the nuclear threshold, even in the face of defeat. For that to happen, NATO would have to lose so much of its nuclear force that it would estimate a highly adverse exchange ratio of theater weapons. While Soviet writers are not explicit, one is encouraged to infer that they believe they might deter US use of its intercontinental nuclear forces while NATO collapses. In this event, a European campaign might be decided wholly by conventional forces, and nuclear war might be avoided.

Clearly, technical military aspects of Soviet doctrine have been changing in light of new technologies. The direction of change is away from nuclear use. It could even be described as a Soviet effort to rule out nuclear use by exploiting new technologies and operation concepts.

Ideology and military force plans are not all that have changed. Similarly great has been the shift in the Soviet approach to questions of arms control. After walking out of the Strategic Arms Reduction Talks (START) forum in late 1983, the Soviets returned in 1985 and soon accepted the idea of deep cuts in the superpowers' strategic arsenals. Later, they embraced Washington's "zero-zero" proposal at the Intermediate-range Nuclear Forces (INF) talks. The treaty resulting from the INF negotiations has set in motion elimination of both longer-range and medium-range weapons in the European theater.

Thus we have witnessed a remarkable shift in the Soviet stance since March 1977, when the Kremlin rejected the notion of deep cuts in strategic forces and continued its insistence on maintaining the higher levels of strategic forces agreed to in SALT II. In 1977, when deep cuts were proposed by President Carter, Soviet military doctrine was in the early stage of revision. The Soviet rationale for deep cuts had not yet fully matured. Now Moscow, not Washington, holds the initiative in demanding reductions, even elimination, of nuclear weapons.

Doctrinal Reform

Synthesizing the three trends of Soviet developments reveals the outlines of the emerging Soviet strategy and its potential effects.

It is not difficult to see that the target of Gorbachev's new ideological offensive against nuclear weapons—his claim that they have no real political use in furthering the interests of humankind—is the theory that underlies Western nuclear deterrence.

"Deterrence" and "extended deterrence," if they mean anything, mean achieving some political utility from the use of or threat to use nuclear weapons in the event of a Warsaw Pact attack in Europe. With his new position on humankind interests and his efforts to depoliticize nuclear weapons completely in the minds of Western publics, opinion makers, and policymakers, Gorbachev can hope to build a consensus internationally for the elimination of nuclear weapons. While it is too early to assess Gorbachev's gains, it would be imprudent to expect that he will have none, and there is reason to believe he might have many.

The theology of nuclear deterrence appeals to an important "church" of Western leaders, opinion makers, and military men. While it is not a large church, its influential members have dominated Western foreign and defense policymaking circles for decades.

If one extends the ecclesiastical

metaphor, one might say Gorbachev is the recipient of a new revelation: the objective basis for a new "humankind interest." An angel has appeared to tell him that Clausewitz and Lenin did not foresee all the dangers that science would bring to mankind. Nuclear devastation, ecological destruction, and a few other threats make necessary a rereading and reinterpretation of the Marxist scriptures.

Gorbachev has reread, and he now sees that parishioners in his Marxist church must find common cause with more than just the working-class parishioners of the imperialist church. In his view, there is also a theological basis for dealing with the clergy of the imperialist church—that is, capitalist leaders. It is not only possible, it is imperative to deal with them to achieve the salvation of mankind.

Gorbachev is training new evangelists in this latest revelation and dispatching them abroad so that they may preach the new gospel to the multitudes of unbelievers and convert them. Meanwhile, Gorbachev himself has launched an ecumenical campaign to engage the imperialist clergy itself. If they are not convinced by the logic of his proselytizing argument, maybe they can be forced to change by their own parishioners, who have learned the new gospel from Soviet evangelists.

Given the tendencies to heresy within both lay and clerical circles of the Western church of deterrence theory—the movements for a nuclear freeze or establishment of a "no-first-use" policy are two good examples—Gorbachev's gambit is not without real prospects. Viewing it with detachment, one cannot but help but admire his shrewdness.

That's not all. In the realm of military-technical and operational developments, NATO's reliance on nuclear weapons is being made to look less and less attractive to military planners.

Western military authorities appear to recognize that Soviet emphasis on conventional weapons is eroding the utility of nuclear arms for stopping Soviet attacks in Europe. With Soviet officers seeking a capability to conduct a multifront operation on a frontage of about 700 kilometers, driving about 1,200 kilometers deep in three to four weeks, the West may face an attack that would make the blitzkrieg campaigns of World War II seem slow by comparison. Nuclear weapons may not disappear altogether, but they might well be relegated to the role to which chemical weapons were confined in World War II.

—Illustration by Cathy Drennan

The INF accord eases the warplanners' task. The congruence of interests between foreign policy and military planning goes far to explain Soviet willingness to embrace the treaty.

The Soviet moves reinforce existing tendencies of long standing in the United States Army, tactical air forces, and much of the Navy. US military planners are less forthcoming about the trends than are their Soviet counterparts, but they do tend to pay less attention to nuclear issues and more to nonnuclear issues in development of both force structure and doctrine. They wall off nuclear employment issues and treat them as separate from conventional employment issues.

Implicitly, deterrence doctrine encourages a clean break. It is politically unacceptable to discuss tying strategic force employment to regional war plans—though key strategy documents such as Presidential Directive 59 and National Security Decision Directive 13 call for them to be linked. Strategic Air Command has made progress in that direction, but regional commanders show little urgency about the task.

Nowhere was this more evident than in developing an employment doctrine for the Pershing II intermediate-range missile in Europe. The US European Command and the multinational Supreme Headquarters, Allied Powers, Europe, essentially abdicated to strategic force targeteers the authorship of an employment concept. Thus, from all appearances, INF weapons seem to be an addition to the Single Integrated Operational Plan (SIOP), not a new striking arm for the Supreme Allied Commander in Europe.

Arms Control

Finally, consider the effects of Soviet arms-control efforts. If one examines the Soviet change in attitude about nuclear weapons and remembers the change in the military-technical aspect of doctrine, one can glimpse the guiding rationale for change in arms-control policy.

The INF treaty will remove two entire classes of theater nuclear weapons. The major consequence has been to reduce the number of NATO nuclear targets that Soviet forces must destroy with conventional weapons. This is not a trivial matter. As the Soviet military command began to believe it might destroy most of the NATO nuclear force in the conventional phase of a war, it was seized with the task of how to destroy that force with conventional means. What the Soviets know for a fact is that the fewer nuclear weapons NATO has, the smaller their task.

In other words, the INF agreement eases the warplanners' requirements in designing the theater military campaign. The congruence of interests between Soviet foreign policy and military planning goes far toward explaining Soviet willingness to accept the zero-zero proposal.

At the same time, large strategic arsenals hang heavy over Soviet military planners. They can deter US use of its strategic forces by threatening retaliation, but they might reduce the size of that task if an arms-control strategy achieves very deep cuts in the US arsenal. The smaller the US strategic force, the less attractive would be the op-

tion of blunting a Soviet theater offensive with strategic forces.

Here's why: If the war does not become a one-day, US-Soviet exchange of nuclear weaponry, but rather an extended conflict in which the US must choose to take weapons out of the SIOP and use them for the theater, the adequacy of the US arsenal becomes questionable. Would it not be better to hold these forces in reserve for negotiations after losing Europe? As the US strategic force declines, this may well become the line of US military thinking during a general European conflict.

These three thrusts—in ideology, in advanced conventional weaponry, and in arms-control policy—are the basic building blocks of what appears to be a conscious Soviet strategy that Gorbachev is aiming at the West. Elements of a Western counterstrategy are fairly evident.

It is clear that, in the short run, Washington cannot abandon extended nuclear deterrence as the underlying philosophy of its strategy. Many Europeans still believe the idea that the US threat to make "first use" of nuclear weapons "couples" the US and Western Europe in common defense. That being the case, it would be extremely unwise to drop extended deterrence abruptly.

It is equally clear that, in the longer run, the United States must replace extended deterrence with something else. Trends in public attitudes are running strongly against dependence on nuclear threats. Members of Western media and intellectual circles have succeeded in fostering such a high level of nuclear illiteracy and fear of nuclear weapons that the West never will be able to rebuild adequate public support for systems required for deterrence.

In rethinking military strategy for NATO, it will be important to note that the "coupling" of the US and Western Europe is not due primarily to nuclear employment policy. The fundamental underpinning of the Alliance concept is the presence of large US conventional forces in Europe.

Moreover, as Soviet opinion so accurately points out, the trends in military technical affairs are undercutting extended deterrence. To try to hold on to this forty-year-old notion indefinitely recalls the Luddite movement, whose members opposed new technology for the British textile industry in the early 1800s. We cannot stop the technological innovations that are changing the shape of future war.

Slowing down Soviet development of new, high-technology weapons, however, is an achievable goal. It is important to remember that, in the Soviet view, defense doctrine has two aspects—a sociopolitical side and a military-technical side. When former Marshal Sergey Akhromeyev tried to explain "reasonable sufficiency" to Americans, he reported that the Soviet Defense Council had debated this revision for two years and that it had decided in favor of change on the sociopolitical side. On the military-technical side, however, he was silent and would not be drawn out.

One gets the impression that Gorbachev persuaded the military to accept the revision of the sociopolitical side of doctrine with the aim of ruling out nuclear weapons. But it is unlikely that he succeeded in driving through a change on the military-technical side, the Soviet military having so recently completed a fundamental revision there.

One can infer with confidence the scale of the demands that this new doctrine puts on the Soviet economy. Gorbachev apparently does not want to pay the price. He can argue that industry and science are unable to deliver the new weapons the new doctrine requires. If the military refuses to yield resources to the civil economy, they will be left with ultramodern military doctrine and obsolete weaponry.

Where Do We Go From Here?

The arguments on both sides seem to create a deadlock. The question becomes how to get out of this deadlock. In the past, the R&D demands of the Soviet military were met in no small part by exploiting East-West economic interaction. What Soviet scientists could not make, the KGB usually could buy or steal from the West. Weapons for the future, in all probability, cannot be developed in the USSR without extensive access to Western economies and the West's R&D communities.

It may be true, as many critics insist, that it is impossible to achieve a fully coordinated, comprehensive Western trade policy or even a narrow Western embargo on strategic technology exports. If this is true, it means that the West can expect to confront both a quantitative and a qualitative arms race for the indefinite future. However, a trade policy that merely slows down the diffusion of technology to the Soviet Union could significantly retard arms development.

It is imperative to get US arms-control positions lined up to support a force posture required by extended deterrence and not allow the Soviets to dictate arms-control packages that undercut deterrence.

The Soviets enjoyed considerable success with the INF treaty, but it was not necessarily a loss for the West. Operationally, it never made any sense to put INF missiles so far forward in Europe, and the US never truly integrated them into support for SACEUR's war plans. Taking them out does very little damage to "coupling," notwithstanding the loud complaints initially heard from Europe.

The same benign situation will not obtain if the West stumbles into a conventional force-reduction agreement. Even a small withdrawal of US forces will create a significant danger that the two halves of the Alliance could indeed become "uncoupled." It will be imperative to have the right answers to the questions this time, because the international pressures for an agreement are growing and being encouraged by Moscow.

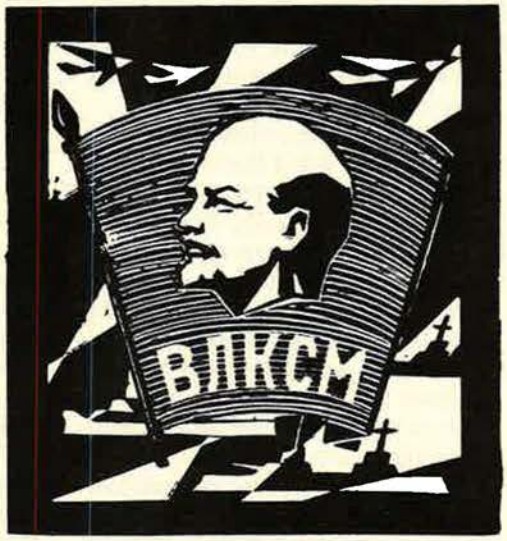
The West's recent determination to engage fully in the East-West military competition has contributed to the forces of change sweeping the Soviet Union. These forces can be extended and strengthened if NATO nations continue to provide adequate military power to back skillful Western diplomacy. If either element is ignored, the West's ability to deter Soviet power will be consigned to oblivion. ■

Lt. Gen. William E. Odom, US Army (Ret.), is director of national security studies at the Hudson Institute and visiting adjunct professor at Yale University. He served as Director of the National Security Agency from 1985 to 1988.

To achieve greater freedom, the Soviets explain, it is first necessary to concentrate power in the hands of the leadership.

THE NEW SOVIET ELITE

BY HARRIET FAST SCOTT



"WE ARE witnessing the formation of a new political elite." Yevgeniy Ambartsumov, an eminent Soviet historian, made that statement not long ago in reference to major political events reshaping the traditional Kremlin power structure.

At a gathering of the Communist Party's Central Committee last September, General Secretary Mikhail S. Gorbachev rammed through the appointment of supporters to the Politburo while removing some Brezhnev holdovers. Then, at a special session of the 1,500-member Supreme Soviet the next day, he took the post of President and set about revamping the government to his liking, with provision for what is supposed to be a democratically elected parliament.

Commentators have debated the long-term significance of these moves. What is undisputed, however, is that they are aimed at firmly consolidating the authority of Gorbachev—and of his allies in the reformist camp. In his analysis, Ambartsumov said as much:

"The [Gorbachev] leadership

wants to demonstrate unequivocally its intention to concentrate all power in its own hands in order to accelerate the implementation of reforms. Democratic methods are not yet sufficiently developed. People want results. Gorbachev has given a sign to the population by shouldering all responsibility himself."

Gorbachev may be, as he suggests, merely seeking new power to advance the cause of *perestroika,* his drive to restructure Soviet economic and social life in ways that provide incentive and choice for individual Soviet citizens.

Even so, Soviet intellectuals express deep concern about the possible fate of *perestroika* as the new process unfolds. Human-rights champion Andrey Sakharov, on his visit to the US, delivered a stern warning about the danger of concentration of power, even in the name of democracy. "Today it will be Mr. Gorbachev," says the Nobel Prize-winning physicist. "Tomorrow, it may be somebody else. There are no guarantees—we must be frank about this—no guarantees."

Soviet citizens are preparing to go to the polls March 26 for the first contested election of a Congress of People's Deputies. Yet, while Gorbachev has claimed that he wants to reduce Party management of industries and social organizations, Party organs are assigned a powerful role in the new setup, and local bodies face restraints.

In short, the new power structure, on close examination, does not appear to be more "democratic," in a Western sense, than the old version. Strong Party influence seems certain to continue.

Calls for Democracy

The recent flurry of political change has its origins in the Extraordinary Nineteenth Party Conference convened by Gorbachev last summer in Moscow, the first gathering of its kind since a few months before the 1941 German invasion. Here, Gorbachev unveiled his blueprint for *perestroika* of the Party apparatus and the agencies of state power.

Not accidentally, the conference was preceded by official disclosures of Party abuses and excesses committed during the reign of Joseph Stalin. This process, far from being of purely historical interest, was intended to discredit the way the Party had operated in the past and to raise—and answer—basic questions about what could be done to prevent such abuses and excesses from recurring.

One critical requirement, in Gorbachev's view, was to bring to the Party a measure of internal democracy that might serve as a check on powerful members. Candidate Politburo member Georgiy Razumovskiy, writing in the Party journal *Kommunist,* made Gorbachev's case plainly with the blunt statement that "the avant-garde role of the Communist Party in *perestroika* and renewal of society is impossible without deep democratization of internal Party life." This democratization, he emphasized, was "the key directive of the Nineteenth Party Conference."

Movement was not visible, however, until the early fall of 1988. Action began at a Plenum of the Central Committee hastily called for Friday, September 30. Foreign Minister Eduard Shevardnadze canceled meetings in New York to hurry back to Moscow. The Minister of Defense and Chief of the General Staff were out of the country, too. In the days before the leaders met, 25,000 KGB security troops, MVD Internal Troops, and an elite Guards Division were mobilized around Moscow. The last time this occurred was in October 1964, when Premier Nikita Khrushchev was ousted.

"Stalin Would Be Proud"

The Plenum was of monumental importance, though it lasted less than one hour. When it was over, startling changes had taken place, and Gorbachev was firmly in control. Robert Gates, the CIA's deputy director at that time, observed afterward that "Stalin would have been proud of the smoothly orchestrated, forty-four-minute . . . session in which people were fired, retired, demoted, and promoted with no dissent or even discussion, [all] delegates voting as one."

Abruptly pensioned off from the Politburo were full members Andrey A. Gromyko, the seventy-nine-year-old President who had served twenty-eight years as Foreign Minister, and Mikhail Solomentsev, a senior functionary. Also removed were candidate members Petr Demichev and Vladimir Dolgikh, both Brezhnev appointees.

Then came the promotions. Vadim Medvedev, a Gorbachev ally, became a full member of the Politburo. Assuming posts as candidate members were Aleksandr V. Vlasov, the Interior Minister, and former Party secretaries Aleksandra P. Biryukova and Anatoliy I.

Lukyanov. These two also are reputed to be attuned to Gorbachev's agenda. Viktor Chebrikov, chief of the KGB, retained his Politburo seat and joined the Secretariat, but relinquished control of the USSR intelligence organization.

The top Party apparatus was reorganized in its entirety. The number of departments that previously ran the day-to-day activities of the Central Committee appears to have been cut in half. Taking the lead role in Party functions were six new Party commissions: Ideology, chaired by Medvedev; Party and Personnel, chaired by Razumovskiy; Domestic Law, chaired by Chebrikov; Social and Economic Affairs, chaired by Nikolai Slyunkov; Agriculture, chaired by Yegor Ligachev; and International Politics, chaired by Aleksandr Yakovlev.

The main goal of this change evidently is to reduce the authority of entrenched interests that once held forth in the CPSU Secretariat. All problems now are to be resolved by the commissions instead. As explained by prominent Soviet journalist Yegor Yakovlev: "The filter

provided by the Secretariat no longer exists."

The changes in Party structure have reverberated far beyond Moscow. Once the national-level CPSU was restructured, the Communist Party apparatus of each of the republics, krays, oblasts, and cities followed suit. For example, the Georgian Communist Party formed five commissions and slashed its departments from seventeen to eight.

Local Accountability

At the local level, the main goal of the reforms will be to unify two previously independent and highly unequal posts—that of the local Communist Party secretary and that of the chairman of the local soviet, or council. Until now, the local council leader lacked authority to act, while the Party boss issued orders without regard to likely consequences. When things went wrong, the poor council chairman took the blame. Now, plans call for one person to take up both positions and for that person to be accountable for results.

According to *Pravda*, other candidates may contest the Party secretaryship itself. "This," the official Party newspaper explains, "will increasingly force the first secretaries to change their work style, to try to be accessible to the people, to show constant attention and concern for their needs and earn the confidence of the masses." Otherwise, it is implied, the voters can throw a Party Secretary out of power.

With reform of the Party launched, Gorbachev wasted no time in seeking changes in the formal system of USSR state power, which is separate and distinct from the CPSU apparatus itself. His apparent objective: Provide the population more power—or at least the illusion of power—and, in the process, give the government more legitimacy.

At the Party Conference in the summer of 1988, Gorbachev outlined the shape of a new legislative body, requiring amendments to the 1977 Brezhnev Constitution. Because of this need, Gorbachev convened an Extraordinary Session of the Supreme Soviet on October 1, 1988, the day after the dramatic CPSU Plenum. Events were orchestrated. First, Gromyko stepped down as the President of the Presidium of the Supreme Soviet. Then Gorbachev was unanimously elected to replace him as head of state. Once installed as president, Gorbachev possessed formal authority to propose constitutional amendments.

The amendments were intended to produce a fresh government model, one with expanded power and more formal independence from the Party bosses. It was to be

based on a strong president chosen by a popularly elected Congress of People's Deputies. This, incidentally, might also provide Gorbachev with a power base outside the Party apparatus itself.

These proposed changes were not published until late October, leaving little more than a month for public debate before the Supreme Soviet was to ratify the changes. Estonians, in particular, bitterly complained about the short time allocated to discussion. Estonia's parliament went so far as to vote itself a right to veto decisions made in Moscow—a display of local impudence that Moscow, unsurprisingly, rejected out of hand. At the end of November, the Supreme Soviet met in regular session and adopted the constitutional amendments.

A New Congress

At the heart of the electoral reform is the new concept of a Congress of People's Deputies. It will have 2,250 members, one-third more than the old Supreme Soviet, which it supersedes. These deputies are to be elected directly in a complicated system based on territorial districts, national-territorial districts, and "social organizations."

Territorial districts will be formed, much like congressional districts in the United States, to represent equal numbers of voters in the USSR. A total of 750 territorial districts will be formed, each represented by a deputy.

So-called national-territorial districts correspond to various Soviet regional subdivisions—union republics, autonomous republics, autonomous oblasts, and autonomous okrugs. A total of 750 of these national-territorial districts will be formed, each represented by a deputy. Each of the fifteen union republics will receive thirty-two deputies; each of twenty autonomous republics, eleven deputies; each of eight autonomous oblasts, five deputies; each of ten autonomous okrugs, one deputy.

The most controversial—and, to political reformers, dismaying—provision of the election scheme concerns selection of the final bloc of deputies. A total of 750 deputies—fully one-third of the new Congress—is reserved for representatives of Party-dominated "social organizations." The "social" deputies can be grouped this way:

- Three groups—the Communist Party itself, USSR trade unions, and USSR cooperative organizations—each will elect 100 deputies, for a total of 300.
- Six groups—the Young Communist Organization (Komsomol), women's groups, war and labor veterans, scientific workers, artists' unions, and other officially recognized social organizations—each will elect seventy-five deputies, for a total of 450.

These "social" deputies will be "elected" by delegates to their congresses or conferences or plenums, with each participant having one vote. The outcome of these votes will not be in doubt. The Communist Party, for example, submitted a list of 100 handpicked candidates for its rank-and-file to "elect" to the 100 seats reserved for the Party. This is expected to be near-universal practice.

Complaints are being voiced. In Latvia, authorities went so far as to pass a resolution condemning such indirect election of deputies from

social organizations. "It does not conform with the principles of democracy," the resolution states.

In fact, the Party is also likely to have a major influence on which candidates fill the remaining seats, despite the theoretical right of ordinary Soviet citizens to nominate rival candidates. The new system will offer voters only a limited degree of choice. Terms are for five years. A deputy may not serve more than two consecutive terms.

The Congress will meet once a year. At its first meeting after the March election, deputies will elect a President and a new, reconstituted Supreme Soviet by secret vote.

That Gorbachev will be elected President is a foregone conclusion. He already has stated that he expects the chairman of the Supreme Soviet also to be the Party's General Secretary. But the President's term will be for five years, and no one, not even Gorbachev, can serve more than two consecutive terms. On paper at least, the Congress will have the right to remove the President at any time by secret ballot.

A Stronger President

The role of the President has been significantly enhanced by the new constitution. Although Brezhnev, Yuriy Andropov, and Konstantin Chernenko served simultaneously as General Secretary and President, the latter office was ceremonial. Now, the Soviet President, rather than the General Secretary, will be the highest official of the Soviet state and will represent the USSR to the nation and in international relations.

Specifically, the President will supervise preparation of questions to be examined by the Congress of People's Deputies and the Supreme Soviet. He will submit reports to the Supreme Soviet on the state of the country, on domestic and foreign policy, and on the defense capability and security of the USSR. He will head the small, secretive, and powerful Council of Defense. He will conduct negotiations and sign international treaties.

Under the new constitutional provisions, members of a new Supreme Soviet will be elected by secret vote of the Congress. This marks a major departure from the past. Then, voting for deputies was direct, but only a single, Party-approved candidate was offered. Frequently, a prominent person was assigned to represent a district whether voters wanted him or not.

A case in point is the Kuldiga district of Latvia, which not long ago proposed recalling its deputy, Admiral Sergey G. Gorshkov, on grounds that he "is detached from the everyday problems of his electors." The voters didn't realize how detached Gorshkov really was. He had died six months earlier, and no one had bothered to inform Kuldigans about his demise.

The new Supreme Soviet, like the old, will have two chambers: the Soviet of the Union and the Soviet of the Nationalities. The two chambers will be numerically equal, but each will be much smaller than the old Supreme Soviet, totaling only 542 members. There will be regular spring and fall sessions, each lasting up to four months. The new Supreme Soviet sessions will take the form of separate or joint sittings. Between sessions, there will be sittings of their permanent commissions and of the USSR Supreme Soviet committees. One-fifth of the Supreme Soviet will be renewed each year.

Making Defense Decisions

What will the Supreme Soviet do? In this new structure, it evidently has been designated as the primary decision-making body with respect to the Armed Forces. The Supreme Soviet will form the USSR Defense Council and ratify its composition, appoint and effect changes in the supreme commands of the USSR Armed Forces, determine basic measures in defense and state security, be able to initiate mobilization, be able to proclaim a state of war in the event of armed attack on the USSR or to meet treaty obligations, decide the uses of the armed forces to meet treaty obligations to maintain security, establish military ranks, institute orders and medals, and confer honorary titles of the USSR.

Under the former system, all this was carried out by the Presidium of the Supreme Soviet. Now, the Presidium is charged with handling military affairs when the Supreme Soviet is between sessions. The Presidium will be able to declare a state of martial law or emergency for the whole country or in particular areas.

Having never had a true standing body at the national level, Soviet citizens are not altogether certain how much power the new Congress and the new Supreme Soviet will have. In the past, the elegant words of the Constitution have not been matched by deeds, to say the least. Only time will tell if real power has been given to the soviets and taken away from the Communist Party.

The democratization unleashed by *perestroika* is not without serious problems. On October 7—ironically, Constitution Day in the Soviet Union—riot police in Moscow were called in to break up a protest demonstration claiming that "Partocracy is not democracy." In Leningrad, similar protests aimed at the political reforms were also dispersed. People's Front movements were spreading through the three Baltic republics of Estonia, Latvia, and Lithuania.

Thus far, Gorbachev's economic *perestroika* has not shown any major successes. Economic progress, if it comes, can be measured—in terms of more food, better housing, quantities of export goods. The progress of political *perestroika* will be more difficult to measure. Will there be more human rights, more democracy and freedom? Or will there be increased concentration of power in the hands of one individual or a small group of like-minded individuals? Although the jury is still out, all signs point toward emergence of a new political elite to replace the old. ■

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

Though its methods may be difficult to decipher, the Soviet Air Force has a clear idea about how to ensure that its fighters show up for a war.

READINESS, SOVIET STYLE

BY RICHARD D. WARD

FOR ALL too many Western analysts, the Soviet tactical fighter force apparently has become a military riddle wrapped in a strategic mystery locked inside a readiness enigma.

Misreadings of Soviet airpower are widespread. The illusion that the Kremlin has built a ramshackle force of second-rate fighters masks the disquieting reality that Moscow's air arm fits its war plans with great precision.

Western skeptics seeking to make the case against Soviet fighters cite very high overhaul rates as "Exhibit A." This, they conclude, can only mean that the aircraft are of inferior quality.

In fact, close examination reveals such maintenance to be deliberate, the key to a highly unusual war-readiness system. Far from failing to achieve high peacetime fighter durability, the USSR keeps its planes in constant repair to ensure their reliability in wartime. Benefits that flow from this system are many:

- High warplane availability, with some ninety-five percent of front-line, deployed fighters ready for war on Day One.
- Low vulnerability, with forces able to move to and operate from austere, dispersed bases devoid of maintenance facilities.
- Extensive reinforcement powers, with thousands of warplanes in reserve for swift deployment to forward locations.

The system that produces these benefits is complex and alien to Western thought. But an analysis focused on the aviation support system of a Frontal Aviation air regiment illustrates the point that Soviet fighter readiness procedures mesh well with Soviet objectives.

Those objectives are based on elements of surprise. In the Soviet view, this requires the ability to launch or respond to an attack from a "standing start," without mobilization; the ability to protect Soviet forces by dispersing them widely across European bases; and the ability to exploit initial successes of a swift attack by rapidly bringing back-up forces to bear on the main action.

Unusual Maintenance Cycle

The Soviet Union's unusual and much-misunderstood maintenance cycle provides the key to all three

The USSR keeps its planes in constant repair. This system keeps close to ninety-five percent of front-line, deployed fighters ready for war on Day One. The Soviets—and their allies—also take an innovative approach to ground equipment. For example, the ladder being used here by an East German mechanic to work on the vertical stabilizer can also be used by the pilot for cockpit access.

objectives. In fact, the frequent overhaul of Soviet fighters is the basis of the Soviet operational approach to readiness.

In simplest terms, the cycle can be broken down into three distinct segments: operational aircraft deployed at the main base, a complex of large overhaul and repair facilities based in the rear, and a material reserve stockpile of refurbished weapons.

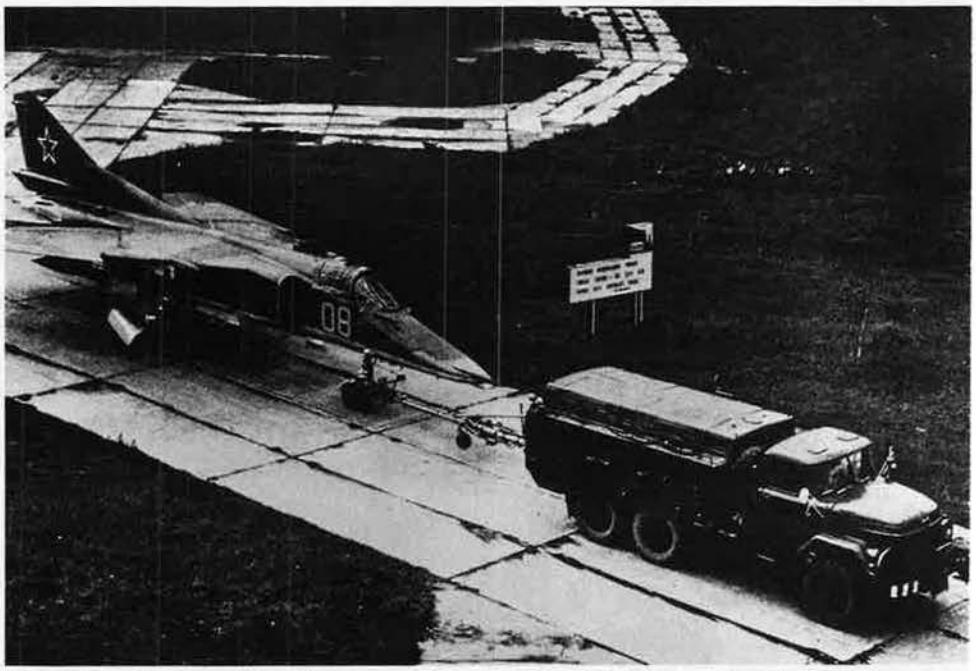
The cycle works this way. When an operational aircraft comes due for an overhaul, it is withdrawn from action and replaced with a new or totally refurbished fighter drawn from the strategic stockpiles. The inactive fighter is then shipped to an overhaul facility for a thorough rehabilitation. Once that is complete, the renovated warplane is itself transferred to the stockpile, available for future deployment as a replacement for some other plane. When that happens, the cycle begins again.

In stark contrast with Western maintenance practice, however, overhaul takes place after an aircraft logs only a few hundred hours of flight time. The figure in the West is usually several thousand hours.

This short cycle for Soviet aircraft, however, stems not from the failure of Soviet components. What needs to be understood is that the Soviet equipment is returned for overhaul at the peak of its reliability. The Soviets have determined how many hours each weapon can be expected to last in war. By subtracting that number from total hours of reliable life in an aircraft, they determine the time at which an overhaul must be performed. This takes place even if the aircraft happens to be working extremely well.

The overall system ensures that aircraft equipment goes to refurbishment immediately when its allowable peacetime flight hours have been accumulated. This overhaul-before-needed philosophy is in keeping with the Soviet dictum that all fighter equipment provided to the regimental commander must be reliable for a specified period.

With so much Soviet maintenance being performed at rear installations, the Soviet military has developed a gargantuan, highly organized, specialized system to carry it out.



The Soviets view the MiG-23 Flogger and its support truck together as the Flogger Weapons System. The truck tows the aircraft and functions as a tool chest and a storehouse for test equipment. This arrangement provides efficient support to the aircraft both on the main operating base and at any dispersed location. Note the concrete slabs used for ramps and taxiways at the bare-base location.

The Soviets maintain a single logistics support organization, known as "Rear Services" or, in Russian, "Tyl." It supports all five of the Soviet military services. Rear Services functions are divided into two principal areas: the Military Central Support System and the Field Logistics Support System.

Each Rear Services support level provides repair installations for Soviet fighter aircraft. However, because of differences in service equipment, each branch has separate engineering support units—troops who actually perform maintenance. In the Soviet Air Force, Aviation Engineering Services (IAS) is responsible for all levels of aircraft maintenance.

At the highest, "national-strategic" level of organization, the Military Central Support System is responsible for material acquisition, through either the civil economy or military procurement agencies. This system is also responsible for maintaining strategic reserve stockpiles. Soviet storage depots stock 13,000,000 metric tons of arms and ammunition and 60,000,000 metric tons of fuel, oil, and lubricants. This is enough reserve war material to support intense offensive operations for up to ninety days.

How "Overhaul Factories" Work

It is at this strategic level of organization that total fighter overhauls are performed. The Soviets maintain entire facilities, known as "overhaul factories," to carry out this task. These factories, located primarily in the Soviet Union, employ more than 100,000 IAS workers, most of them former aircraft maintenance troops.

The principal function of these centralized, air-army-level overhaul factories is to renew airframes and aircraft components. In most cases, overhaul facilities are former production plants with machinery for the same models still in place. In some cases, current production plants are used to overhaul aircraft on lines even as new production models continue to roll from adjacent assembly areas.

The Field Logistics Support System functions below the national level. It is responsible for operational and tactical-level support of the armed forces. One half of the Field Logistics Support System, called the Operational Logistic System, supports fronts, armies, corps, and divisions. Operational reserves—stockpiles of combat-ready weapon systems—are positioned at this level.

Within this system, the IAS operates Air Division repair depots, which perform major maintenance tasks just short of complete overhauls. Most weapons parts needing repairs are crated and sent to rear-echelon depots rather than to facilities at a forward operating base, as would be the case in the West.

The other half of the Field Logistics Support System, the so-called Tactical Logistics System (TLS), supports smaller units such as air regiments and battalions. War reserve stockpiles at this level include expendables such as fuels and lubricants, munitions, food, water, and material goods. These are stored on motor transports or in containers sized for truck and train transport. The TLS directly supports air operations, a task critical to readiness of Frontal Aviation units.

How does this extensive Soviet maintenance activity affect the Kremlin's ability to carry out its wartime objectives? Clear-cut results can be seen in aircraft availability—the pivotal factor in Soviet planning for "standing-start" air operations in event of war.

Unlike his Western counterpart, a Soviet commander does not have to worry that many of his planes are nearing the end of their reliable combat lives. The replacement cycle, if it does nothing else, ensures that all or virtually all deployed Soviet aircraft are available for combat right away and have the staying power to last for some time.

If strikes originate from the main bases, the aircraft will be launched very rapidly, alternating from both ends of the runway to minimize exposure time and maximize deployment rate. When the sorties start, the expectation is that at least ninety-five percent of the combat aircraft on each air base would be flying.

In peacetime, only a small percentage of Soviet fighters is used for training, the bulk of the training taking place on simulators. The training aircraft never dip below wartime service hours. Unused standby aircraft are maintained in a "run-in" state, keeping Soviet air squadrons at almost full strength on a constant basis.

Efficient Wartime Operation

Reinforcing the inherently high availability of Soviet fighters is another factor: The Soviet Air Forces, to a degree not seen in the West, design their fighters to be able to operate efficiently in war's harsh environment.

Their very simple designs tend to keep support requirements to a minimum. Soviets believe that weapons must be supportable in the fog of war. In practical terms, this means that aircraft are designed to last only for a postulated combat life and with sophistication commensurate with the technical qualifications of the maintenance personnel who are operating under the stress of war.

For example: On every Soviet fighter, one can remove the afterburner without having to disconnect fuel and electrical lines—a great advantage when it comes to wartime repairs. Realizing that this is the most frequent maintenance task, the Soviets have simplified it.

Soviet military planners have enhanced operational effectiveness by carefully balancing performance against readiness. Without doubt, readiness is the primary consideration, a fact reflected in the ruggedness of Soviet planes. In the words of one analyst: "The Soviets can 'turn' these aircraft [for combat] while they are being bombed, strafed, gassed, and snowed on in below-zero weather. Their aircraft may not be the best performing, but they're certainly not delicate."

Equally great is the impact that the Soviet maintenance cycle has on the ability of a Frontal Aviation regiment to disperse—yet another of the Soviet Union's wartime requirements.

In peacetime, it is true, the maintenance procedure becomes a complicated task requiring long-distance transport and time-consuming repair cycles. But in wartime,

—TASS/Sovfoto

A Soviet pilot and his crew chief prepare for a mission. The trucks assigned to each aircraft have an off-road capability, and maintenance crews are armed. In the background, several bomb caskets can be seen. The bombs are fuzed and are positioned with the aircraft for rapid upload. The round shape of the casket allows for rolling the bombs when necessary.

the much smaller number of base-level maintenance troops and equipment greatly reduces the support "tail" and allows more flexibility in aircraft deployment.

Soviet aircraft appear well suited to combat operations from austere dispersal bases lacking repair facilities. The Soviet view is that an abundant supply of virtually new aircraft will display few of the routine maintenance problems that would occur in equipment that has been ridden hard in peacetime. With little need for repairs, the jets can operate from a wide variety of strips.

The Soviet embrace of dispersal as a major wartime objective has had an impact on USSR base structure. The Soviets have decided that base-level, or intermediate-level, maintenance and its accompanying facilities only complicate the task of building combat readiness. Maintenance is minimized and in most cases eliminated. Most main base repair tasks are of the "remove and replace" type.

The configuration of the Soviet base reflects this. While the American air base is a stand-alone fortress from which to launch multimission air operations, operating in much the same way as an aircraft carrier, the Soviets see their typical base as a combat deployment fire base. In a sense, the Soviets operate their main operating bases as the US Air Force operates its dispersed bases. The USSR air base, in wartime, would serve one function—that of launching combat sorties, not that of a major maintenance facility.

Rear-Echelon Overhauls

The Soviets believe that major repairs and overhauls should be conducted at rear-echelon facilities where skilled labor and precision machinery can be concentrated efficiently. These high-value facilities would be less vulnerable in those locations.

At a main base, virtually all aircraft support equipment is mounted on trucks. Thus, this important equipment can be transported quickly to dispersal sites. Entire tactical aviation units, including flight-line support, medium-level repair shops, inspection and armament vans, and flight operations control vans, can be convoyed to remote bases without breaking radio silence.

In sum, it appears that Western aircraft could attack all Soviet main operating bases and their limited repair facilities and still have little or no effect on the overall readiness of Soviet fighter regiments.

In addition to the contribution it makes to wartime fighter availability and dispersal operations, the unique Soviet maintenance cycle ensures that military commanders will have sufficient reserve forces to exploit early successes.

The Soviet Union has built a substantial stockpile of reserve weaponry—from aircraft components to entire, battle-ready aircraft—and constantly replenishes it. It is estimated that well over half of all fighters the Soviets produce are stored in material reserves. The constant inflow from the overhaul factories prevents any diminution of the reserves.

War reserves are maintained separately from other weapons, in what the Soviets refer to as "full readiness" for immediate use. In peacetime, replacement of such emergency material reserves takes place when their "shelf lives" have expired. In wartime, these emergency material reserves are used for the specific purposes of equipping high-readiness units and replacing combat losses.

The war reserves would also greatly reduce the need for base maintenance. Malfunctioning aircraft parts would be replaced from war reserve stockpiles, eliminating the need for repair depots. Such a procedure would be especially necessary in the initial period of the conflict, when the Soviet economy would not yet have converted to wartime production to replace forces destroyed in battle.

As might be imagined, the unorthodox Soviet maintenance cycle requires the Soviets to deploy a unique support organization with each of its air regiments. This air base support group, known as the Aviation Technical Battalion (ATB), is a separate and distinct unit that combines several functions.

One ATB subsection, the Independent Air Field Technical Support Group (OBATO), handles the traditional Rear Services functions on base premises. Primarily responsible for upkeep of the airfield, OBATO personnel maintain runways, taxiways, and hardstands. The group uses specialized runway maintenance vehicles, which in wartime would also aid in preparing austere strips. OBATO is responsible for fuel dumps, motor vehicle refueling points, portable pumping stations, and other logistics enterprises.

All the aircraft servicing and maintenance on a base, however, remains the domain of the Air Force engineering service, organized in an ATB subgroup known as the Technical Exploitation Unit (TECh). It has responsibility for the operation, maintenance, and repair of aircraft, helicopters, aircraft engines, weapons, and equipment.

The TECh manages transfer of equipment to overhaul factories for scheduled maintenance; transfer of equipment to repair depots for unscheduled maintenance; and inspection, minor repair, servicing, and arming of aircraft. It is also responsible for replacement and calibration of repairable items.

Mobile Repair Shops

Virtually all of the TECh is mobile. The TECh provides the personnel and equipment to inspect and replace components and conduct repairs using truck-mounted specialty service equipment called mobile repair shops or "PARMS." The units are designed specifically for dispersal operations.

All services can be provided in the field from these portable truck-mounted facilities. Each aircraft is assigned to a specialized support truck. It provides AC and DC power, compressed air, simple inspection equipment, and an auxiliary fuel pump. It also has a communication link with the IAS duty officer.

This truck actually tows the aircraft. In fact, the fighter and its truck together form an aircraft "system." The truck becomes the principal means of wartime dispersal because it can tow an aircraft to a dispersal airstrip and then maintain it at that site.

Armament and external store service are also provided by the TECh. This job is relatively simple because there is little or no assembly of bomb, rocket, or external tanks on a Soviet air base. All stores are deliv-

—Photo by Frederick Sutter/IDI

This Mikoyan test pilot's expression at the Farnborough Air Show last fall reflects the Soviets' determination to have their aircraft operate under any conditions. The MiG-29 in the background has doors that cover the intakes when the landing gear is lowered. This prevents foreign object damage to the engines at austere strips.

ered to the base crated and ready to load.

In all its features, the peacetime Soviet tactical aviation support organization is designed for efficient and rapid transition to war. How would the various components of Soviet readiness come into play in a conflict?

If Soviet leaders choose to conduct operations from the main base, the entire system would function much as it does in peacetime. It is in a dispersal operation, however, that the true strength of the Soviet system would become apparent. Even after a Western attack that disables the main base runways, the Soviets would be able to rebound and keep fighting. All evidence indicates that such an operation might resemble the following scenario.

At the main operating base, the first step is the immediate dispatch of an advance airfield-activation unit to planned dispersal areas. Work begins on preparation of deployment sites for dispersal of aircraft and aircraft-support units that are to follow within hours.

These would prepare at least three dispersed airfields in each dispersal area. Runway clearance, support-area preparation, and setup of command and control areas and regimental headquarters all would take place swiftly. Activities at the regimental headquarters would include preparation of the central command and control system, an intermediate-level maintenance center, helicopter pads, and garrison areas.

While the advance units are en route to the deployment sites, other support teams at the main operating base load mobile aircraft and airfield service equipment onto trucks. Strict radio silence is maintained during performance of all these tasks.

When the loading is complete, a convoy of the mobile garrison and support units, led by the regimental commander and his staff, leaves through several different exits and proceeds to the initial checkpoint. At this time, even the commander is unaware of his destination. The convoy receives directions en route, either from highway control troops or from a series of beacons.

In this convoy, each aircraft-servicing vehicle is towing a high-performance aircraft. Speeds on the highway reach up to twenty kilometers per hour. The remote sites, only a few kilometers from the main base, are reached quickly. Throughout, the regiment succeeds in masking its redeployment to new locations.

At the dispersed base, elements of Soviet remote-site philosophy are apparent—mobile flight operations control towers, camouflaged shelters, mobile pipelines and roadways, and simple power support equipment.

The advance units are finishing the preparation of the airstrip, a highway section about 2,200 meters long and twenty-two meters wide. In the "runway" portion of the airfield, the median strip has been paved over, with an apron at either end, measuring 100 meters long and thirty meters wide. Automatic landing systems and crash barriers are deployed at both ends of the runway.

In less than eight hours after the regimental dispersal began, the unit launches its first combat sorties.

Support depth is minimal, with the fighter unit having access to only the most critical parts, basic repair and inspection equipment, fuel bladders, and ammunition. As the war continues and the stockpiles are depleted, resupply of certain critical materials and cadres for both the ground and air forces are provided by air transport, which use the dispersal bases to stage their operations. The largest aircraft in the world, the An-124 Ruslan transport (whose NATO code name is Condor), can operate from the highway strip and appears frequently.

Such is the style in which the Soviet Union has planned to go to war. While the Kremlin's ways may be mysterious to many in the West, the problems they pose are only too apparent. ■

As a Project Engineer at General Dynamics Corp. in Fort Worth, Tex., Richard D. Ward leads the Comparative Systems Analysis Group of the advanced-design section. His career in aviation has included work at Rockwell and McDonnell Douglas. He has participated in the X-15, XB-70A, F-4, F-15, and F/A-18 programs. His most recent article for AIR FORCE *Magazine, "MiG-2000," appeared in the March 1985 issue.*

Life was better before. *Perestroika*'s promise is for tomorrow. The question is whether Gorbachev can pull it off—and how long he has to continue the experiment.

—Photo by Arnie Sachs/UNIPHOTO

INSIDE GORBACHEV'S RUSSIA

BY THOM SHANKER

IT IS AS much a part of the pedestrian's outfit in the USSR as a pair of shoes, and one would rather forget the house key on the kitchen table than leave the *sumochka* at home. Usually a worn plastic sack or a pouch of woven string, a *sumochka* is unfolded from the pocket, purse, or briefcase by harried Soviet consumers whenever they chance on a vendor's treasure: cherries trucked in from Central Asia, off-season hothouse cucumbers, a fresh torte.

Shoppers in the Soviet Union are foragers. They do their buying on the run, in spurts. Pick up toilet paper on the way to work. Duck into a bakery during lunch. Going home, stop at a state-run meat store (maybe two or three) before deciding that the long lines and poor selection make it worthwhile to shell out the extra rubles for a small cut of beef at the nearby farmers' market.

Soviet General Secretary Mikhail Gorbachev is trying to make it easier. He is promising an end to shortages and long lines, an end to shoddy consumer goods and inferior agricultural produce, if only his workers will sign on to his program of reform and labor more efficiently.

From any capital in any country in the world, avid followers of current events have been able to judge for themselves Gorbachev's prowess at negotiating a ban on shorter- and intermediate-range nuclear forces or neutralizing—at least for the moment—senior rivals like Yegor Ligachev. But three years spent roaming the cities, villages, and countryside of the USSR showed me that Gorbachev's fate is equally dependent on the opinions and actions of all the Ivans and Nikolais, the Alexandras and Natashas, the faceless millions who populate his nation.

As Moscow struggles to energize a lethargic economy and raise USSR living standards, Mikhail Gorbachev's message to Soviet workers is "Trust me." But the Soviet population, having seen earlier economic and political reforms come to naught, remains skeptical about the new leader's campaign of perestroika and glasnost.


DENT OF THE UNITED
STATES

Gorbachev's platform of economic and political renewal is a voluntaristic system of reform. It says, "Work harder now and life will be better later on—I promise. Trust me." But Gorbachev is fighting a system in which economic relationships have long been defined as "The government pretends to pay us, so we pretend to work."

At the heart of what Gorbachev has dubbed the Second Russian Revolution, one undertaken without firing a shot, is the two-pronged strategy of *glasnost* and *perestroika*. The first is the style and the second the substance of Gorbachev's reform.

Glasnost is usually translated as "openness," although its true Russian meaning probably is a bit closer to "publicity." *Perestroika* is the broad-ranging program by which Gorbachev is seeking to restructure his society. He speaks of decentralizing both the political and economic sectors, letting more people have a voice in shaping domestic policy, and letting more local managers have a chance to call the shots in running their factories and farms.

Speaking Out on the Quality of Life

Gorbachev has said that one of his greatest achievements since coming to power in March 1985 has been to transform the USSR into a giant debating society, and that is true. A foreign visitor to the Soviet Union before the advent of Gorbachev would have been hard pressed to find anyone other than a Jewish refusenik or political dissident willing to engage in a heartfelt discussion of society's failings. Today, residents in major Soviet cities exhibit a remarkable eagerness to speak their minds about the quality of life.

The Soviet press, for the most part, has become readable and exciting, undertaking insightful reporting into such topics as prostitution, drug-running, and official corruption worthy of headlines in any nation. To be sure, there are still plenty of hacks in the Soviet press—old-line Stalinists who, like their soulmates in the massive bureaucracy, fear reform as a threat to their golden life—but there is also a growing number of young, committed Soviet journalists who view their profession as a way to direct the nation on the path to democratization and reform.

Under the new cultural openness, previously banned books and movies have come to light in a social renewal the likes of which has not been seen since the Khrushchev thaw.

Thus far, however, what we've really been seeing is a cleaning of the cultural attic as long-suppressed works are finally made public. We are still awaiting new works of art, literature, theater, and cinema that reflect the excitement and opportunity of the Gorbachev era.

Just before my departure from the Soviet Union, I was invited to attend the debut of a new film, a sort of rock-and-roll detective story that has since become a smash hit among Soviet youth. All the pop music royalty from the Leningrad and Moscow music scenes performed before the curtain went up in a concert hall sponsored by the Moscow Electric Lamp Factory. It was the sort of hall that would have banned such an outpouring of youthful exuberance before the lines between official and unofficial blurred under *glasnost*.

An avant-garde art show mounted in conjunction with the premiere displayed works mocking the now-disgraced Leonid Brezhnev and the bloody excesses of Joseph Stalin. One of my artist friends—some of his works were on display—was disappointed, though, by the predictability of the Brezhnev satires and the sullen depictions of the Stalin years.

"What of importance can we underground painters

—Photo by C. Lee/UNIPHOTO

For Gorbachev, finding ways to improve the quantity and quality of Soviet food supplies is a priority. Evidence to date, however, is that he has made little—if any—headway in easing the long waiting lines, the shortages, and the inferior quality of agricultural goods. Although the state heavily subsidizes the prices of meat, bread, and other staples, the average Soviet citizen spends thirty percent of personal income on food.

have to say when more challenging statements than our own appear every day in official publications like *Ogonyok, Literaturnaya Gazeta,* and even *Izvestia*?" he asked, noting a remarkable turnabout of the Kremlin's new era.

Gorbachev's reforms also have heralded the rise of street politics in the USSR, as a vast array of informal political organizations eschewing ties to the Communist Party has organized to field candidates in local elections, erect monuments to Stalin's victims, and publish unofficial political journals. These groups are peopled by young men and women of ideas and ideals who are taking Gorbachev at his word when he speaks about a new era of "socialist pluralism." In their support of *perestroika,* these informal political activists are offering themselves as a most important test of Gorbachev's sincerity.

One of the more exciting examples of freewheeling political organizations is the Saturday afternoon meetings in Michael's Park behind the Russian Museum in Leningrad. Reminiscent of habitués of Speakers' Corner in Hyde Park or students on any American college campus circa 1967, members of the informal organizations mount their soapboxes to proclaim new goals under the wary eyes of Soviet militiamen.

The Darker Side of *Glasnost*

Not unexpectedly, the new openness also has its darker side. Citing Gorbachev's reforms to defend their right of freer expression, other groups have surfaced from the underbelly of Soviet life to espouse platforms of anti-Semitism and ardent—even dangerous—Russophilia.

Reaching a precise definition of Kremlin reform, therefore, is important because of the need to banish wishful naïveté when interpreting the attractive Gorbachev buzzwords of *glasnost* and *perestroika*. Despite the exciting and laudable changes under way in the USSR, Gorbachev's openness is not like First Amendment freedoms in the United States, and the Soviet leader is hardly a Jeffersonian democrat when he talks about the need to decentralize power.

Glasnost is, in reality, a political tool, one necessary to motivate the population by showing the extent of decline under previous rulers now disgraced. It also is a way to bring the population into the body politic, to enfranchise them, for Gorbachev knows that people outside the system will hardly work more diligently for reform. Think, then, of *glasnost* not as sunlight across the land, but as a spotlight shone on those problem areas deemed by the Soviet leadership to be in need of correction.

Another common misinterpretation of Soviet reform also vanishes upon spending time in the USSR. While the Reagan Administration can be complimented for building up American arms in an effort to bring the Soviets back to the bargaining table in Geneva, it is shocking to read American pundits saying that the US's military buildup was responsible for bringing about *perestroika*.

Let's not kid ourselves. *Perestroika* is completely homegrown, brought about by a crisis of economic decline in the USSR. Gorbachev knew that without economic restructuring, the Soviet Union could be a Third World power in every important area except nuclear arms by the year 2000.

But the internal contradictions of Gorbachev's economic reform are already appearing. There is no more compelling example of the dangers ahead than the periodic panic that grips Soviet shoppers whenever rumors erupt that an end to the wasteful policy of state subsidies will bring an immediate rise in the price of meat, bread, cheese, and other staples.

Economists both East and West agree that Gorbachev is right when he concedes, "We are faced with the need to carry out not just partial improvement of the system of pricing, but a radical reform of wholesale purchase and retail prices."

The statistics of state subsidies are difficult to gather, but when pieced together they tell a story of enormous waste that shackles initiatives for reform. Documents published by the Communist Party Central Committee revealed that government subsidies for consumer goods top 72 billion rubles a year, or almost $120 billion. The prices the state paid for food production rose 460 percent in the last thirty years, although the price tags for those goods in state stores hardly changed.

The Promise of Worker Prosperity

The reason for these subsidies is the USSR's promise of worker prosperity, a social contract that guarantees low prices for food, apartments, health care, and public transportation.

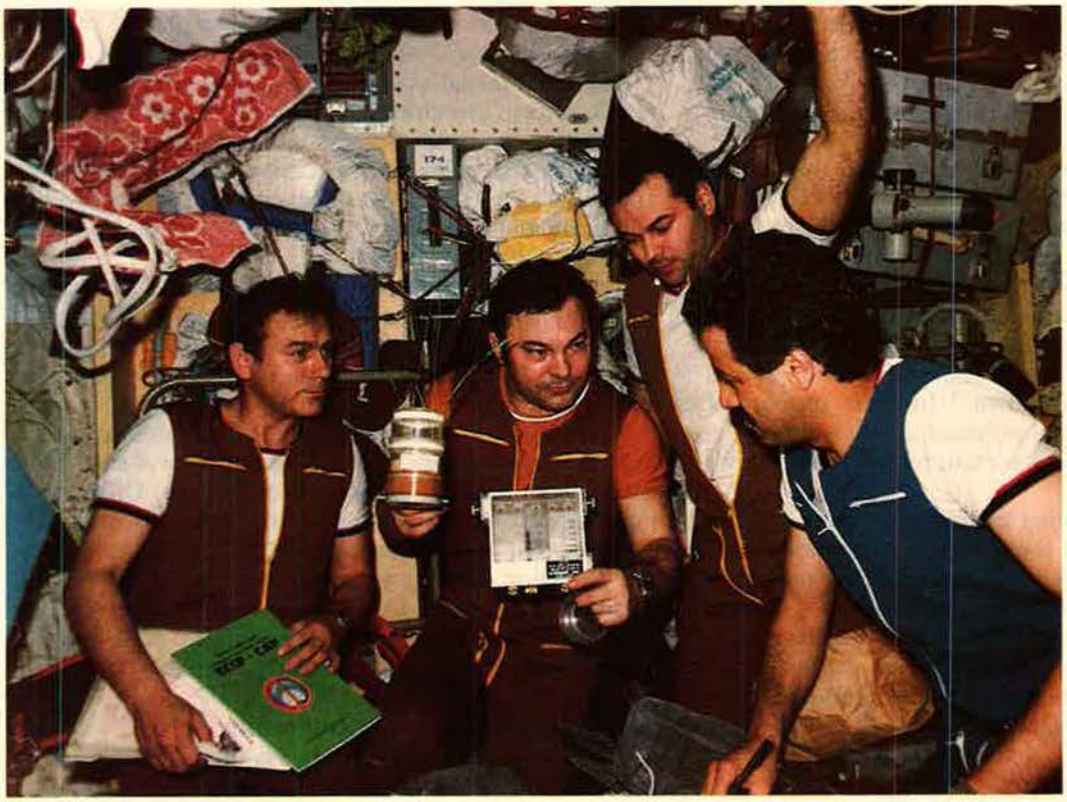
Now Gorbachev and his economic brain trust are saying that prices should reflect the true cost of production as part of a far-reaching program to drag Soviet industry out of its deep rut. Reforms targeted at consumers also include increasing the quality and quantity of industrial goods, plus improving agricultural storage and transportation to recover some of the thirty percent of produce lost each year to spoilage.

A survey of my Soviet friends revealed that, on the average, they spend about thirty percent of their earnings on food. By comparison, families in the US devote nineteen percent of their budget to food.

Gorbachev's goal of a market-style pricing mechanism in the USSR brings with it the risk of inflation, a taboo under Marxist ideology. If consumer prices go up in the Soviet Union, similar demands will be made for salaries, prompting an increase in the cost of goods those workers produce. The USSR would then be caught in a spiral of inflation familiar to residents in the capitalist West.

Inflation already exists in the USSR, although it is hidden in clever ways. It was an old *babushka,* or grandmother, who opened my eyes to the system one day when I was shopping at the central market in Kiev. She told me how authorities had skillfully increased bread prices by introducing new and better-quality varieties at higher prices, while reducing the availability of the old, cheap bread. Disguised inflation also includes the development of cooperatives that operate cafes, produce clothes, or compete with the state in the undernourished service sector. Once touted as the cure-all for service-starved Soviet consumers, the program of free-enterprise cooperative ventures has foundered on bureaucratic opposition and popular distrust.

Bright spots do exist in the strategy to inject profit



—TASS/Sovfoto

While the Kremlin has lavished funds and attention on technical spectaculars such as the Mir orbital space station (at left, Mir cosmonauts pose with a biological experiment), it has trouble keeping the capital city supplied with simple items such as toothpaste and apples. The consumer sector has been stunted by official neglect, skewed priorities, a gargantuan bureaucracy, and a history of stifled creativity and initiative.

motives into the consumer sector—most notably the charming restaurants that dot major cities and the clever gifts on sale at first-ever art fairs.

But Moscow city officials say they have met barely ten percent of their goal for granting permits to cooperatives, which are allowed to fill gaps in the state-run economy for ventures like apartment remodeling, tailoring, hairdressing, and radio repair. The slow start-up for cooperative ventures and individual labor projects—both attempts to loosen the fetters on a new generation of Soviet entrepreneurs—illustrates the resistance threatening the Kremlin reforms.

The Threat to Power Bases

Some bureaucrats are loath to support any plan for social renewal that may curtail their power base in a given economic sector. Even those who acknowledge the need for new cooperatives may be powerless to help fledgling business people get office space or wrangle needed supplies from the state, which still maintains its monolithic control over raw materials and manufacturing. In addition, seventy years of communism and a centuries-old foundation of serfdom foment animosity toward any man or woman who makes a few extra rubles for a better life.

The new breed of socialist tycoon fears the lessons of Soviet history, when earlier generations of state-encouraged capitalists were crushed beneath tides of renewed ideological orthodoxy. "I don't see this as a problem," joked Aleksandr Panin, the Moscow City Council secretary in charge of implementing the new economic law. "We'll just build cooperative prisons."

While black humor was refreshing during my interview with this Soviet bureaucrat, it cannot erase memories of the high-living period from 1921 to 1928 when the young Soviet state flirted with capitalism under the New Economic Policy (NEP)—nor of the purges that followed.

Under NEP, much like today, commerce was told to flourish, and a new class of traders, known as Nepmen, emerged to compete freely with the state sector. The deviation from socialist norms was rationalized as necessary to recover from the economic ravages of the Bolshevik Revolution and the subsequent civil war. But as Joseph Stalin reasserted party control over the economy with the first five-year plan, Nepmen vanished, many into labor camps, convicted of speculation.

Those who have never lived in the USSR find it hard to believe that a nation that can produce the shiny Zil limousines that wheeled through Washington and New York City during the summits, or can keep men in space longer than the United States can, is not capable of supplying even Moscow with enough toothpaste or fresh fruit. During one shortage that hit while I was there, toothpaste sold for the equivalent of $50 on the black market. Apples had vanished from the state stores.

How the Rules Are Changing

In addition to inflation, a second time bomb is ticking beneath Gorbachev's reforms, viewed from the perspective of the average Soviet citizen. It is unemployment, Soviet-style, which was best explained to me by Valentin Shirayev in Volgograd, the hero city that was nearly destroyed during house-to-house fighting in World War II.

Shirayev manages a good factory. His Volgograd Motor Works on Russia's steppes (great plains) has not missed a production target in eight years. He has a carefully regulated network of suppliers, and he maintains good relations with the bureaucrats in Moscow who dictate the tiniest details of all Soviet industry.

But the rules are changing. By 1990, the iron collar of

Bedek Aviation: Cost-effective maintenance, repair, overhaul, conversion and testing of commercial and military engines and components. Computerized monitoring, expert personnel, strict inspection, customer consultation, after sales service.

Engines and components serviced include:

Pratt & Whitney	JT3, JT4, JT8D, (JT9D), PT6, F100, J52, TF33
General Electric	J79, F110, T64
Lycoming	T53
Allison	C250, T56
Snecma	ATAR 9C

Total Aero-Engine Service Capability

Ben-Gurion International Airport
Israel 70100
Tel: (3) 971-2630
Tlx: 381014 ISRAVIA
Cables: ISRAELAVIA
Fax: (3) 971-2290

ISRAEL AIRCRAFT INDUSTRIES LTD
BEDEK AVIATION DIVISION

Bedek Aviation: Customized conversions of heavy transport aircraft to various configurations for multimission civil or military applications: Cargo, Combi, VIP, refuelling tankers, passive and active EW, ELINT/SIGINT/COMINT, reconnaissance, maritime patrol.

CONVERT TO	B 707	B 727	B 737	DC 8	C 130
Passenger	•	•	•	•	•
Cargo	•	•	•	•	•
Combi	•	•	•	•	•
Vip	•	•	•	•	•
Tanker	•				•
Sigint	•	•	•	•	•
Sigint/Cargo	•	•	•	•	•
Airborne C^3	•	•	•	•	•

Heavy Transport Aircraft Conversion

Ben-Gurion International Airport, Israel 70100
Tel: (3) 971-2653
Tlx: 381014 ISRAVIA
Fax: (3) 971-2290

ISRAEL AIRCRAFT INDUSTRIES LTD
BEDEK AVIATION DIVISION

Bedek Aviation: Repair, overhaul, testing and reconditioning of aviation components and subsystems for civil and military applications. Oxygen systems; Landing gears; APU; Propellers; Avionics; Airborne Computers; Navigation & Flight Instrumentation; Fuel & Hydraulic Systems; CSD; Gear Boxes.

Aircraft Systems and Accessories Servicing

Ben-Gurion International Airport
Israel 70100
Tel: (3) 971-3554
Tlx: 381014 ISRAVIA
Cables: ISRAELAVIA
Fax: (3) 971-2290

ISRAEL AIRCRAFT INDUSTRIES LTD
BEDEK AVIATION DIVISION

Bedek Aviation: Comprehensive, cost-effective systems upgrading, re-engining, rewiring, structural improvements – for better reliability/maintainability, extended service life, enhanced mission capability, improved flight safety.

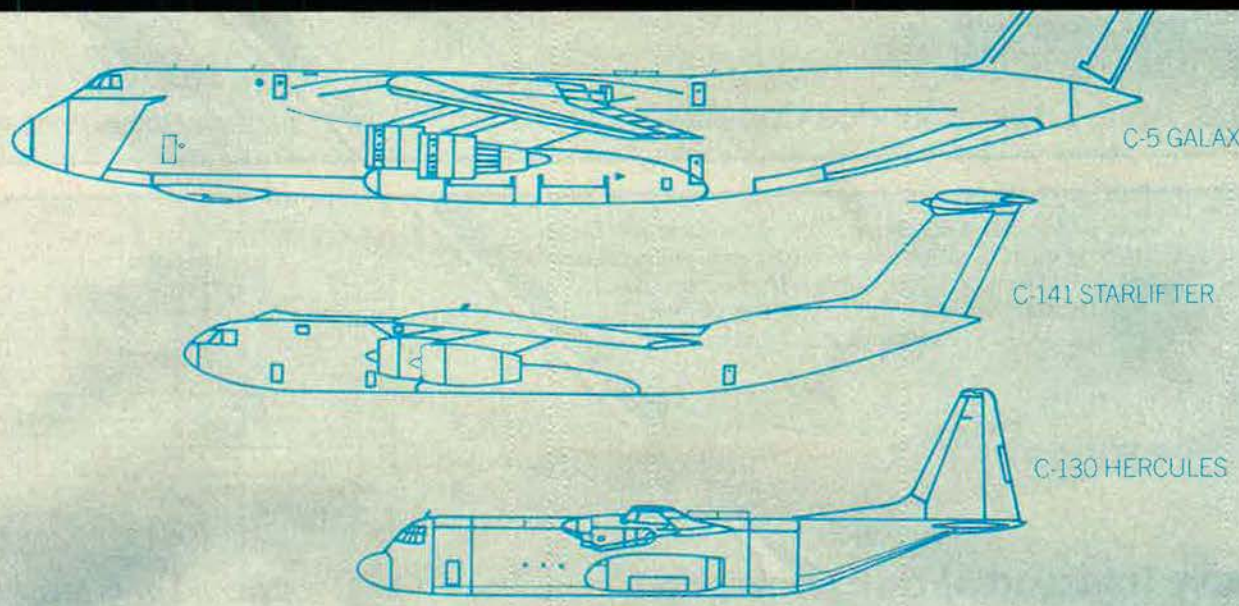
A/C Type	Overhaul	Accessories	Upgrading
M3/M5/M50/M3NG	•	•	•
Kfir C2/C7	•	•	•
F-4 Phantom	•	•	•
F-5	•	•	•
A-4 Skyhawk	•	•	•
Fouga/Amit	•	•	•
F-15	•		•

Military Aircraft Upgrading and Maintenance

Ben-Gurion International Airport
Israel 70100
Tel: (3) 971-7518
Tlx: 381014 ISRAVIA
Cables: ISRAELAVIA
Fax: (3) 971-2290

ISRAEL AIRCRAFT INDUSTRIES LTD
BEDEK AVIATION DIVISION

MAC TEAM



THE SHORTS C-23 SHERPA is the newest member of the distinguished Military Airlift Command Team. In fact, this rugged STOL aircraft is an important reason why the 10th MAS in Zweibrucken, West Germany has won five top awards since 1985. These include the "MAC Outstanding Operational Support Airlift Squadron" two years in a row.

With its high payload/multi-mission capabilities, advanced avionics, simple design and short field performance — coupled with an unrivaled reliability record and the lowest purchase and operating costs of any aircraft in its class — the Shorts C-23 Sherpa is eminently qualified for airlift duty, anywhere in the world.

Find out all the ways the Shorts C-23 can add to your airlift team . . . and subtract from your operating costs. Contact Short Brothers (USA), Inc., 2011 Crystal Drive, Suite 713, Arlington, VA 22202-3719. Or call us at (703) 769-8700.

SHORTS

state control will be loosened, and Shirayev will set his own production goals and scramble for his own materials. His engines will not be sold unless he finds a buyer. His employees will be paid only according to the quality of their work. Shirayev said that in some factories, the new get-tough campaign to eradicate widespread shoddy production led agents of the USSR State Committee for Standards to reject up to forty percent of production—virtually shutting down the plants until machines could be retooled and workers retrained.

New laws on economic enterprise will require that factories show profits, a formidable concept in a nation where chronically inefficient industry in 1986 accumulated debts of $65 billion.

"Soon," Shirayev conceded with a wry smile at the thought, "we, too, will have the freedom to go bankrupt."

Although Gorbachev calls all of this a second revolution, what is raging through society seems, at times, to be more like civil war, with reformers at odds with conservatives in the party and with nonparty members maneuvering for a greater voice in decision-making.

Gorbachev says from the rostrum what earlier was whispered only at home—that the system is failing. But even as the Soviet leader's program of national renewal tears at the false foundations supporting the party's monopoly control of Soviet life, a major contradiction emerges.

Life for most Soviets was better before Gorbachev, my friends lament. Maybe there is now more promise, more hope, and life is more interesting. But, as a middle-aged Soviet journalist told me: "As much as it hurts to say it, I must tell you straight. Life was simply better and easier before."

Revolution From the Top Down

Having now returned to the United States after three years in Mother Russia, I am asked: "Is Gorbachev for real?" The question should be: "Can he pull it off?"

No one knows how much time the Politburo and the Central Committee will give Gorbachev to make good on his promises of economic growth with political stability in order to fend off the Kremlin gray wolves who want to return to the predictable, if stagnant, way of doing things.

A Russian émigré at a major media office in London told me they are running a "Gorby Lottery" with bets on when the Soviet leader will be ousted—sort of a Kremlinological Sunday Football Pool.

Gorbachev has a big job. His people missed the Renaissance, the Reformation, and the Industrial Revolution, and already are generations behind in the computer age. Gorbachev is battling not only seventy years of stagnation under communism, but centuries of a serf mentality that brought a leveling of intellectual abilities and death to creativity and self-motivation. You can read this analysis on the pages of the Soviet press.

Gorbachev is now trying to educate the Russian people in the ways of freedom and tolerance. But, in true Russian fashion, he is doing it from above. His revolution is from the top down and is thus far pretty thin. Even Andrey Sakharov, the Nobel Peace Prize laureate and father of modern Soviet dissent, praises Gorbachev's reforms, but warns that to enforce decentralization, the Soviet leader has had to gather far too much power to himself. Sakharov says he trusts Gorbachev with this enhanced authority, but voices the question, "What if . . . ?"

Gorbachev is fighting a bureaucracy afraid of losing its control of the easy life while fighting a population that thus far has only long vodka lines and more discipline in the workplace.

Will Gorbachev make it?

Westerners who have lived in the Soviet Union have a more skeptical attitude about Gorbachev's reforms and his message than do pundits and politicians who deal only with the rhetoric of reform. Those of us who have lived there have seen the hospitality of the people, traveled the expansive countryside, and been touched by that ineffable quality that is called the Russian soul. My best friend in the USSR, a jazz critic from Leningrad named Alek, once told me: "This place is like a disease. It gets into your blood."

At the same time, though, those of us who have lived in the Soviet Union have seen the brutality of the society, its dehumanizing and desensitizing aspects. We know that Gorbachev is just one man and, although sincere, is almost alone in his struggle.

Public-opinion polls in Europe have shown that vast numbers of residents view Gorbachev as more a man of peace than Ronald Reagan is. While Reagan's "evil empire" talk made him sound like a man enamored of saber-rattling, the trustworthiness of a political leader is dependent on the stability of his society. Our Western, pluralistic democracy has institutional safeguards that are wholly missing from the Soviet Union. We have Congress, the courts, the vote, and the press to assure that the voice of the people will be heard and followed.

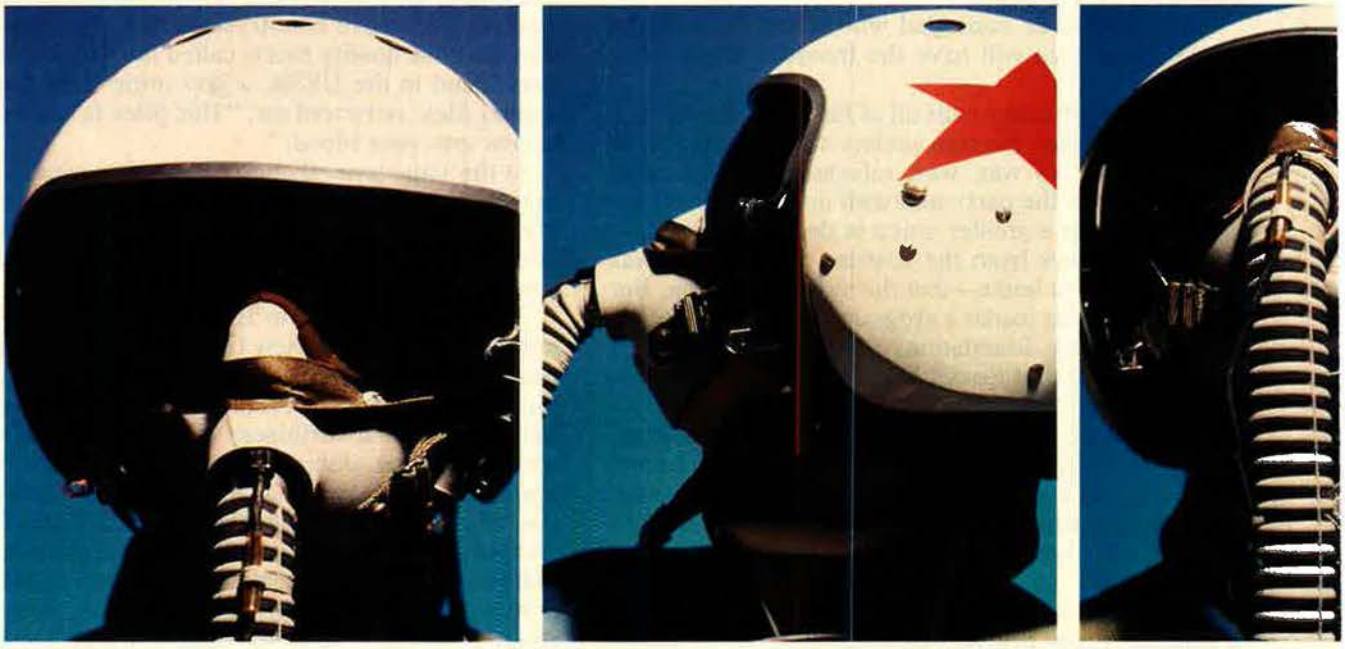
We must watch what is happening on the streets of his country to gauge how the man's words are put into action on such topics as tolerating a diversity of political opinion, honoring human rights, and respecting decisions of ethnic or regional minorities.

How long does Gorbachev have to pull it off?

I like to think of Gorbachev as Moses of the Old Testament leading the children of Israel out of slavery in Egypt. The metaphor recalls how the Israelites were forced to wander in the deserts of Sinai for forty years because these former slaves were not fit to enter the Holy Land. Only a new generation, born in the ways of freedom, could do that.

The same applies to Gorbachev. Everything he is doing—the sobriety laws, the steps toward democratic reforms, the cultural awakening, the injection of market incentives—is aimed at creating a new Soviet citizen. Gorbachev's vision of democracy—like democracy everywhere—is messy. He knows his people are not yet ready for it. However, Gorbachev cannot expect forty years like the Almighty gave Moses. The Politburo is not known for divine patience. ■

Thom Shanker spent three years as Moscow correspondent for the Chicago Tribune, *returning to Washington in August 1988. Before joining the* Tribune *in 1982, he spent two years in the master's degree program at the Fletcher School of Law and Diplomacy, specializing in the US-Soviet strategic balance. He now is Pentagon correspondent for the* Tribune, *covering national security, science, technology, and space.*



AFTER TEN YEARS, THE F-16 IS STILL TURNING HEADS.

F-16. The best single fighter in the world. The F-16's sleek, radical airframe has always attracted its admirers. No other fighter performs with such agility at both subsonic and supersonic speeds.

The enemy can't outrun it. They can't outmaneuver. And they can't outgun it.

They know going in they're not coming out.

In fact, the Fighting Falcon can enter a fight with full internal fuel, pull 9 g's, and still accelerate.

Perhaps that's why, if you're the enemy, it's the last fighter you'd ever want to see.

GENERAL DYNAMICS

Buran is just an orbiter—a vehicle rather than a system. But to the surprise of the West, the Soviets were able to fly the first mission completely by computer.

THE SOVIET SPACE SHUTTLE

BY MARCIA S. SMITH

On November 15, 1988, the world finally witnessed the first flight of the Soviet space shuttle *Buran*. Rumors about the existence of a Soviet shuttle had circulated for more than a decade, and USSR space officials had been stating since January 1988 that launch was imminent.

The long-awaited flight of *Buran* ("Snowstorm") was a significant success for the Soviet space program, especially because it demonstrated an ability to control automatically a complex space vehicle during a difficult flight profile, a capability that experts thought the Soviets did not possess.

Thanks to General Secretary Gorbachev's policy of *glasnost*, the Western world has been given an unprecedented peek into a major Soviet space program, and the extensive publication of some technical details by Soviet specialists would have been unthinkable a few years ago.

The Soviet shuttle program is referred to as "VKK" (air-space vehicle). This specific program began in the mid-1970s, but the Soviets have stated that they started development of a shuttle-type vehicle in the 1950s. In the mid-1960s, a spacecraft was tested, though it was much smaller than today's VKK. That program was terminated, and work on VKK did not begin until the 1970s. Total costs are said to be $10 billion.

There can be no question that the Soviets benefited from US experience in developing and operating a reusable shuttle. But claims that the Soviet shuttle is a carbon copy of the US vehicle are highly exaggerated. The US "shuttle" is a system of four elements: the airplane-like orbiter, the external tank (ET) that holds the fuel for the main engines located on the orbiter, and two solid rocket boosters (SRBs). Each time the American shuttle is launched, all four components must be used, so cargo being taken into space is limited by the size and weight constraints of the orbiter's cargo bay.

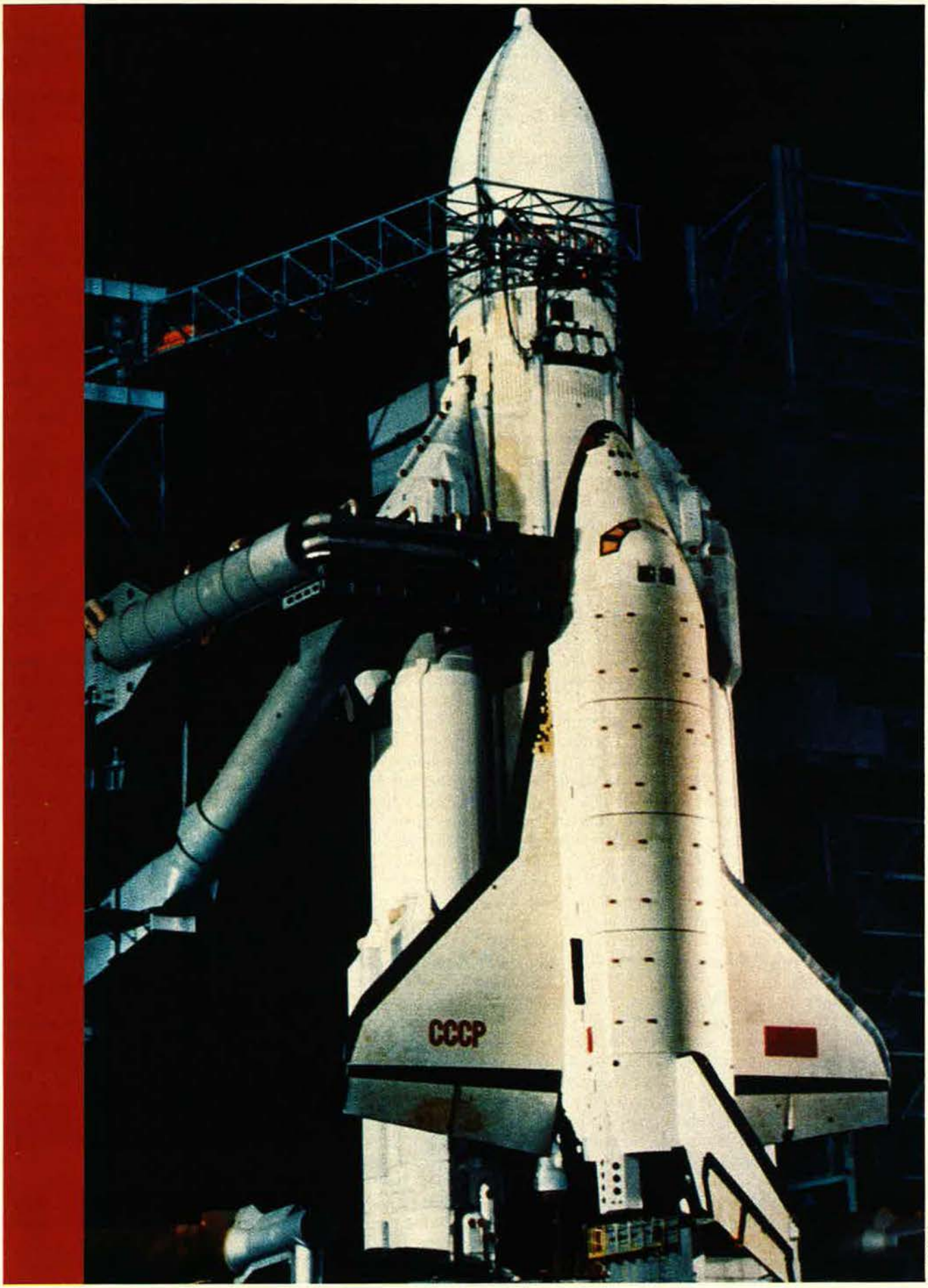
A Different Approach

The Soviets took a different approach. Their "shuttle" is not a system, but a vehicle without main engines that physically resembles a US orbiter and flies into space on a heavy-lift launch system called Energiya. The launch vehicle—the equivalent of the main engines, ET, and SRBs—is Energiya, which can operate independently of a shuttle. Able to launch at least 105 metric tons into low Earth orbit, it is similar in capability to the US Saturn V launch vehicle used to send Apollo crews to the Moon. If the Soviets have a payload that is too large or heavy to be carried in the shuttle cargo bay, they can leave the shuttle off for that flight. Thus, the Soviets possess a more versatile space transportation system.

Energiya's first stage consists of four strap-on boosters fueled by kerosene and liquid oxygen, a combination the Soviets have used for many years, though the engines are of new design. Each of the four strap-ons produces a thrust of 740 metric tons and drops away 165 seconds into flight. In the two flights Energiya has made to date (May 15, 1987, and November 15, 1988), the strap-ons were not recovered, but the Soviets have said this may be done in future flights.

The second stage is a large central core that resembles the US external tank. It uses liquid hydrogen and liquid oxygen; Energiya is the first system to use this high-

***Buran* sits mated to its Energiya booster at the Baikonur Cosmodrome before its first unmanned flight. Unlike the US shuttle orbiters, Buran has no main engine. Energiya can also operate independently.**



—TASS/Sovfoto

energy combination in the Soviet space program. The four main engines for achieving orbit are located on the central core. Each produces 148 metric tons of thrust, giving a total liftoff thrust of 3,550 tons for the Energiya system. The central core is jettisoned after 486 seconds and falls into the Pacific, so the main engines are not reusable, as they are on the US shuttle. Evidently, the USSR concluded that any potential cost advantages of reusing the main engines were outweighed by other factors. Engines on whatever payload is being launched act as a third stage for final boost into orbit.

Energiya is launched from the Baikonur Cosmodrome at the Tyuratam launch site near the Aral Sea. The facility has a role similar to that of Cape Canaveral. (Plesetsk, near the Arctic Circle, has a purpose similar to that of Vandenberg AFB. Kapustin Yar, near Volgograd, corresponds to Wallops Island.) The shuttle is mated to Energiya horizontally in a processing facility and moved to the launchpad in that position. The Energiya/shuttle vehicle is erected to a vertical stance at the pad (US systems are mated vertically and then moved to the pad). The Soviets impose a fifteen-kilometer-radius exclusion zone around the launchpad beginning thirteen hours before launch, when fueling begins.

The shuttle *Buran* is thirty-six meters long, sixteen meters high, and 5.6 meters in diameter, with a twenty-four-meter wingspan, a wing area of 250 square meters, a wing sweep angle of forty-five degrees, and a 2,000-kilometer cross-range maneuvering capability. The cargo bay is 18.3 meters long and 4.7 meters in diameter. *Buran* is made of steel, aluminum, and titanium, covered with 38,000 ceramic tiles for thermal protection. As on US orbiters, tiles on the leading edges are made of carbon-carbon material. Other tiles are made of superfine quartz fiber.

The ship's total takeoff mass is 105 tons, its landing mass eighty-two tons. It can carry thirty tons into orbit and return with twenty tons. Under normal conditions, the craft will carry crews of two to four cosmonauts, but it can carry up to ten persons at a time. The cabin has a volume of seventy-three cubic meters and has six windows. The Soviets say that ejection seats can be used in the first two minutes of flight, but it is not clear if such seats are provided for ten crew members. The US shuttle had ejection seats for two-man crews who flew four test flights, but the seats were later removed.

The only engines on the Soviet shuttle itself are two orbital maneuvering engines used in the final moments of achieving orbit or reentry and thirty-eight reaction control engines for maneuvering in orbit. In flight testing, the orbiter was equipped with four jet engines for takeoff and landing from an airstrip. Existence of the engines led many Western analysts to conclude that they were part of the operational version of the orbiter and would be used to give the shuttle the ability to abort a landing and try again. However, the Soviets have made it clear that their shuttle, like its US counterpart, must land on the first attempt.

Soviet Shuttle Capabilities

Moscow maintains that the shuttle can remain in orbit for up to thirty days, compared to seven to ten days for the US shuttle. But the Soviets do not specify what type of electrical power is used or how they would provide other consumables. The question of electrical power is interesting because the USSR has never used fuel cells in its spacecraft, though the US has used them for Gemini, Apollo, and the shuttle. Whether the shuttle program signals introduction of fuel cells into the Soviet space effort is unclear. It could be that the shuttle must dock with an orbiting power supplier (perhaps a space station) in order to remain in orbit for long periods or have energy beamed to it from a free-flying power station. For years, the Soviets have discussed the potential of solar power satellites to support activities in space. They have never given any indication of when they plan to build such plants, however, and fuel cells would be a much simpler solution.

Western analysts were surprised that the first flight of *Buran* came on only the second flight of Energiya. The first Energiya test, on May 15, 1987, was a failure. Its payload landed in the Pacific rather than achieving orbit. The Soviets announced that Energiya's two stages had worked perfectly but that the engine on the payload itself had failed. Thus they had some confidence in the two-stage Energiya, but risking an expensive space shuttle on a vehicle that had been flown only once was a surprise. The Soviets are more conservative than Americans when introducing systems, particularly those carrying crews into space. Hence, Western space experts should not have been surprised when the Soviets announced that their first shuttle flight would not carry a crew. Even if Energiya had been fully proven, it is probable that the flight would have been automated. Every Soviet spacecraft designed to carry crews has been tested in an automated mode first.

The Mercury, Gemini, and Apollo spacecraft were each tested without a crew, but that procedure was changed for the shuttle. The complexities of flying a space shuttle entirely by computer were judged to be too great. Perhaps that is why so many Western observers assumed that the Soviets would be forced to abandon the conservative approach and use a crew. Indeed, there was a spirited debate within the ranks of Soviet space program officials over this question. In February 1988, the head of Glavkosmos, the Soviet space agency, announced that *Buran* would not carry a crew. In May, however, the head of the cosmonaut corps said a crew would be aboard. The debate was less surprising for its substance than for the fact that it was aired publicly.

Awaiting the Launch

Beginning in January 1988, the "imminent" launch of the Soviet shuttle was announced repeatedly by Soviet officials, and use of the word "soon" in statements throughout the spring led Westerners to expect a launch at any time. In March, the Soviets pledged to announce the flight in advance and to televise it live. Despite the pronouncements and release of a photograph of *Buran* on September 29, when the US shuttle returned to space, it was not until October 26 that the Soviets fulfilled the first promise by making the advance announcement that the launch would occur at 6:23 a.m. Moscow Time (MT) on October 29 (8:23 a.m. at the launch site). But as the hour approached, there was no live TV coverage. Time passed without announcement of a launch, and at 7:17 a.m. MT the Soviets released a statement that a problem had developed and that the launch would

be delayed four hours. Then, at 7:25 a.m. MT, they said the postponement was indefinite. At 5:20 p.m. MT, they revealed the reason.

Computers had detected a last-minute anomaly and automatically stopped the countdown. The malfunction was related to the access arm connecting the orbiter to the pad support structure. This arm has several purposes, providing access to the orbiter by technicians and (someday) a crew, emergency escape for a crew, and housing for connections to orbiter gyroscopes that have to be updated. Computers found that the arm had not retracted sufficiently and, at T minus fifty-one seconds, aborted the launch. At 9:00 p.m. MT, live footage, direct from the launch site, was telecast to prove that the vehicle was not damaged.

As Western observers waited for announcement of a new launch date, Moscow at first said it "won't be long." Then the Soviets announced that the launch would be postponed until after November 7 festivities associated with the celebration of the October Revolution. On November 12, a new launch date was set: 6:00 a.m. MT on November 15.

This time, all systems functioned perfectly and the launch took place, though approaching bad weather caused some concern. Hours before launch, a cyclone was approaching from the Aral Sea, and temperatures were near freezing. Officials decided to go ahead with the launch, since they were within prescribed weather margins and wanted to demonstrate that they could launch under less than ideal circumstances. No live television coverage was provided, but pictures were shown ninety minutes after launch.

The two stages of Energiya fired as planned, and at 160 kilometers altitude, *Buran*'s orbital maneuvering engines fired for sixty-seven seconds and then a few minutes later for forty-two seconds, placing it in a 250-kilometer circular orbit at 51.6 degrees inclination. Data from *Buran* were relayed to Earth using three communications satellite systems—*Luch, Gorizont,* and *Molniya*—in geosynchronous and semisynchronous orbits.

After three hours and twenty-five minutes and completion of two orbits, *Buran* glided to a landing just twelve kilometers from the pad. Landing speed was 340 kilometers per hour, and a seventy-five-square-meter parachute was deployed fourteen seconds after the main landing gear touched down on the runway. The parachute was automatically jettisoned when the speed fell to fifty kilometers per hour. The shuttle takes 1,100 to 2,000 meters to come to a stop, and the Soviets have said that in an emergency it could land at any airport. The strip at Baikonur is specially outfitted for shuttles, and two more such strips are being built, one at Simferopol in the Crimea and the other at an unspecified site in the eastern USSR. The Baikonur runway is 4.5 kilometers long and eighty-four meters wide. It is equipped with radar, rangefinders, Kurs and Glissada landing systems, an air traffic control system, special transfer devices, and a six-story building that serves as command post and control tower.

—TASS/Sovfoto

At the end of its two-orbit mission,* Buran *landed on a specially constructed runway at Tyuratam near the Aral Sea. The Soviet shuttle also used a drag chute to slow it down once on the runway. Buran's computer-controlled first flight stunned many Western observers.

The automated control of the spacecraft throughout the mission, including landing, impressed many Western analysts. Moscow was thought not to possess computers capable of maneuvering the vehicle through such a demanding flight profile. The Soviets used four fault-tolerant computers linked in a redundant set. The control system can continue to operate even if two computers fail. The use of a computerized system to control the shuttle showed a level of confidence unexpected in light of problems the Soviets had encountered in 1988. Computer problems, made worse by pilot error, left a Soviet and Afghan cosmonaut crew stranded in orbit for one day in September, and the automated Phobos 1 craft en route to Mars was lost at the end of August when a ground controller sent an incorrect command to the

spacecraft telling it to turn off its stabilization systems. The quality of shuttle computers and personnel operating them must be greatly improved over those of other projects.

The computer-controlled system will be used even when a crew is aboard, with the crew serving as backup. After the flight, the Soviets began touting their computer abilities in both hardware and software. They referred to *Buran*'s flight as "evidence of a Soviet breakthrough" in technology, signifying an ability to develop and operate "an intricate computerized system on a par with the US 'Star Wars.' " Among possible applications, they mentioned automatic aircraft landing, automatic control of highway traffic, and weather forecasting.

Buran's flight apparently achieved all its objectives. Television photos of the shuttle as it landed, released after the event, showed discoloration of a large number of the thermal protection tiles. The Soviets later announced that many tiles had melted during the flight, turning into marble due to a special coating applied to protect them against moisture. Four tiles came off during the mission. Whether or not tile problems will postpone the next launch of the Soviet shuttle system is unclear. No launch date has been announced.

Plans for the Future

Soviet officials have stated that they are building "several" orbiters, and each will be able to fly 100 times. But they also have repeatedly said that they don't plan to launch a shuttle more than four times a year. The need for several orbiters would exist only if a high loss rate were assumed, if a very long turnaround time between flights were required, or if many flights per year were planned. The first two explanations seem unlikely. A system would not be designed with a high loss rate in mind, especially a system intended to carry cosmonauts. Long turnaround times would not be designed into a program, and there is no reason to expect this. Thus, it is probable that a higher launch rate is planned—or was planned when the shuttle was designed.

The Soviets have worked on the shuttle program for about ten years, so it was a program decision made in the Brezhnev era. It may have come in response to the US program rather than to a specific and independent requirement. While there is considerable logic in developing a reusable space transportation system for access to Soviet space stations, which have been launched since 1971, the need for a large cargo bay is not as obvious. The US shuttle has a large cargo bay because it was designed as a "space truck" to carry spacecraft (and people) to low Earth orbit. The US shuttle was also designed to replace almost all of the older Expendable Launch Vehicles (ELVs) in the US fleet.

Thus, the US shuttle's purpose is quite different from that of the Soviet version. The Soviets have indicated that they will not retire any of their ELVs, and the addition of Energiya as a heavy-lift launch vehicle in its own right gives them additional capacity. It is reasonable to question why Moscow chose to develop a reusable space shuttle with such a large cargo bay instead of a smaller crew-transport system. It is possible that such a system also is under development. Soviet officials have long held that they will use their shuttle to return to Earth large spacecraft that can be repaired and reused. Specifically, they mention modules that will dock with the *Mir* space station in years to come. However, it seems unlikely that they would have gone to the expense of designing a shuttle simply to retrieve these modules.

Questions about the utility of the Soviet shuttle arose in the West as soon as *Buran* landed. Perhaps in response to repeated queries, Yuriy Semenov, a primary designer of the shuttle, gave a long interview in December 1988 about the potential uses of the craft. The first one that he listed was to salvage troubled spacecraft, including nuclear-powered satellites that malfunction. Semenov also identified the Salyut 7 space station, launched in 1984 and replaced by Mir in 1986, as a target for a shuttle flight in the 1995–2000 period. The Soviets, however, have not mentioned development of a remote manipulator system similar to the "arm" developed by Canada for the US shuttle. It enabled shuttle crews to retrieve or repair the Solar Maximum Mission, a Westar and a Palapa, and Leasat. Semenov also said that the shuttle would be used as a research laboratory, for launching complex optical and radio telescopes, and for use in space construction.

Whether the Soviets actually designed their shuttle for these purposes, or are merely making projections on the basis of the American experience, may never be known. There is no question that influential members of the Soviet scientific community are as unenthusiastic about the Soviet shuttle as were many members of the American scientific community about the US shuttle. Roald Sagdeyev, who headed the Soviet Institute for Space Research from 1973 to 1988, has openly criticized the shuttle program, stating that even though *Buran*'s flight was an "outstanding technological achievement," it has "absolutely no scientific value." As the pressures of *glasnost* and *perestroika* build, the Soviet shuttle may find itself embroiled in political controversy.

It is not clear when the next shuttle flight will take place. Statements in December indicated that *Buran* could make another flight in the near future, but that no such task had been set. A decision on whether to have a crew aboard the next mission apparently has not been made. The Soviets encountered an unexpected setback during 1988 with regard to crews. They have identified only three shuttle pilots. One died suddenly of a brain tumor last summer. Another perished a few weeks later in an airplane crash. While other shuttle pilots are undoubtedly in training, the loss of two of its premier members must weaken the corps considerably.

At present, there appears to be no operational urgency to get the shuttle flying again. The Soviets have repeatedly demonstrated a slow, step-by-step approach to spaceflight. The only clear conclusion is that they will not launch the shuttle again until they have thoroughly analyzed the data from the first flight and are confident of success in whatever mission they plan. ■

Marcia S. Smith, an internationally recognized authority on the USSR's space activities, is a specialist in aerospace policy for the Congressional Research Service of the Library of Congress. She served in 1985–86 as Executive Director of the National Commission on Space. The views expressed in this article—her first for AIR FORCE *Magazine—do not necessarily represent those of CRS or the Library.*

Those who see a new, benign era in the USSR have reached their conclusions without benefit of evidence.

ILLUSIONS OF CHANGE

BY WILLIAM F. SCOTT

THREE years after Mikhail Gorbachev unveiled his "defensive doctrine," the West, in great anticipation, awaits the dawn of a new, benign era in Soviet military affairs. Some believe the great day to be at hand, a conclusion reached without benefit of evidence.

Moscow offers hints and promises. Defense spending will be cut. From what level, and when? Officials reply that no one knows what the military spends, so no figures are available. Are weapons still pouring from production lines? Yes, admit Soviet apologists, who then imply the Five-Year Plan is merely running its course.

Moscow is putting a new spin on its defensive doctrine, with a troop reduction thrown into the bargain. While these moves succeed in softening perceptions of Soviet intentions, the intentions themselves remain obscure. There is no evidence of change, only an illusion of evidence. This is hardly a military secret.

Once, Soviet military textbooks openly acknowledged Communist doctrine to be "offensive." Early in the 1980s, the word "offensive" began changing to "defensive," a fact little noted until Gorbachev embraced "defensive-ness" in 1986. Propagandists struggled to define what "defensive" meant. In a 1987 textbook for officers, the authors made plain that only the political side of doctrine was defensive. The military-technical side—configuration, size, equipage of actual fighting forces—remained resolutely "offensive."

In its latest twist, Moscow goes a step further: Doctrine may be offensive, but only for defensive purposes. This idea was advanced last October by Gen. Col. V. N. Lobov, first deputy chief of the General Staff. "The offensiveness of the doctrine," said Lobov, "lies in the fact that [it] is directed toward averting war."

While some see this as a new development, the concept is quite old, as readers of Soviet military writings can attest. One need only look to the Third Party Program of the Communist Party of 1961 to find this statement: "It is possible to avert a world war. . . . By active and determined effort, peoples of the world can and must force imperialism into disarmament."

The prescription for "averting" war and "forcing" the imperialists to disarm was straightforward: Build overwhelming military force, primarily nuclear. Moscow did.

Much the same sentiment was expressed in a 1980 Warsaw Pact Communiqué signed by President Leonid Brezhnev and Marshal Nikolai V. Ogarkov. In it, the Pact nations declared that they "have never striven and will not strive for military superiority. . . . They have not, have never had, and will not have any other strategic doctrine except a defensive one." This came six months after the invasion of Afghanistan.

One can only speculate about current doctrinal emphasis on averting or preventing war. A possible cause is a change in nuclear strategy. Some years ago, Brezhnev proposed a "no first use" policy. Last summer, V. V. Zagladin, a senior foreign affairs official, made a remarkable admission. "While rejecting nuclear war and waging a struggle to avert it," he stated, "we nonetheless proceeded from the possibility of winning it." He implied that this was no longer the case.

Are Kremlin plans still based on this possibility? Statements of Party leaders and the contents of military textbooks diverge. The 1987 edition of the military text *Tactics,* updating a pre-Gorbachev 1984 edition, made only minimal changes in the Soviet approach to nuclear weapons employment. The same is true of textbooks published in 1988.

Gorbachev's proposed Soviet reduction of 500,000 troops is portrayed as the defensive doctrine in action and cause for optimism in the West. Unilateral Soviet troop cuts, however, are not new and have been undertaken for nondefensive reasons.

Between 1955 and 1958, for example, the Kremlin reduced the size of its armed forces from 5,703,000 to 3,023,000—a startling cut of nearly 2,700,000 troops. In 1960, Premier Nikita Khrushchev announced another cut of 1,200,000, though the move was suspended the following year.

Why did the Kremlin take these steps? Then, as now, the Soviet Union faced major demographic problems resulting from very low postwar birth rates. To conceal this weakness, Khrushchev called the world's attention to his nuclear weapons and claimed that manpower was no longer a major factor, though he knew differently.

Is history repeating itself? The new tone of Soviet doctrine, and the plan for military force reductions, is rooted in the Brezhnev years. Can Gorbachev's restructuring bring about a fundamental change? On the record, one has to conclude that no incontrovertible evidence has yet been adduced. ■

Dr. William F. Scott retired from the Air Force in 1972 as a colonel. He served two tours in the US Embassy in Moscow, first as Senior Air Attaché (1962–64) and later (1970–72) as Air and Defense Attaché. Since then, he and his wife, Harriet Fast Scott, have made numerous trips to the Soviet Union.

ORGANIZATION OF THE SOVIET ARMED FORCES

The major elements of aerospace power that make up the US Air Force are, in the USSR, spread among three separate services. All combat and principal support functions are headed by serving officers who are also Deputy Ministers of Defense.

THE Soviet Armed Forces are organized in five separate services: 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. In addition to these forces, the Soviet Armed Forces also include the Border Guards, subordinate to the KGB, and the Internal Troops, subordinate to the Ministry of Internal Affairs (MVD).

A word of caution: 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, with its commander taking precedence over those of the other services, regardless of rank.

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 210 divisions form the basic combat structure. A reorganization appears to be in progress with the establishment of corps and brigades replacing, in some cases, divisions and regiments. Ground Forces personnel, numbering some 1,800,000, are equipped and trained to fight in chemical, bacteriological, and nuclear warfare environments.

The **Troops of Air Defense** (Voyska PVO) were formed in 1948 as PVO-Strany. In the early 1980s, air defense aircraft in border regions of the USSR were merged with tactical air units of the Soviet Air Forces. There were also changes in air defense districts. Assets of the troops of air defense of the Ground Forces were transferred to the Troops of Air Defense.

Since 1986, the Troops of Air Defense have gone back, in general, to the organization that existed in the 1970s. All strategic SAMs, radars, and air defense aircraft are once more under direct control of air defense headquarters in Moscow. Tactical SAMs and radars have been returned to the Soviet Ground Forces.

Troops of Air Defense now have approximately 2,250 fighter-interceptors, approximately 9,000 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. Antispace defense (PKO) and antirocket defense (PRO) continue to improve. Great attention is being given to high-energy laser beams, probably for initial use as antisatellite weapons.

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 Transport Aviation (VTA).

Strategic Air Armies of the VGK, consisting of bomber and strike aircraft, are divided into five units. One, the Moscow Air Army, has intercontinental bombers postured for nuclear war. Two air armies, at Smolensk and Irkutsk, have part of the Backfire force, as well as Bear, Blinder, and Badger aircraft. The Legnica and Vinnitsa Air Armies have more than 500 Fencer aircraft, 200 fighters of various types, and 120 reconnaissance/ECM aircraft. A new tanker aircraft, the Midas, enables air-refuelable combat aircraft to conduct longer-range operations.

Frontal aviation, or Air Forces of Military Districts and Groups of Forces, are to maintain air superiority and to strike targets in the "operational depth" of the enemy. "Army aviation," comprising mostly combat helicopters, is primarily to attack mobile targets at the "tactical depth," providing direct support to Ground Forces units. (It should be noted that "army aviation" in the Soviet Armed Forces is not the same as "Army Aviation" in the United States.)

Transport Aviation includes some 600 fixed-wing aircraft. A small number of the new An-124 Condor transport aircraft are now in service with VTA. 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 this component.

The **Soviet Navy** places primary emphasis on aircraft and submarines, armed with some 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, and a limited transport force. The total Naval Aviation forces exceed 1,600 aircraft.

In December 1988, General Secretary Gorbachev announced that by 1991 the Soviet Armed Forces will be unilaterally cut by 500,000 men. In the Western part of the Soviet Union and Eastern Europe, 10,000 tanks, 8,500 artillery systems, and 800 combat aircraft are to be withdrawn. Even if these cuts materialize, the Warsaw Pact will still have a significant advantage in conventional forces over NATO. ■

Make Your Flight Plan Complete

Call 1-800-654-6511 (In Oklahoma call 1-800-522-3711) before you take off and have a Hertz car waiting when you land. Hertz will make your land travel a smooth experience with special government savings on daily, weekly or weekend rentals.

Your HERTZ/AIR FORCE ASSN. CDP ID#83080 is the key. Mention it when calling your travel consultant or Hertz for reservations.

Be sure to ask how Hertz can help you earn bonus miles or points in participating airline and hotel frequent traveler programs too!

CDP ID#83080 MUST APPEAR ON RENTAL AGREEMENT

WEEKLY SAVINGS COUPON

Now you can save two ways when renting a midsize through 4-door full size car for at least 5 consecutive days including Saturday night at Affordable Weekly Rates. Use your Hertz CDP ID# to take advantage of your Affordable Weekly Discount. Then mention this coupon to receive an additional $10 Off the already discounted rate. Present your Hertz CDP ID Card and this coupon when picking up your car. Advance reservations are required and vary by location. Call Hertz for details at 1-800-654-2210 (In Oklahoma call 1-800-522-3711).

This coupon has no redeemable cash value, may not be combined with any coupon or promotion (except your Affordable Weekly Discount).

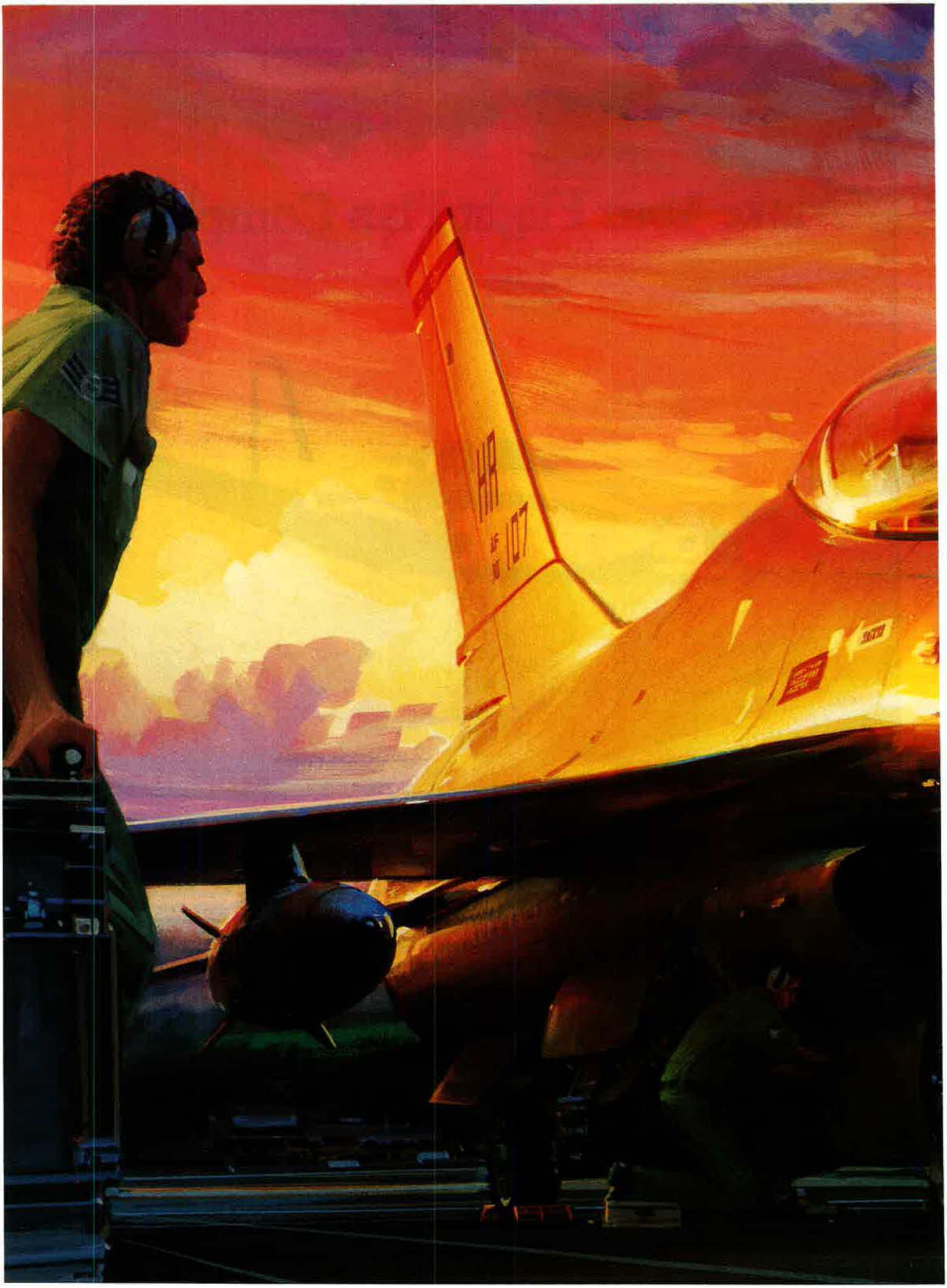
HERTZ RENTAL AGENT: CUSTOMER'S CDP ID# MUST APPEAR IN THE ID BOX ON THE RENTAL AGREEMENT. CUSTOMER'S AFFORDABLE WEEKLY DISCOUNT DOES APPLY IN CONJUNCTION WITH THIS COUPON. NO OTHER RATE, DISCOUNT, COUPON OR PROMOTION CAN BE USED IN COMBINATION WITH THIS OFFER. ATTACH COUPON TO RENTAL AGREEMENT.

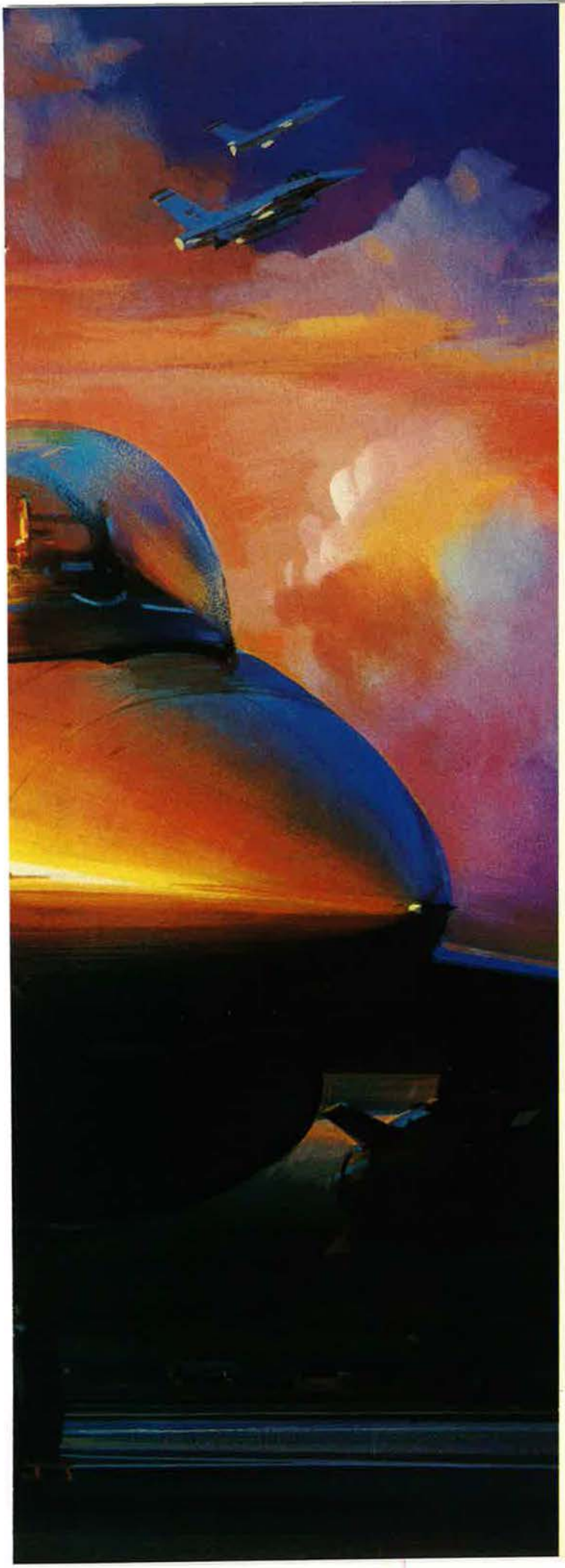
TERMS AND CONDITIONS: This coupon is valid at Hertz Corporate and participating licensee locations in the U.S. for midsize through 4-door full size cars (class C,D,F). Rates include a limited number of miles with a charge for excess miles. Cars must return to renting location. Blackout periods and holiday/seasonal surcharges apply. Cars subject to availability. Taxes, optional refueling service, LDW (where sold), PEC & PAI, LIS, and any other extra service charges are not included and are not subject to discount. Call Hertz for details. Offer expires 6-30-89.

PC #19191

Hertz

Hertz rents Fords and other fine cars


HR
107



Software.

Fuel for mission success.

Regardless of mission or platform, software is the fuel that powers your defense applications. Today, the trend in software development is toward integration, fault tolerance, transportability and maintainability. As a consequence, software development should not be restricted by the hardware, the language or even the architecture of a single family of processors.

Control Data's software development teams aren't limited to writing programs for just our own hardware. We have the fluency and flexibility to adapt to different structures and methodologies—choosing only those best suited to the *application* rather than the hardware. For more than 30 years, we have helped meet challenges in many mission-critical areas: systems engineering, real-time distributed systems, algorithmic development, communications, networking and more.

Consider these accomplishments: Our development teams are involved in such software intensive applications as ATARS, PAVE PAWS, Cobra Judy, BMEWS and F-14D Global Executive. Our work with the U.S. Navy as prime contractor for the Ada Language System helps support the STARS initiatives. Our capabilities in multiprocessor technology and communications enable us to develop software for DEC VAX® environments and UNISYS® hardware as well as our own CYBER systems.

Control Data's Government Systems Group has the experience and expertise to provide total support, from mission analysis to field service. Our computer-aided software engineering processes and background in software reuse help us offer you a lower cost per line of code. We have the capability to manage competitive procurements or the flexibility to offer complete systems with single vendor responsibility.

Our staff of software specialists is ready to discuss your software needs with you. Please call 612/853-5000. Or write Control Data's Government Systems Group, P.O. Box O, HQF500, Minneapolis, MN 55440.

Control Data with smarter software.

CONTROL DATA

VAX® is a registered trademark of Digital Equipment Corporation. UNISYS® is a registered trademark of UNISYS Corporation.

Dynamic power. For centuries proven in the cruelest of environments. On the harsh surface of planet Earth.

From man's earliest water wheel to the state-of-the-art closed Brayton cycle system, the efficiency of dynamic power has never been approached.

Using only one moving part, it was developed in concert with NASA's Lewis Research Center. This Fluid System design derives its energy from the sun's heat. And by storing thermal energy, massive storage batteries are eliminated.

Dynamic power means lighter payload weight at launch with more kilowatts in orbit. And its smaller surface area reduces orbit-decaying drag.

For the Space Station, our solar-driven system will provide reliable power for NASA's scientific research. And all planned commercial experiments.

What's more, over the 30-year life of the Space Station, the Fluid System design, providing 250 kilowatts of power, will save over $3 billion compared to conventional systems. A powerful thought for scientists and budget planners alike.

Fluid Systems Division, 1300 West Warner Road, Tempe, AZ 85284. (602) 893-4421.

Allied-Signal Aerospace Company

Allied Signal

TOP LEADERS OF THE SOVIET ARMED FORCES

General of the Army Dmitriy 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 Mil tary District 1980–84, Far Eastern Military District 1984–87. Deputy Minister of Defense for Cadres January–May 1987. Member of the Central Committee since 1987 (Candidate 1981–87). Candidate member of the Politburo since June 1987. Promoted 1984.

General Colonel Mikhail Alekseyevich Moiseyev. 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). Frunze Military Academy (1972). Voroshilov Military Academy of the General Staff with a Gold Medal (1982). Promoted to General Colonel in 1987.

General of the Army Petr Georgiyevich Lushev. Born 1923. Russian. Commander in Chief of United Armed Forces of the Warsaw Pact (announced February 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 since 1981. Malinovsky Tank Academy (1954). Academy of the General Staff (1966). "Hero of the Soviet Union" (1983). Promoted 1981.

Marshal of the Soviet Union Viktor Georgiyevich Kulikov. Born 1921. Russian. Last Soviet Marshal to have held an operational command. Stepped down in February 1989 as Commander in Chief of United Armed Forces of the Warsaw Pact. First Deputy Minister of Defense since 1971. Member of the Central Committee CPSU since 1971. Deputy of the Supreme Soviet 7th through 11th sessions. Entered service in 1939. Commander of the Kiev Military District (1967–69), then Commander in Chief, Soviet Forces Germany (1969–71). Chief of the General Staff (1971–77). Frunze Military Academy (1953). Academy of the General Staff (1959). "Hero of the Soviet Union" (1981). Lenin Prize. Promoted 1977.

General of the Army Aleksey Dmitriyevich 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. Lenin Military-Political Academy (1957), Higher Academic Courses of same (1973). Promoted 1986.

General of the Army Yuriy Pavlovich Maksimov. 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. Frunze Military Academy (1950). Academy of the General Staff (1965). "Hero of the Soviet Union" (1982). Promoted 1982.

General of the Army Yevgeniy Filippovich Ivanovskiy. Born 1918. Byelorussian. Commander in Chief of the Ground Forces since February 1985 and Deputy Minister of Defense. Joined the Red Army in 1936. Took part in invasion of Poland (1939), war with Finland (1939–40). Commander of an army (1961–65). First Deputy Commander of the Moscow Military District (1965–68), then Commander (1968–72). Commander in Chief, Soviet Forces Germany (1972–80). Commander of the Byelorussian Military District (1980–85). Member of Central Committee CPSU since 1971. Deputy of the Supreme Soviet 8th through 11th sessions. Military Academy of Mechanization and Motorization (1941). Academy of the General Staff (1958). "Hero of the Soviet Union" (1985). Promoted 1972.

General of the Army Ivan Moiseyevich Tret'yak. Born 1923. Ukrainian. Commander in Chief of Troops of Air Defense (Voyska PVO) 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). 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 Aleksandr Nikolayevich 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 the 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. 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 the Military Sciences (1968). Promoted 1975.

Admiral of the Fleet Vladimir Nikolayevich 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. Naval Academy (1965). Academy of the General Staff (1969). "Hero of the Soviet Union" (1981). Promoted 1983.

—HARRIET FAST SCOTT

SOVIET AEROSPACE ALMANAC

Information for this Almanac was compiled by the staff of AIR FORCE Magazine from a variety of sources. Because the Soviets publish relatively little data about their armed forces, some details are necessarily estimates.

We especially acknowledge the assistance of the US Air Force's Directorate of Soviet Affairs, Bolling AFB, D. C., for its advice and counsel on this project. We would also like to thank William and Harriet Fast Scott for their review of this material.

—THE EDITORS

Significant Dates in Soviet Military History

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

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 Kronshtadt/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.

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).

Soviet Aeronautical Milestones

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

1904—Nikolai Zhukovskiy, "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. Petr 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. Petr 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 Andrey 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 Andrey 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.

Top Soviet Aces of World War II

Men	Solo Victories
Kozhedub, I. N.	62
Pokryshkin, A. I.	59
Gulaev, N. D.	57
Rechkalov, G. A.	56
Yevstigneyev, K. A.	56
Vorozheykin, A. V.	52
Glinka, D. B.	50
Women	
Yamschikova, O.	17
Litvyak, L.	12
Budanova, K.	10

More than 800 Soviet aviators claimed sixteen or more victories in the "Great Patriotic War." Many of these—including Gulaev, Rechkalov, and Yevstigneyev—are additionally credited with shared victories in "group flights."

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	USSR Air Force Day (Aviation Day)
Second Sunday of September	Tank Forces Day
November 10	Soviet Militia Day
November 19	Rocket and Artillery Forces 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

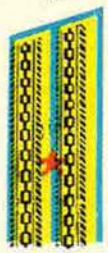
Podpolkovnik
Lieutenant Colonel

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

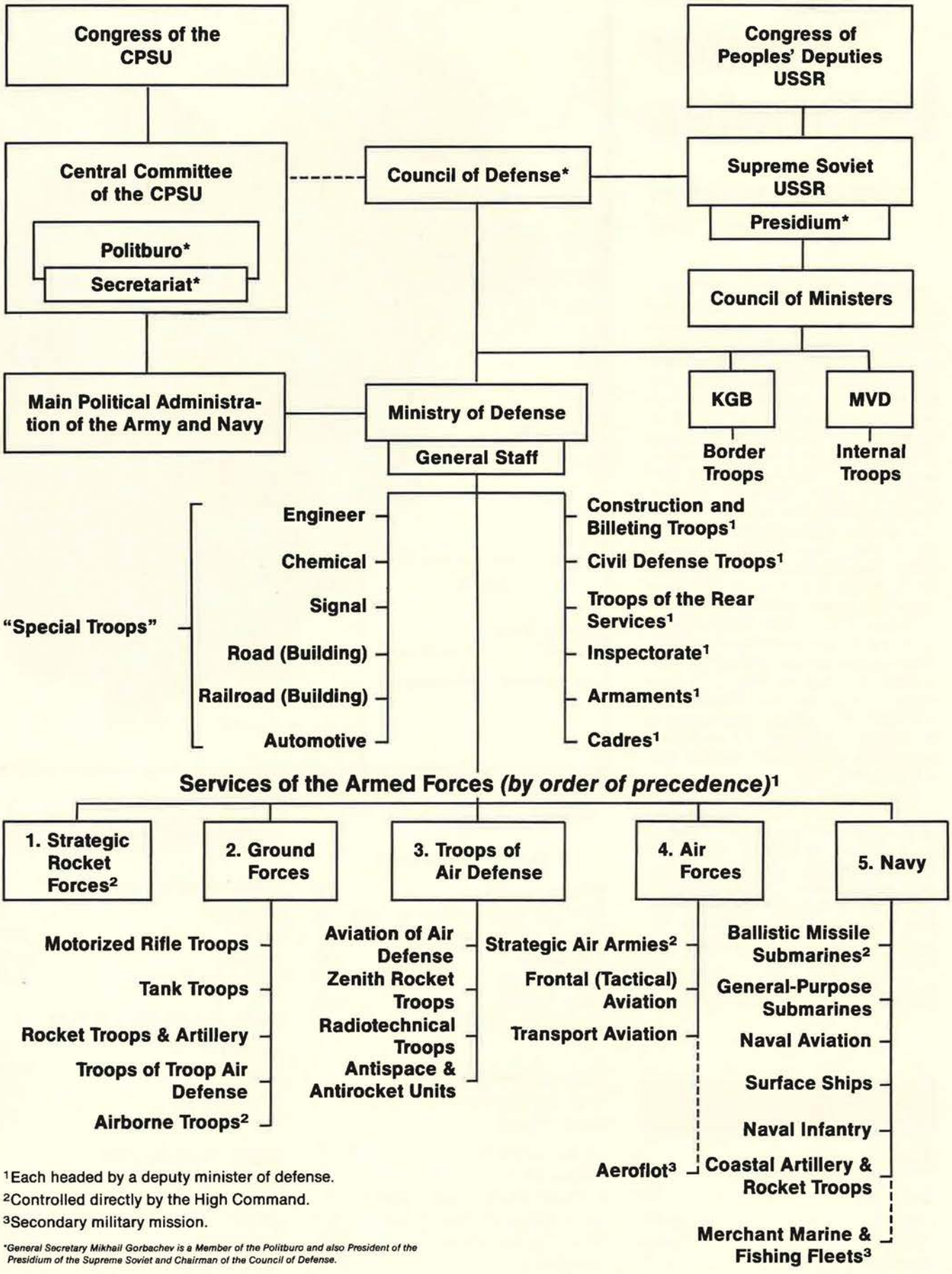
Serzhant
Master Sergeant

Mladshiy Serzhant
Staff Sergeant

Efreytor
Airman First Class

Ryadovoy
Airman Basic

The Soviet Military Establishment



[1]Each headed by a deputy minister of defense.

[2]Controlled directly by the High Command.

[3]Secondary military mission.

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

Soviet Theater Estimates

COMBAT ORGANIZATION

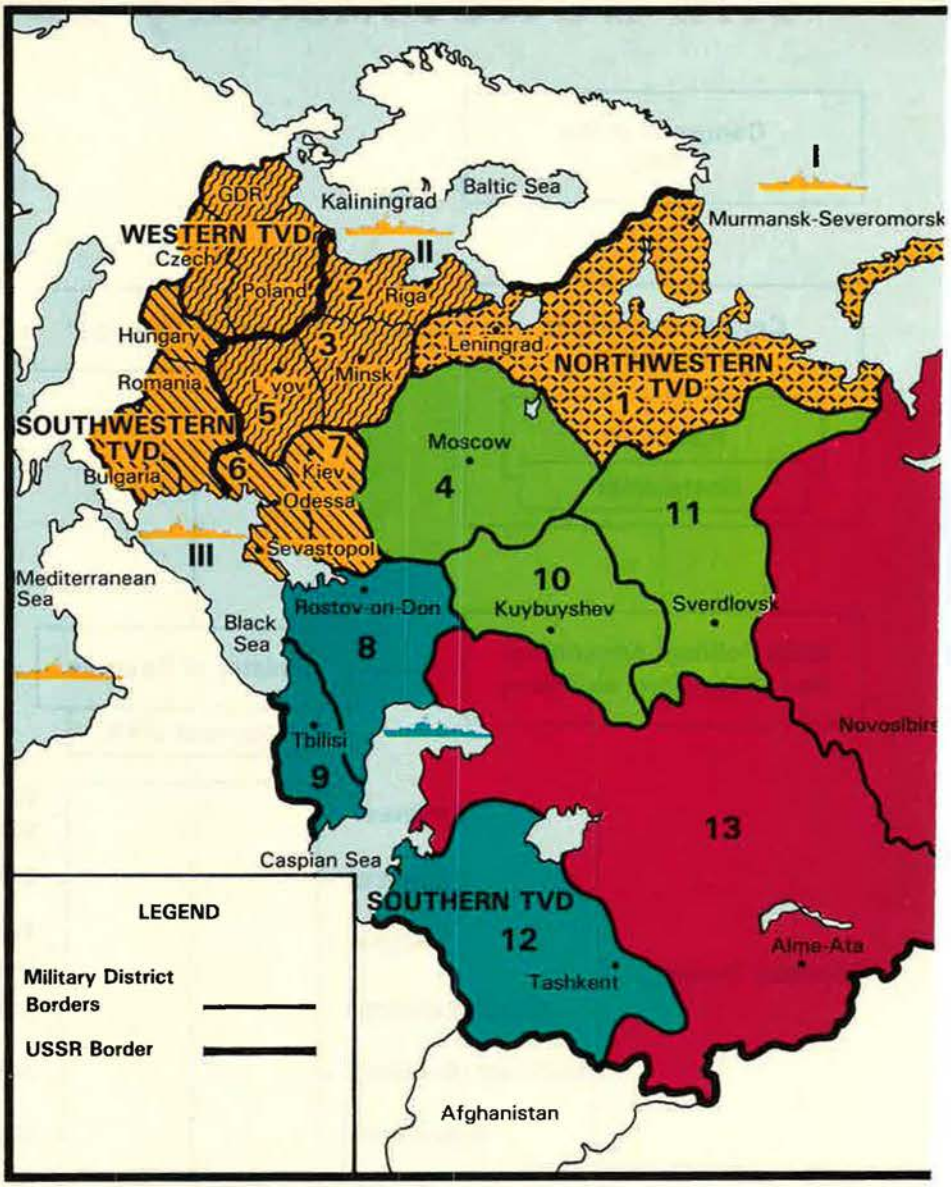
(As of October 1, 1988)

Normal peacetime command and control of Soviet combat forces (excepting strategic elements, some air defense assets, and KGB and MVD units) is primarily exercised through the Commanders of the sixteen Military Districts, the four Naval Fleets within the country, and the four Groups of Soviet Forces in eastern Europe. District commanders are responsible for the training and housekeeping of the diverse forces in their geographic area; individual services handle administrative support.

In wartime, operational control would shift to Theaters of Military Operations (TVD—*Teatr Voyennykh Deystviy*), which could include several "fronts." In some instances, district commanders would become the TVD commanders. Fifteen TVDs have been tentatively identified. Some of these may be grouped into continental Theaters of War (TV—*Teatr Voyny*). While the Far Eastern and Southern TVs probably correspond to their TVDs, the Western TV most likely includes the Northwestern, Western, and Southwestern TVDs.

Commanders of TVDs and TVs are combined-arms commanders, directing all operations in their areas during conflict and reporting directly to the Soviet Supreme High Command. The Soviets consider the Western TV the most important, and its commander holds a position of special responsibility—perhaps extending to control of all Warsaw Pact forces in wartime.

The Soviets have never published specific information on TVs or TVDs.



Pacific Ocean TVD

Pacific Ocean Fleet

Aircraft Carriers	2
Principal Surface Combatants	71
Other Combatant Craft	405
Auxiliaries	250
Submarines[3]	90
Naval Aviation	545
Naval Infantry Division	1

Indian Ocean Squadron

(most units drawn from Pacific Ocean Fleet)

Ships, average	12–21
Submarines	1–2
Principal Surface Combatants	2–3
Amphibious Warfare Ships	1–2
Mine Warfare Ships	1–3
Auxiliaries	8–12

FAR EAST THEATER

Far East TVD

Divisions	58
Tanks[4]	15,000
Artillery[2]	13,600
Tactical Aircraft	1,200

WESTERN THEATER[1]

Northwestern TVD

Divisions	12
Tanks[4]	1,100
Artillery[2]	2,000
Tactical Aircraft	150

Southwestern TVD

Divisions	29
Tanks[4]	7,200
Artillery[2]	7,000
Tactical Aircraft	800

Western TVD

Divisions	63
Tanks[4]	19,500
Artillery[2]	17,700
Tactical Aircraft	2,000

MILITARY DISTRICTS

1. Leningrad
2. Baltic
3. Byelorussia
4. Moscow
5. Carpathia
6. Odessa
7. Kiev
8. North Caucasus
9. Transcaucasus
10. Volga
11. Ural
12. Turkestan
13. Central Asia
14. Siberia
15. Transbaykal
16. Far East

FLEETS

I. Northern
II. Baltic
III. Black Sea
IV. Pacific Ocean

Boundary representations are not necessarily authoritative.

1 During wartime, the Western Theater would comprise the Northwestern, Western, and Southwestern Theaters of Military Operations (TVDs).

2 This category includes all field artillery, mortars, and multiple rocket launchers 100 mm in size or greater.

3 Not including SSBNs.

4 Medium tanks only.

Atlantic TVD

Baltic Fleet

Principal Surface Combatants	46
Other Combatant Craft	315
Auxiliaries	160
Submarines	40
Naval Aviation	280
Naval Infantry Brigade	1

Black Sea Fleet

Aircraft Carriers	1
Principal Surface Combatants	69
Other Combatant Craft	210
Auxiliaries	160
Submarines	28
Naval Aviation	500
Naval Infantry Brigade	1

Mediterranean Squadron
(most units drawn from Black Sea and Northern Fleets)

Ships, average	36–49
Submarines	6–8
Cruisers	1–2
Destroyers	1–3
Frigates	2–3
Amphibious Warfare Ships	0–1
Mine Warfare Ships	1–2
Auxiliaries	25–30

Arctic TVD

Northern Fleet

Aircraft Carriers	1
Principal Surface Combatants	73
Other Combatant Craft	128
Auxiliaries	210
Submarines[3]	130
Naval Aviation	420
Naval Infantry Brigade	1

SOUTHERN THEATER

Southern TVD

Divisions	32
Tanks[4]	5,500
Artillery[2]	5,800
Tactical Aircraft	650

Caspian Flotilla

Principal Surface Combatants	5
Other Combatant Craft	85
Auxiliaries	20

STRATEGIC RESERVES

Divisions	20
Tanks[4]	4,500
Artillery[2]	4,500
Tactical Aircraft	135

Lineup of Soviet Military Power

(As of October 1, 1988)

Strategic Nuclear Missiles

1,360 (approx.)—Intercontinental ballistic missiles (ICBM). SS-11: 400. SS-13: 60. SS-17: 125 (with 500 warheads). SS-18: 308 (with 3,080 warheads). SS-19: 330 (with 1,980 warheads). SS-24: 12 (with 120 warheads). SS-25: 125 (with 125 warheads). (The total ICBM figure does not include ICBMs held in reserve for flight testing.)

965—Submarine-launched ballistic missiles (SLBM). SS-N-5: 33. SS-N-6: 240. SS-N-8: 292. SS-N-17: 12. SS-N-18: 224. SS-N-20: 100. SS-N-23: 64.

465+*—Intermediate/medium-range ballistic missiles (IRBM/MRBM). SS-4: 90 (all based west of the Urals). SS-20: 375+. (Approximately one-third of the SS-20 launchers are deployed in the Far East.)

**Designated for elimination under INF Treaty.*

Air Defense

2,165—Interceptors. MiG-23 Flogger: 900. MiG-25 Foxbat: 350. Su-15 Flagon: 475. Su-27 Flanker: 135. Tu-28/-128 Fiddler: 15. Yak-28 Firebar: 15. MiG-31 Foxhound: 235. MiG-21 Fishbed: 40.

8,600—Strategic surface-to-air missile (SAM) launchers. SA-1: 1,750. SA-2: 2,400. SA-3: 1,000. SA-5: 1,950. SA-10: 1,500.

4,700+—Tactical SAM launchers. SA-4: 1,350. SA-6: 800. SA-8: 900. SA-9: 425. SA-11: 250. SA-12A: 45+. SA-13: 930.

15—Airborne warning and control aircraft. Tu-126 Moss: 6. Il-76 Mainstay: 9.

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

10,000—Warning systems. These include early warning and ground control intercept radars and satellites.

Air Forces

166+—Long-range strategic bombers. Tu-95 Bear: 160+. Mya-4 Bison: 0. Blackjack: 6.

515—Medium-range bombers. Tu-22M Backfire: 175 (excludes Backfires with Soviet Naval Aviation). Tu-16 Badger: 220. Tu-22 Blinder: 120.

1,660—Tactical counterair interceptors. MiG-21 Fishbed: 250. MiG-23 Flogger: 875. MiG-29 Fulcrum: 425. Su-27 Flanker: 110.

2,710—Ground attack aircraft. MiG-21 Fishbed: 130. MiG-27 Flogger: 855. Su-7/-17 Fitter: 750. Su-24 Fencer: 750. Su-25 Frogfoot: 225.

75—Tanker aircraft. Mya-4 Bison: 40. Tu-16 Badger: 20. Il-78 Midas: 15.

600—Tactical reconnaissance and electronic countermeasures aircraft. MiG-21 Fishbed: 60. MiG-25 Foxbat: 130. Su-17 Fitter: 150. Su-24 Fencer: 100. Yak-28 Brewer: 160.

129—Strategic reconnaissance and ECM aircraft. Tu-16 Badger: 110. Tu-22 Blinder: 15. Tu-95 Bear: 4.

500—Support helicopters. Mainly Mi-8 Hip aircraft, plus Air Forces helicopters subordinate to army elements (see Ground Forces).

1,500—Training aircraft. Includes 800 fixed-wing, of which perhaps 600 are combat capable, and 700 rotary-wing aircraft.

606—Military air transports assigned to Transport Aviation (VTA). An-22 Cock: 55. An-12 Cub: 160. Il-76 Candid: 380. An-124 Condor: 11.

1,450—Transports in other elements of the armed forces. An-12 Cub: 300. Others: 1,150.

1,670—Civil aviation aircraft (Aeroflot). An-12 Cub: 160. Il-76 Candid: 60. Other medium- and long-range transports: 1,450.

Ground Forces

52,800—Main battle tanks. T-54/-55: 19,200. T-62: 11,500. T-64: 9,800. T-72: 9,500. T-80: 2,800.

1,350+—Surface-to-surface missiles. FROG-3/-5/-7: 650. SS-21 Scarab: 150+. SS-1 Scud B: 550+. SS-23 Spider: 0. SS-12 Scaleboard: 0.

49,860—Artillery pieces, mortars, and multiple rocket launchers. Artillery pieces: 32,000. Mortars: 10,760. MRLs: 7,100. (Total does not include more than 4,000 antitank artillery pieces.)

70,000—Infantry fighting vehicles and armored personnel carriers.

4,385—Combat and support helicopters.† Mi-2 Hoplite: 550. Mi-4 Hound: 15. Mi-6 Hook: 435. Mi-8 Hip: 1,920. Mi-24 Hind: 1,400. Mi-26 Halo: 55. Mi-10 Harke: 10. Mi-28 Havoc and Hokum are still in development. (Total includes 1,200 Hip E and Hind D and E gunship helicopters.)

†Air Forces assets subordinate to Ground Forces elements.

Naval Forces

74—Ballistic missile submarines. Delta: 41. Hotel: 1. Yankee: 16. Typhoon: 5. Golf: 11.

142—Nuclear-powered general-purpose submarines. Cruise missile attack: 50. Attack: 78. Other: 14.

135—Diesel- and electric-powered general-purpose submarines. Cruise missile attack: 16. Attack: 115. 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).

33—Cruisers. *Kirov*-class nuclear-powered guided missile: 2. *Sverdlov*-class light: 4. Guided missile: 27.

53—Destroyers. Includes 42 guided missile destroyers.

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

960—Small surface-ship combatants. Patrol: 190. Coastal patrol and river/roadstead: 400. Mine warfare: 370.

183—Amphibious warfare ships and craft.

800—Auxiliary ships. Material support: 70. Underway replenishment: 85. Fleet support: 145. Other: 500.

Naval Aviation

295—Strike and bomber aircraft. Tu-22M Backfire: 120. Tu-16 Badger: 150. Tu-22 Blinder: 25.

155—Fighter and fighter-bomber aircraft. Su-17 Fitter: 70. Yak-38 Forger A: 75. MiG-23 Flogger: 10.

45—Tankers (Tu-16 Badger).

190—Reconnaissance and electronic warfare aircraft. Tu-16 Badger: 115. Tu-95 Bear D: 40. Tu-22 Blinder: 5. Ka-25 Hormone B: 20. Su-24 Fencer E: 10.

460—Antisubmarine aircraft. Tu-142 Bear F: 60. Mi-14 Haze A: 95. Ka-27 Helix: 70. Ka-25 Hormone A: 100. Be-12 Mail: 90. Il-38 May: 45.

600—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, 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 a Soviet Marshal.

Bilateral Treaties

- Afghanistan: Friendship, Cooperation, and Mutual Assistance (1978).
- Angola: Friendship and Cooperation (1976); Military Cooperation Agreement (1983).
- Congo: Friendship and Cooperation (1981).
- 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).

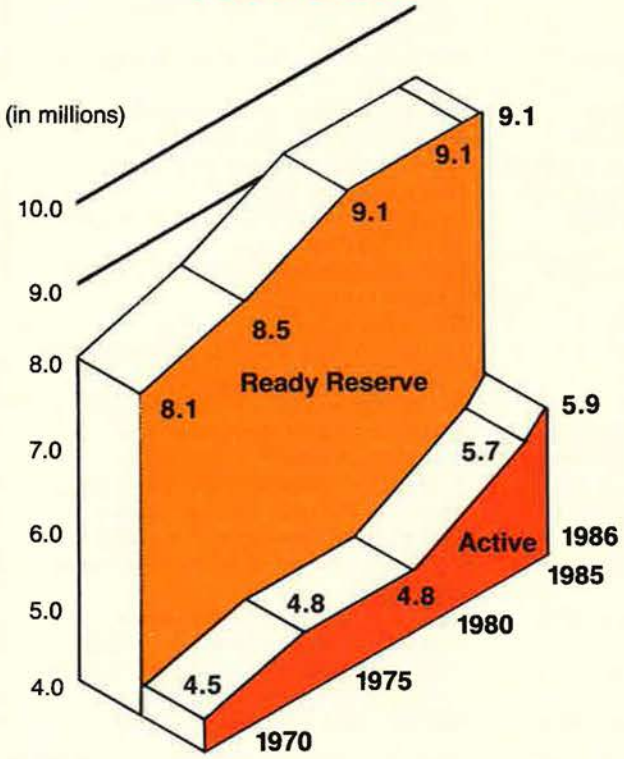
Soviet Active Military Population

(As of October 1, 1988)

Ground Forces	1,800,000
Air Forces	340,000
Navy	350,000
Strategic Defense Forces	505,000
Strategic Attack (includes Strategic Rocket Forces and strategic elements of the Air Forces and Navy)	410,500
Command/General Support	1,500,000
Security Forces (KGB/MVD)	570,000
Total	**5,475,500**

The Soviet retreat from Afghanistan—where Moscow maintained its largest foreign presence outside Eastern Europe—stemmed from resistance by mujahedeen (left). The chart below, showing that occupiers numbered 65,000 as recently as October 1988, points up the speed of the pullout. February 15, 1989, was the deadline for departure of the last Soviet units.

Trends in Soviet Military Force Levels



Significant Military Deployments Outside the Soviet Union

(As of October 1, 1988)

EUROPE	
Warsaw Pact Countries	635,000
ASIA	
Afghanistan[1,4]	65,000
Mongolia	61,000
Vietnam[2]	2,700+
Laos	500
India	300–500
Kampuchea	300
MIDEAST	
Syria	4,000
South Yemen[4]	1,000
Iraq[4]	800
North Yemen	500
AFRICA[3]	
Ethiopia[4]	1,500
Libya[4]	1,400
Angola[4]	1,200
Mozambique[4]	800
Algeria	700
Congo[4]	85+
Mali	50
LATIN AMERICA	
Cuba[5]	7,700
Peru	125
Nicaragua[4]	75

1 Total includes all military and security forces.
2 Estimate does not include transient Soviet naval presence.
3 About 900 additional Soviet military advisors are deployed in smaller numbers to many other African nations.
4 Significant Cuban military forces are also deployed to this country.
5 Includes an estimated 2,800 Soviet advisors and technicians, 2,800 in the Soviet brigade, and 2,100 in the SIGINT facility.

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

(1957–1988)

Photo Reconnaissance	775
Communications	299
Electronic Intelligence (ELINT)	179
Related to Manned Spaceflight (manned: 65; unmanned: 105)	170
Minor Military (radar calibration, etc.)	150
Navigation/Geodetic	146
Scientific/Developmental (including rocket tests)	111
Weather/Natural Resources	83
Early Warning	60
Venus or Mars Missions	42
ASAT-Related	38
Lunar Missions	30
Fractional Orbital Bombardment System (FOBS)	18
Unknown	6
Total	**2,107**

—Courtesy Teledyne Brown Engineering

Soviet Space Launches to Orbit or Beyond

(As of December 31, 1988)

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

—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	Voshkod 1	First multiple crew member spaceflight (Cosmonauts Komarov, Yegarov, Feoktistov)
March 1965	Voshkod 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

GALLERY OF SOVIET AEROSPACE WEAPONS

BY JOHN W. R. TAYLOR

Bombers and Maritime

Beriev M-12 (NATO 'Mail')

Production of this twin-turboprop amphibian began 25 years ago. About 100 M-12s were built, of which as many as 95 continue to perform overwater surveillance and antisubmarine duties within a 230-mile radius of shore bases of the Soviet Northern and Black Sea fleets. No photographs have been published showing stores on the underwing pylons.

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.

New Beriev Flying-boat ('Tag-D')

Last year's 'Gallery' noted that "It would be surprising if there were no plans to replace the M-12 with another amphibian." It has since been confirmed that a new seaplane, with the provisional Western designation 'Tag-D', is under development, with a possible ASW/surveillance/minelaying role. Nothing more is known, but the designation implies that the aircraft was identified at Taganrog, where the Beriev OKB has been centered since 1945. Nor is anything known of the 'Tag-A, B, and C' types that must have been identified earlier.

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. Its lengthened fuselage retains few cabin windows; 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. To compensate for the effect on the CG position of these changes, and equipment inside the cabin, the wing was moved forward.

Il-38s of the Soviet naval air force are encountered frequently over the Baltic and North Atlantic. A Soviet Treaty of Friendship and Co-operation, 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.

Tupolev Tu-16 (NATO 'Badger')

The prototype Tu-16 flew for the first time in the winter of 1951/52. About 2,000 production models were delivered to the medium-range bomber force and Soviet Naval Aviation and have been operated in eleven basic forms. Replacement with 'Backfires' has been under way since the mid-1970s, but 270 are estimated to remain operational, mostly with the Smolensk and Irkutsk air armies, supported by 20 Tu-16 aerial refueling tankers and about 115 of various versions equipped for ECM duties and for strategic reconnaissance. Soviet Naval Aviation is thought to have about 120 Tu-16 attack models, 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. Strike, tanker, and ECM variants are deployed to a permanent base at Cam Ranh Bay, Vietnam, with a potential combat radius encompassing Thailand, the Philippines, Guam, most of Indonesia, and southern China. 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 aerial refueling tankers, using a unique wingtip-to-wingtip transfer technique to refuel other 'Badgers' or a probe-and-drogue system to refuel 'Blinders.' About 120 operational with Chinese Air Force (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 bomb bays.

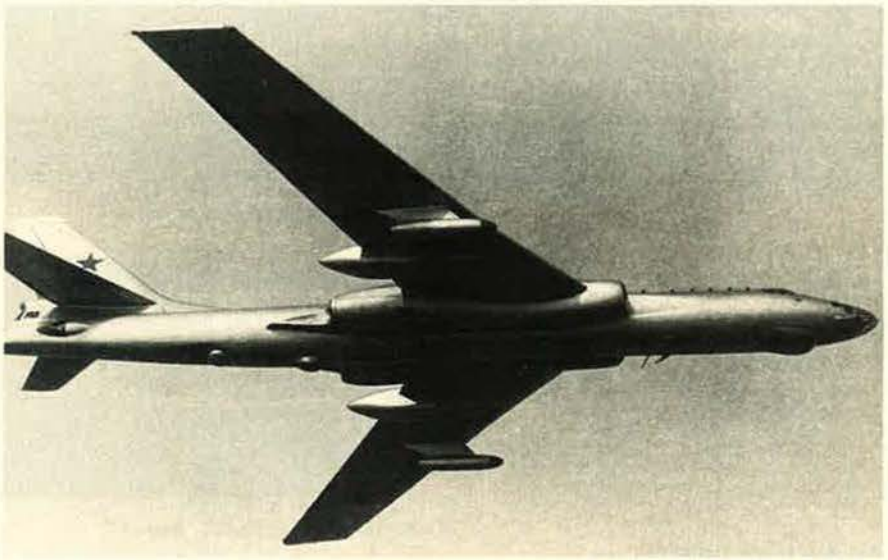
Badger-E. Photographic and electronic reconnaissance version. Similar to 'Badger-A', but with cameras in bomb bay and two additional radomes under fuselage, larger one aft.

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 anti-

Beriev M-12 (NATO 'Mail')

Ilyushin Il-38 (NATO 'May') dropping sonobuoy (Swedish Air Force)



Tupolev Tu-16 (NATO 'Badger-F')

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

shipping 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.

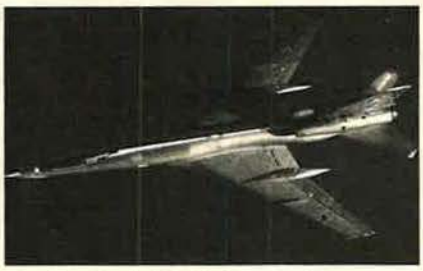
Dimensions: span 108 ft 0½ in, length 118 ft 11¼ in, height 45 ft 11¼ in, wing area 1,772.3 sq ft.

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.

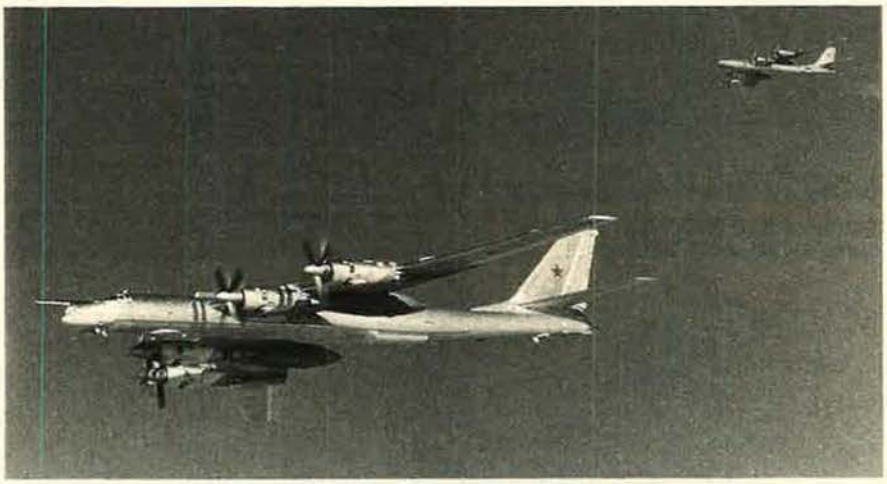
Accommodation: crew of six.

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-C')

Tupolev Tu-26 (NATO 'Backfire-C')



Tupolev Tu-142 (NATO 'Bear-H')

Tupolev Tu-142 (NATO 'Bear-F')

Tupolev Tu-22 (NATO 'Blinder')

Tu-22s were the first Soviet operational bombers with supersonic dash capability. About 120 remain operational with 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 the 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 suggest added equipment for 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 Koliesov 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 1,800 miles.

Accommodation: three crew, in tandem.

Armament: single 23 mm gun in radar-directed tail mounting. Other weapons as described for individual versions.

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

During the years when B-1 production was halted in the US and when Britain's Royal Air Force dismantled its V-bomber fleet, production of 'Backfires' continued in the Soviet Union at the still-maintained rate of 30 aircraft a year, in progressively improved models. Simultaneously, ALCMs of advanced types were built for the still-formidable 'Bear', and 'Blackjack' took shape as its ultimate replacement. With the INF treaty beginning to take effect, and possible ICBM force reductions to follow, the significance of these bombers is clear. 'Bear-H' ALCM carriers "knock on the US door" off the coast of Alaska during training flights simulating attacks on North America. For Western Europe and Japan, relief at the removal of Soviet SS-20 missiles is tempered by frequent sightings of missile-armed 'Backfires', which can be escorted by Su-27 'Flanker' fighters.

DoD's *Soviet Military Power* publication notes that 'Backfire' can be equipped with a probe to permit in-flight refueling so that it can be used against the continental US if sufficient tankers are available. However, the 350 'Backfires' currently operational in Soviet air armies and Soviet Naval Aviation are 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. Two versions are operational:

Backfire-B. Initial series production version. Slightly inclined lateral air intakes, with large splitter plates. Two twin-barrel guns in tail mounting.

Backfire-C. Advanced production version with wedge-type air intakes. Upturned nosecone with small pod at tip. No visible flight refueling probe. Single GSh-23 twin-barrel 23 mm gun, with barrels one above the other, in aerodynamically improved tail mounting.

During the SALT II treaty talks, Soviet delegates referred to 'Backfire' as the Tu-22M, but its current service designation is believed to be Tu-26. It is capable of performing nuclear strike, conventional attack, antiship, and reconnaissance missions, with its low-level penetration features making it more survivable than earlier Soviet bombers. Although 'Backfire' has been used for development launches of new-generation cruise missiles, it is not considered likely to become a designated AS-15 carrier. *(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')

Nobody should be deceived by the antique appearance of Andrei Tupolev's huge four-turboprop 'Bear', of which the prototype flew in summer 1954. Of 170 'Bears' now flying with the Soviet air armies most are of the recently 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. High performance is not the only factor that has kept this remarkable aircraft in continuous production for 35 years. Equally important has been its ability to accommodate extensive avionics and the largest air-to-surface missiles and radars yet carried by combat aircraft. Versions that may be identified by unclassified NATO reporting names are:

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 tail 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. Reentered 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, all 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'). Aircraft observed up to mid-1988 had only an internal (rotary?) launcher for six of these 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. 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 eight are stationed permanently 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 also carry out simulated attack and training missions against the USA 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 former Soviet Navy 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')

Tupolev Tu-(160?) (NATO 'Blackjack')

Like USAF's B-2, the Soviet Union's new strategic bomber, known to NATO as 'Blackjack', made its debut before carefully selected Western cameras during the second half of 1988. 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.

'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'. The Soviet Union is expected to build a production series of at least 100 'Blackjacks' at a complex that has been added to the vast Kazan airframe plant. Twelve are known to have been completed by mid-1988, by which time the first operational squadron had been formed at Dolon air base in the central USSR. The Soviet designation is reported to be Tu-160, but there is no confirmation of this.

Power Plant: four unidentified afterburning turbofans, each probably smaller and with lower rating than those of 'Backfire'. Provision for in-flight refueling assumed.

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 2.0 at high altitude, max unrefueled combat radius 4,535 miles.

Armament: internal stowage for up to 36,000 lb of free-fall bombs, short-range attack missiles, or ALCMs. Each rotary launcher carries 12 SRAMs or six ALCMs, currently AS-15 'Kents', to be superseded by supersonic AS-X-19s.

MiG-21MF (NATO 'Fishbed-J')

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.

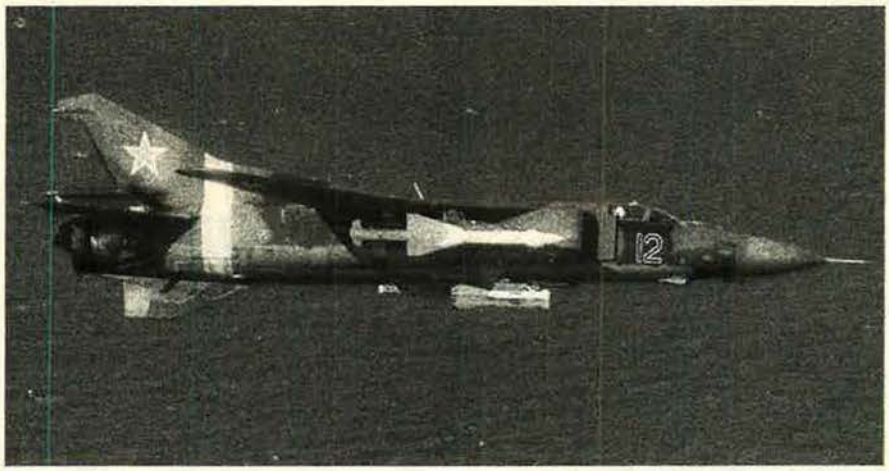
MIG-21*bis* ('Fishbed-L'). Third-generation multirole air combat fighter/ground attack version, with Tumansky R-25-300 turbojet, rated at 16,535 lb st with afterburning, wider and deeper dorsal fairing, updated avionics, and generally improved construction standards. Internal fuel capacity increased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

The Soviet Union has offered to India, and possibly to other countries, an uprated version of the MiG-21, which may have led to press reports last year of a nonexistent 'MiG-35'. Based on the MiG-21*bis*, the new aircraft embodies advanced wing technology, an R-33D turbofan of the kind fitted to the MiG-29, increased fuel capacity, multimode radar, state-of-the-art avionics including flight management system and head-up display, and combat flaps. *(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.



MiG-23MF (NATO 'Flogger-B' armed with two AA-7 'Apex' and two AA-8 'Aphid' air-to-air missiles (Swedish Air Force)

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 Voyska PVO home defense interceptor units. They are expected to serve in sizable numbers through the mid-1990s and are flown by all of 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 early 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'). First identified when six aircraft from Kubinka air base made goodwill visits to Finland and France in the summer of 1978. 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

MiG-23 (NATO 'Flogger-G') (Jahn Charleville/SAF)

MiG-25 (NATO 'Foxbat-E') (DoD)

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.

On all versions, wing sweep is variable manually, in flight or on the ground, to 16°, 45°, or 72°. Full-span single-slotted trailing-edge flaps are each in three sections, permitting continued actuation of outboard sections when wings are fully swept. Upper-surface spoilers/lift dumpers operate differentially in conjunction with horizontal tail surfaces (except when cut out at 72° sweep), and collectively after touchdown. Leading-edge flap on outboard two-thirds of each main (variable-geometry) wing panel, coupled to trailing-edge flaps. Horizontal tail surfaces operate differentially and collectively for aileron and elevator functions respectively. Conventional rudder.

It is estimated that about 900 'Flogger-B/G/K' interceptors serve with the Soviet strategic air defense force and a further 900 in tactical air force regiments. *(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 sea level, service ceiling 59,055 ft, combat radius 560–805 miles.
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 rocket packs, air-to-air missiles, 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')

Still the fastest combat aircraft identified in squadron service, the MiG-25 was designed nearly 30 years ago to counter the threat of the XB-70 Mach 3 strategic bomber then under development for USAF. Emphasis was placed on high-speed, high-altitude capability and a radar/missile fit that would permit attack over a considerable range; maneuverability was less important. Despite the subsequent NATO switch to low-level operations, 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. Built mainly of steel, with titanium only in places subject to extreme heating, such as the wing leading-edges. 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, of which first photographs became available in late 1975. New nose, 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 F-15 *Streak Eagle* in 1975 and subsequently set the current absolute height record of 123,523 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 stand-off 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 since early 1985, and surprise star of the 1988 Farnborough Air Show in the UK, the MiG-29 is a twin-engine combat aircraft comparable in size to the Navy's F/A-18 Hornet. 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. Although intended primarily as a single-seat counterair fighter, it has a full dual-role air combat/attack capability, and a combat-capable two-seater is also in production and service. NATO reporting names that may be quoted are as follows:

Fulcrum-A. Single-seater, identified to date in four 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.
- As preceding variant, but with more deeply curved fuselage aft of the cockpit, almost certainly providing additional fuel tankage. This model may have different reporting suffix.

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.

Comparison of the general configurations of the MiG-29 and much larger Su-27 shows that the two designs are strikingly similar in most respects; even in such detail as current tail fin location and the manner in which the mainwheels retract into the wingroots. An innovation on the MiG-29 is that doors close the engine air intakes against foreign object ingestion when the nosewheels are in contact with the ground during takeoff and landing; engine air is then taken in through louvers in the upper surface of the wingroot extensions. All-round view from the cockpit is inferior to that from an F-15 or F-16, and there is no evidence of flight-refueling capability. The controls are hydraulically actuated, rather than fly-by-wire.

More than 450 MiG-29s are operational with Soviet units stationed in East Germany, Hungary, and in the USSR west of the Urals. They are replacing MiG-21s, Su-15s, and some MiG-23s. Export deliveries have been made to East Germany, India, Iraq, North Korea, Syria, and Yugoslavia, with Zimbabwe suggested as the next recipient. Manufacture is centered at a factory in Moscow.

Power Plant: two Tumansky R-33D turbofans, each 18,300 lb st with afterburning. Provision for nonconformal auxiliary fuel tank 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.

Deployment of MiG-31s with Voyska PVO 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 Gorkiy 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: two crew, 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. Longer-span wings than those of earlier 'Flagon-A, C, and D', with compound sweep. R-13F-300 turbojets, each rated at 14,550 lb st, and additional fuel, increasing speed and range. Uprated avionics. 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 450 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.

MiG-29 (NATO 'Fulcrum-A') (Martin Fricke)

MiG-31 (NATO 'Foxhound') armed with AA-8 'Aphid' and AA-9 'Amos' air-to-air missiles (UK Ministry of Defence)

Sukhoi Su-27 (NATO 'Flanker')

Still at a comparatively early stage of deployment, this Soviet counterpart of USAF's F-15 will equip all fighter components of the Legnica and Vinnitsa air armies, primarily to escort Su-24 strike missions. More than 100 are in service already with the Soviet Union's strategic air defense forces, replacing older types such as the Yak-28P, Su-15, and Tu-28P/128. Operating in conjunction with the AEW&C 'Mainstay', those based in the Kola Peninsula have been particularly active in simulated interceptions of NATO aircraft over the Barents Sea.

Two versions have been identified to date by NATO reporting names, as follows:

Flanker-A. Prototypes, which began flight tests in 1977. Curved wingtips, and tail fins mounted centrally above each engine housing.

Flanker-B. Production version, with square wingtips carrying launchers for air-to-air missiles, tail fins located outboard of engine housings, extended tailcone, and other changes.

In the spring of 1988, Rear Admiral William O. Studeman, USN, referred to **Flanker-B variant 2** as a version that could be intended for ramp-assisted operation from the Soviet Navy's large aircraft carrier now fitting out at Nikolayev. It can be assumed that a two-seat trainer version of 'Flanker', with combat capability, also exists.

Like the smaller MiG-29, which it resembles closely in general configuration, the Su-27 is described by DoD as a supersonic all-weather counterair fighter, with look-down/shoot-down weapon systems and beyond-visual-range air-to-air missiles and with a possible secondary ground attack role. The Su-27's range, thrust-to-weight ratio, and maneuverability are all improved in comparison with earlier Soviet fighters. Its large pulse-Doppler radar and heavy armament give it formidable potential against low-flying aircraft and cruise missiles. DoD estimates suggest a combat radius as great as that of the Tu-28P 'Fiddler', making the Su-27 capable of escorting missile-armed bombers and deep-penetration ground attack aircraft on sorties against the UK and western Europe.

Sukhoi Su-27 (NATO 'Flanker') (DoD)

Series production is centered in a plant at Komsomolsk, Khabarovsk Territory. A specially prepared version, known in the Soviet Union 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 'Flanker-B' follow.)*

Power Plant: probably two Tumansky R-32 turbofans; each 29,955 lb st with afterburning.

Dimensions: span 48 ft 2¾ in, length excl nose probe 70 ft 10½ in, height 18 ft.

Weight: gross 44,000–60,000 lb.

Performance: max speed Mach 2.0 at height, Mach 1.1 at S/L, combat radius 930 miles.

Accommodation: pilot only.

Armament: one 30 mm gun in starboard wingroot extension. Up to ten air-to-air missiles, including pairs of AA-10A/B/C (NATO 'Alamo-A/B/C'), and four AA-11 ('Archer') or AA-8 ('Aphid'). Likely ability to carry up to 13,225 lb of external stores for secondary attack role.

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. Which is correct is of little consequence, as fewer than 50 'Fiddler-Bs' remain operational with the Voyska PVO 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 Voyska PVO 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 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. The system works, and pufferjets 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 operational roles are assumed to be reconnaissance, strikes against small ships, and fleet defense against shadowing, unarmed 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 (incl 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.

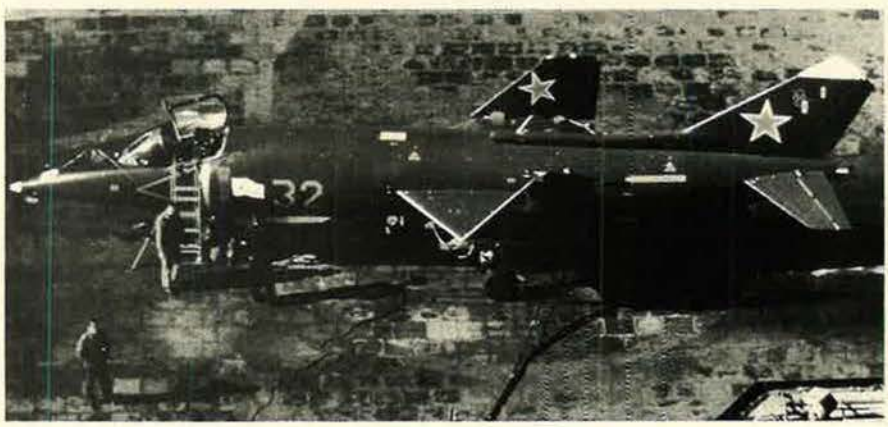
Armament: four pylons under inner wings for 5,730–7,935 lb of stores, including AS-7 'Kerry' short-range air-to-surface missiles, armor-piercing antiship missiles, AA-8 'Aphid' air-to-air missiles, gun pods each containing a 23 mm twin-barrel GSh-23 cannon, rocket packs, bombs, and auxiliary fuel tanks.

Yakovlev Yak-41

The existence of this second-generation Yakovlev V/STOL fighter/attack aircraft was revealed by Rear Admiral William O. Studeman, USN, in spring 1988. It is assumed to be an evolutionary development of the Yak-38 'Forger', with refined configuration including the now conventional twin tail fins, a nose radar, and supersonic performance. 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 Khatchaturov, on the lines of the Harrier's Rolls-Royce Pegasus. However, a liftjet/vectored-thrust multi-engine power plant similar to that of the Yak-38 seems more likely.

MiG-27 (NATO 'Flogger-J')

Sukhoi Su-17s (NATO 'Fitter-K') of the Polish Air Force



Yakovlev Yak-38 (NATO 'Forger')

Attack Aircraft

MiG-27 (NATO 'Flogger')

This single-seat ground attack aircraft has many airframe features in common with the MiG-23, but differs in such important respects that its Soviet designation was changed to MiG-27. It has the same basic power plant as the Soviet air forces' 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. Basic 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. New nose shape, 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.

A total of about 830 'Flogger-Ds' and 'Js' is 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-7B (NATO 'Fitter-A')

This single-seat ground attack fighter has been phased out of service with the Soviet air forces, but remains operational in some Warsaw Pact and non-European air forces.

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

Air support is regarded as the key to success in Soviet offensive operations. This explains the 38 percent increase in the number of ground attack aircraft assigned to tactical air forces during the 1980s, bringing the total to 2,900, of which more than 1,000 are swing-wing Su-17s. 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.

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.

It was deduced for some years that certain export versions of the variable-geometry 'Fitter' series had different engines from the Su-17 variants listed above. 'Fitter-C/D/E/G/H/K' operated by the Soviet air forces and some other air forces have a rear fuselage of basically constant diameter and are powered by a Lyulka turbojet. 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-20 (Su-17MK, 'Fitter-C'). Generally similar to Soviet air force 'Fitter-C', with Lyulka engine, but with reduced equipment standard. Supplied to Algeria, Czechoslovakia, Egypt, Iraq, and Poland.

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.

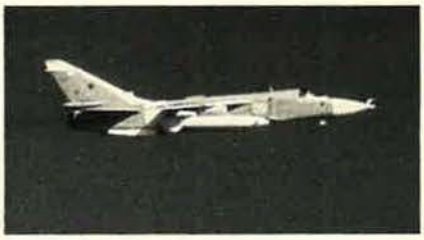
Accommodation: pilot only.

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')

Best deep-interdiction aircraft in the Soviet tactical inventory, the Su-24 has twice the combat radius of the Su-17 while carrying a comparable weapon load. Its ability to carry a wide range of air-to-surface missiles provides defense suppression and some hard-target kill potential. A specially developed long-range navigation system and electro-optic weapons delivery systems enable the Su-24 to penetrate hostile airspace at night or during poor weather with great precision and then deliver ordnance within 180 ft of its target.

The Su-24 is smaller and lighter than USAF's F-111, with three-position (16°, 45°, 68°) variable-geometry wings carrying the first pivoting pylons that were seen on a Soviet vg aircraft. It entered squadron service in December 1974 as a replacement for the Yak-28 (NATO 'Brewer'). More than 800 are now operational, including 500 assigned to strategic missions with the Legnica and Vinnitsa air armies, at least one squadron with the Baltic Fleet air force for maritime reconnaissance, and the remainder with air forces of the military districts and groups of forces. Five versions can be identified by NATO reporting names:



Sukhoi Su-24 (NATO 'Fencer-C') (Swedish Air Force)

Sukhoi Su-25 (NATO 'Frogfoot')

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 afterburning turbojets; believed to be related to Lyulka AL-21F fitted in Su-17. 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, 34 ft 5½ in swept; length excl probe 69 ft 10 in; height 19 ft 8¼ in.

Weights: empty, equipped 41,885 lb, gross 90,390 lb.

Performance: max speed Mach 2.18 at height, Mach 1.2 at S/L, service ceiling 54,135 ft, combat radius (lo-lo-lo) over 200 miles, (hi-lo-hi, with 6,615 lb weapons and two external tanks) 805 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 (NATO 'Frogfoot')

This is a type of aircraft that the Soviet forces pioneered with the Ilyushin Il-2 *Shturmovik* of World War II. The pilot is again protected by flat slabs of armor around his cockpit, and big wings support ten weapon pylons for a wide range of ordnance, including chemical weapons and self-protection air-to-air missiles. From 1982, in Afghanistan, the Soviet tactical air forces tested techniques for coordinating low-level close support by Su-25s operating in partnership with Mi-24 'Hind' helicopter gunships. With new attack helicopters like the Mi-28 'Havoc' and Kamov 'Hokum' under development to join the Mi-24, the upgrading of Soviet tactical airpower clearly continues to enjoy high priority.

More than 250 Su-25s have been delivered from the Tbilisi airframe plant to Soviet tactical units; the Czechoslovak Air Force has at least one squadron, and others have been exported to Iraq. Equipment on the Czechoslovak aircraft includes SRO-2 (NATO 'Odd Rods') IFF, Sirena 3 radar warning receivers, a nose-mounted laser rangefinder and marked target seeker, a chaff/flare dispenser in the tailcone, and a strike camera in the top of the nosecone. The rear of each wingtip fairing comprises split airbrakes of the kind fitted to the Grumman A-6 Intruder.

Power Plant: two nonafterburning Tumansky R-13-300 turbojets; each 9,340 lb st. Provision for external fuel tank on each inboard underwing pylon.

Dimensions: span 46 ft 11 in, length 50 ft 6¾ in, height 15 ft 9 in, wing area 362.75 sq ft.

Weights; empty 20,950 lb, gross 39,950–42,330 lb

Performance: max speed 608 mph, combat radius (hi-lo-hi with 4,410 lb weapons and two tanks) 345 miles.

Accommodation: pilot only.

Armament: one twin-barrel 30 mm gun in port side of nose. Eight underwing pylons for 9,920 lb of air-to-ground weapons, including 57 mm and 80 mm rockets, 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 self-defense missiles.

Reconnaissance, ECM, and Early Warning Aircraft

New Reconnaissance Aircraft

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 at present as Ram-M, a designation that suggests a development status somewhere between the MiG-29 (Ram-L) and the Tupolev bomber known to NATO as 'Blackjack' (Ram-P). No details are yet available, except that it has twin tail fins.

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:

Antonov An-12 (NATO 'Cub-B') (Swedish Air Force)

Antonov An-74 AEW&C Variant (NATO 'Madcap') at Antonov OKB

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' 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 a visit to the Antonov design bureau by Mr. Gorbachev 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.

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 under-fuselage 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')

Development of this AEW&C version of the Il-76 began in the 1970s as a replacement for the Tu-126s operated by the Voyska PVO home defense force and tactical air forces. Known to NATO as 'Mainstay', it has a conventionally located 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

Ilyushin Il-20 (NATO 'Coot-A') (Swedish Air Force)

Ilyushin Il-76 AEW&C Variant (NATO 'Mainstay') (Royal Norwegian Air Force)

combat command and control. 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. More than 12 have been deployed so far, to the Soviet northwestern TVD (theater of military operations). They are intended to operate primarily with the Soviet air forces' new-generation MiG-29, MiG-31, and Sukhoi Su-27 counterair fighters.

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-21PFMA, 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 65 'Fishbed-Hs' of both models estimated in service with Soviet tactical air forces.

MiG-25 (NATO 'Foxbat-B and D')

Although 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. 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, Libya, Syria, and with No. 106 Squadron of the Indian Air Force.

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.

The MiG-25 'Foxbat-F', a 'Wild Weasel' type of defense suppression or electronic reconnaissance 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 thought to be 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 under way.

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 cylin-

drical 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 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')

The 600 aircraft that equip the Soviet Military Transport Aviation force (VTA) carry mainly equipment and cargo. The 1,600 long- and medium-range aircraft of the national airline, Aeroflot, provide immediately available troop transport capability. Fewer than 150 medium-range An-12BPs continue to serve in VTA units located primarily 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 An-12BP entered service 30 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 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')

The An-26 twin-turboprop 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. An OPB-1R sight is available to ensure pinpoint delivery into the drop zone. 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. Some operated by 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-12BP of the Royal Jordanian Air Force (Ivo Sturzenegger)

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, and is now known to be in Soviet air forces service. India ordered 118, Peru has 15, some have gone to Afghanistan, and at least three 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. When fitted with two 5,112 ehp Ivchenko AI-20DM 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.

The An-32 can be fitted with 4,195 ehp AI-20M engines for operation in moderate climatic conditions. *(Data for version with AI-20DM engines.)*

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 31,165 ft, range with max payload 1,242 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-72 and An-74 (NATO 'Coaler')

The An-72 was conceived as a STOL replacement for the An-26 that would be able to operate from unprepared airfields or from surfaces covered with ice or snow. The high location of the engines was adopted primarily to avoid foreign object ingestion. Their efflux is ejected over the wing upper surface and then down over large multislotted flaps to provide a considerable increase in lift for short-field operation, 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 pre-series batch of ten, 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 two 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.

An-74 ('Coaler-B'). Specialized version for operation in the Arctic and Antarctic, with flight crew of four, more advanced navigation aids including inertial navigation system, and provision for wheel/ski landing gear. Airframe identical with that of An-72A, but with larger nose radome that does not follow curve of fuselage undersurface.

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 8½ in, wing area 1,062 sq ft.
Weights: max payload 22,045 lb, gross 76,060 lb.
Performance: max speed 438 mph, normal cruising speed at 26,250–32,800 ft 342 mph, ceiling 32,800 ft, take-off 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 two (An-72) or four (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 combirole, An-74 carries eight mission staff, plus 3,307 lb of freight in rear compartment.
Armament: none.

Antonov An-124 (NATO 'Condor')

The An-124 is 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 summer 1988. Planned production rate is eight to ten aircraft a year, and 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 100 percent 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

Antonov An-74 (NATO 'Coaler-B') (Paul Jackson)

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 has available at last turbofan engines comparable 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 51,650 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.

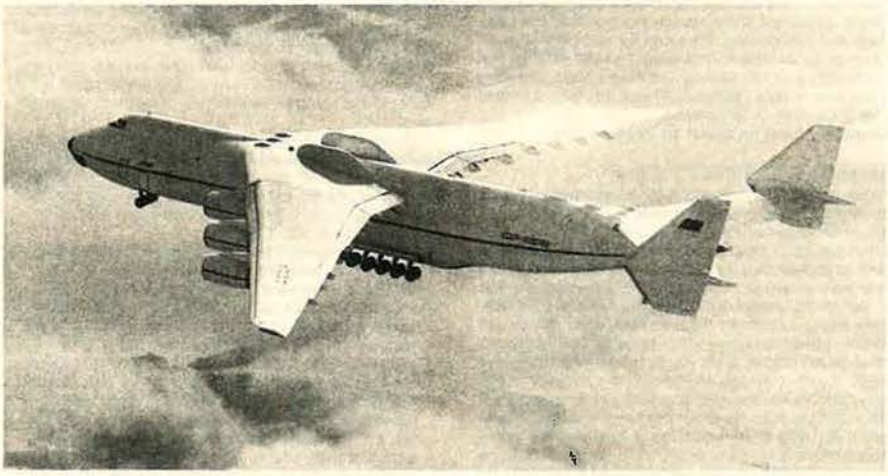
Weights: nominal max payload 330,693 lb, gross 892,872 lb.

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 relief crew; up to 88 passengers on upper deck; freight on 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-124 (NATO 'Condor') (Air Portraits)



Antonov An-225 Mriya (Tass)

Antonov An-225 Mriya

The An-225 was completely unknown in the West until the prototype was unveiled at Kiev on November 30, 1988, despite being much larger than any other airplane currently flying. In terms of takeoff weight and capability, it is a 50 percent scale-up of the An-124, with six turbofan engines instead of four, and gross weight increased from 405 to 600 metric tons. Normal flight crew will be six, as for the An-124. Each main landing gear has seven pairs of wheels in tandem, compared with five pairs on the An-124, enabling it to match the latter's ability to turn on narrow runways—a feature demonstrated impressively at the Farnborough Air Show last September.

Known by its design bureau as the Mriya (Dream), the An-225 will play a major role in the Soviet space program, by carrying on the two beams above its center-section loads such as the Buran space shuttle orbiter, and sections of the giant Energiya rocket launch vehicle. The redesigned, twin-fin, tail unit preserves optimum directional control when such loads are in place. The An-225 will also be used to ferry heavy equipment, internally and externally, to the more remote and inhospitable regions of the USSR on behalf of the oil, gas, chemical, and electrical power generating industries.

Piloted by Aleksandr Galunenko, the prototype (SSSR-480182) made a 75-minute first flight 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 airports with an 11,500 ft runway. Fewer than ten are likely to be manufactured, as the An-124 is large enough to handle most of the normal demands made on Aeroflot and the VTA. However, Antonov's General Designer, Pyotr Balabuyev, 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. With an unchanged cross-section, 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 51,650 lb st.

Dimensions: span 290 ft 0 in, length 275 ft 7 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')

This Soviet counterpart to USAF's C-141 StarLifter now equips two-thirds of the 600-strong Soviet VTA transport force and will continue replacing An-12BPs at the rate of about 50 a year. Its designers were given the task of producing an aircraft that would 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. In day-to-day military use, an Il-76 can carry twice the maximum payload more than three times as far as an An-12BP can.

Design features include rear-loading ramp/doors, a T-tail, 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. A developed version of the Il-76 is in service with the Soviet air forces in an AEW&C role (see entry on 'Mainstay') and is being joined by Il-78 in-flight refueling tankers based on the Il-76 (see entry on 'Midas').

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 passengers.

Armament: two 23 mm NR-23 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 was known to be 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')

It is doubtful if any M-4 strategic bombers remain operational, but those examples modified into probe-and-drogue refueling tankers will remain in service until the Il-78 'Midas' fleet is large enough to take their place entirely. About 40 are thought to be available.

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.

Armament: basic bomber has eight 23 mm NR-23 guns in twin-gun turrets above fuselage forward of wing, under fuselage fore and aft of weapon bays, and in tail. It is not known how many, if any, are retained by tanker version.

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 to supplement and eventually replace the L-29 as the standard trainer of the Soviet and other air forces. Well over 2,000 have been delivered, with production continuing at a rate of 200 a year. There are five versions:

L-39C. Basic and advanced flying trainer; operators include the air forces of Afghanistan, Cuba, Czechoslovakia, the German Democratic Republic, and the USSR. Production continues.

L-39V. Single-seater. As basic L-39C, but with added winch for target towing for antiaircraft artillery training.

L-39ZO. Weapon training version, with four underwing weapon stations. Strengthened wings. Exported to Iraq, Libya, and Syria. Production continues.

L-39ZA. Ground attack and reconnaissance version, with underfuselage gun and underwing weapon stations. Strengthened wings and landing gear. Operational with air forces of Czechoslovakia and Romania. Production continues.

L-39MS. New version with improved airframe, more powerful engine (4,850 lb st), and upgraded avionics and equipment, including electronic displays. First flight with new engine was made in 1986.

Power Plant (current production versions): 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 (L-39C): empty 7,617 lb, gross 10,362 lb.

Performance (L-39C): max speed 466 mph at 16,400 ft, service ceiling 36,100 ft, range 683 miles on internal fuel.

Accommodation: crew of two, in tandem.

Armament (L-39ZA): underwing bombs, rockets, air-to-air missiles, or reconnaissance packs, on four hardpoints, and a 23 mm GSh-23 twin-barrel cannon in an underfuselage pod.

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, 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 R-13 turbojet and four underwing stores pylons.

MiG-23UM (NATO 'Flogger-C')

(See page 90.)

MiG-25U (NATO 'Foxbat-C')

(See page 90.)

MiG-29UB (NATO 'Fulcrum-B')

(See page 91.)

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 98)* is primary training of helicopter pilots.

Mil Mi-24 (NATO 'Hind-C')

(See page 98.)

Sukhoi Su-7U (NATO 'Moujik')

The Soviet and several other air forces use this tandem two-seat adaptation of the Su-7B as an operational trainer for their ground attack pilots. Changes are minimal. The forward fuselage fuel tank is deleted and the fuselage lengthened slightly to make room for the second ejection seat, the occupant of which has a periscopic sight for improved forward view. The aft cockpit is fitted with a slightly raised canopy, from which a prominent dorsal spine extends back to the base of the tail-fin. Versions in service are the **Su-7UM** and **Su-7UMK,** corresponding to the single-seat 'BM' and 'BMK' respectively.

Power Plant: one Lyulka AL-7F turbojet; 19,840 lb st with afterburning.

Dimensions: span 28 ft 9¼ in, length 58 ft 8½ in, height 15 ft 9 in, wing area 297 sq ft.

Sukhoi Su-15 trainer (NATO 'Flagon-G')

(See page 91.)

Sukhoi Su-17 trainer (NATO 'Fitter-E and G')

(See page 93.)

Tupolev Tu-22U (NATO 'Blinder-D')

(See page 88.)

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 trainer (NATO 'Forger-B')

(See page 92.)

Yakovlev Yak-52

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.

Helicopters

Tilt-rotor aircraft

Evidence suggests that the Soviet Union is pursuing development of tilt-rotor aircraft, most likely for use as troop carriers. This was to be expected in view of US progress with the Bell/Boeing V-22 Osprey program and the success of the Bell XV-15 tilt-rotor research aircraft. The objective of the Soviet effort must be to provide higher-performance and more versatile replacements for such helicopters as the Mi-8/17 (NATO 'Hip') and Mi-24 ('Hind') in the 1990s. It has been reported that early projects were designated Mi-30 and Mi-32.

Kamov Ka-25 (NATO 'Hormone')

Replacement of this compact twin-turbine/coaxial rotor helicopter with the equally compact but vastly more effective Ka-27 has reduced the number of Ka-25s in Soviet Navy service to little more than 100. Others are operated by India, Syria, Vietnam, and Yugoslavia. Versions identified by NATO reporting names are as follows:

Hormone-A. Basic ship-based ASW version, with large flat-bottomed housing for undernose search radar, and racks for small stores, including canisters of 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, surmounted by inflation bottles. 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 a variety of Soviet Navy ships, including missile frigates, cruisers, the helicopter carriers *Moskva* and *Leningrad*, and carrier/cruisers of the *Kiev* class.

Kamov Ka-25 (NATO 'Hormone-B')

Hormone-B. Special electronics variant, able to provide over-the-horizon target acquisition for long-range 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 nuclear-powered 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 inessential operational equipment and weapons removed. This version sometimes has a yagi aerial mounted on the nose. *(Data for 'Hormone-A' follow.)*

Power Plant: two Glushenkov GTD-3F turboshafts; each 900 shp (later aircraft have 990 shp GTD-3BMs).

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

Weights: empty 10,505 lb, gross 16,535 lb.

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

Accommodation: crew of two on flight deck; two or three systems operators in main cabin, which is large enough to contain 12 folding seats for passengers in transport role.

Armament: ASW torpedoes, nuclear depth charges, and other stores in underfuselage weapon bay, when installed.

Kamov Ka-27 (NATO 'Helix')

According to its designer, the Ka-27 was conceived as a completely autonomous "compact truck," able to stow in much the same space as the Ka-25 with its rotors folded, despite its much greater power and capability, and able to operate 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. In 1983, at least 16 Ka-27s were seen on board the *Kiev* class carrier/cruiser *Novorossiysk*, since when the replacement of 'Hormone-As' with 'Helix-As' has continued. Four variants may now be identified, as follows:

Helix-A. Basic ASW version, with probable crew of three. Equipment includes undernose radar, a ventral weapons bay for torpedoes and other stores, sonobuoys, IFF, two radar warning antennae above the tailplane, two ESM radomes above the rear fuselage and tail. More than 90 operational. Eighteen ordered for Indian Navy.

Helix-B. Sea-based combat version for amphibious assault duties, photographed on board the *Ivan Rogov* in the Mediterranean in 1987. Primary functions are delivery of precision-guided weapons and target designation. Faceted panels around nose, and undernose fairings, for sensors and specialized equipment. Two pylons on each side of cabin for rocket packs and other stores. About 30 in service.

Helix-C. Civil versions, designated Ka-32.

Helix-D. Search and rescue and plane guard helicopter, first seen on the *Novorossiysk*. Features include an external fuel tank on each side of the cabin and a winch beside the port cabin door.

Export versions of 'Helix-A' operational in Yugoslavia have the Soviet designation **Ka-28.**

Power Plant: two Isotov TV3-117V turboshafts; each 2,225 shp.

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

Weights: max payload 8,818 lb internal, 11,023 lb slung; normal gross 24,250 lb, with slung load 27,775 lb.
Performance: max speed 155 mph, service ceiling 19,685 ft, range 497 miles.
Accommodation: flight crew of two, with seat for third person; folding seats for 16 passengers as alternative to mission equipment, litters, or freight.
Armament: not yet determined.

Kamov Ka-? (NATO 'Hokum')

It became known in summer 1984 that the Kamov Bureau had begun flight-testing a new combat helicopter that has the NATO reporting name 'Hokum'. An accompanying artist's impression is believed to be accurate in all general detail. 'Hokum' can be seen to have 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. DoD states that this helicopter has not been observed carrying antitank guided weapons. Instead, it is thought to have a primary air-to-air role (an assessment that is not universally accepted), with an armament of air-to-air missiles and a rapid-fire gun for employment as a low-level helicopter intercept system by day and night and in adverse weather conditions. Like other combat helicopters, 'Hokum' has a crew of two, in tandem, with elevated rear seat. Survivability is enhanced by use of infrared suppressors, infrared decoy dispensers, and armor.

In 1988, 'Hokum' was still at the development stage, with only prototypes involved in flight and structural testing. If 'Hokum' enters production, DoD expects that it will give the Soviets a significant rotary-wing air superiority capability. The system has no current Western counterpart."
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.

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 5,000 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.

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. Teamed with Mi-24 gunships, the Mi-8s and Mi-17s make up the most formidable helicopter attack units in the world. 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.

Hip-D. For airborne communications role; see page 94.

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.

Hip-F. Export counterpart of 'Hip-E'. Missile armament changed to six 'Saggers'.

Hip-G. For airborne communications duties; see page 94.

Hip-H. See entry on Mi-17.

Hip-J and K. ECM versions; see page 94.

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.

Kamov 'Hokum' (DoD)

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 and a sponson on each side at the rear 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. About 120 operational in Soviet forces.

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. About 20 in service with Soviet Navy; others with the East German and Polish services.

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.

Three Mi-14s have been exported to Bulgaria, four to Cuba, 12 to Libya, at least four to Poland, six to Romania, eight to East Germany, and an unknown quantity to North Korea. 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 28,660 lb.
Performance: max speed 143 mph, range 575 miles.
Accommodation: crew of four or five in 'Haze-A'.

Mil Mi-17 (NATO 'Hip-H')

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 TV-3 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 Afghanistan and 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.

An accompanying illustration shows an Mi-17 used to patrol the border between East and West Germany. Features include rocket pods, a decoy flare dispenser under the tailboom, and domed and cylindrical covers replacing the two front cabin windows.
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-24 (NATO 'Hind')

The Mi-24 is the Soviet counterpart of the US Army's AH-64 Apache. Most of the 1,250 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 its variety of weapons and operational equipment makes it a formidable adversary. As a result of combat experience in Afghanistan, infrared jammers, suppressors, and decoy dispensers have been added, and armor has been increased. Variants identified to date are as follows:

Hind-A. Initial series production version. 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 weapon 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. 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 under tailboom. Export models, including those for India, 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. 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 gun on starboard side of front fuselage. Bottom of nose smoothly faired above and forward of sensors.

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 unidentified 'clutching hand' mechanisms, which are probably associated with radiation sampling, 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.

Deliveries of all models of the Mi-24 exceed 2,300, from plants in Arsenyev and Rostov, with production reducing progressively from its peak rate of more than 15 per month. In addition to the Soviet armed forces, operators include 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.

Power Plant: two Isotov TV3-117 turboshafts; each 2,200 shp.
Dimensions: rotor diameter 55 ft 9 in, length excl rotors and gun 57 ft 5 in, height 21 ft 4 in.
Weights: empty 18,520 lb, gross 24,250 lb.
Performance ('Hind-D'): max speed 192 mph, service ceiling 14,750 ft, combat radius with max military load 99 miles, range with max fuel 466 miles.
Accommodation ('Hind-D/E'): crew of two; flight mechanic, and provisions for eight troops or four litters in main cabin.
Armament: see individual model descriptions.

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 began infield testing and development with the Soviet air forces in early 1983 and was fully operational by 1985. More than 50 are now available. First export deliveries, of ten for India, began in June 1986. Infrared jammers, suppressors, and decoy dispensers are fitted to production aircraft.

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.

Mil Mi-24 (NATO 'Hind-F')

Mil Mi-26 (NATO 'Halo')

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 best illustration yet available is a DoD artist's impression, showing an aircraft similar in general configuration to its US counterpart, the AH-64 Apache, with stepped cockpits for the weapons operator and pilot, a heavy caliber gun in an undernose turret, and weapons pylons carried on stub wings for up to 16 antitank guided missiles and other stores. These will provide for an air-to-air combat capability in addition to the conventional air-to-surface roles. An undernose electro-optics pod is expected to enclose low-light-level TV and/or a laser designator and marked target seeker.

Knowledge of Soviet design practice suggests that the Mi-28 has two Isotov TV3-117 turboshaft engines of the kind fitted to the Mi-24 and Ka-27, but its rotor system is new. Like all current Soviet first-line helicopters, it will be fitted with infrared suppressors, decoy dispensers, and extensive armor. There is little reason to believe that the Mi-28 has progressed beyond the prototype development phase.

Dimensions: rotor diameter 55 ft 9 in, length 57 ft 1 in.
Weight: gross 17,635 lb.
Performance: max speed 186 mph, combat radius 150 miles.

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 50 remained in service in 1988, all located in the western USSR, opposite European NATO. They are being 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 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 420 SS-11 Mod 2/3s remained in 1988. 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. Since 1975, a total of 138 SS-11 silos have been modified to accept SS-17 missiles, all upgraded to Mod 3 standard with four MIRVs. Like the SS-19, the SS-17 is capable of flexible targeting, making it suitable for use against targets in Eurasia as well as in the US, a feature of added importance since signature of the INF Treaty. The silos, like those for the SS-18 and SS-19 ICBMs, are hardened to resist very high overpressure.

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 have been upgraded since 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. 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. A Mod 5 version, or SS-18 Follow-On, has been tested, to further improve the accuracy of this ICBM.

Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: ten 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 350 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.

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 441 SS-20 IRBM launchers had been deployed 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 countertargeting 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.
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 rail-mobile version of the SS-24, deployment began in 1987, and about 10 of these ICBMs were operational by 1988. A silo-based version, offering greater accuracy, was expected to follow. 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 capability. 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 spring of 1988, the Soviet Union was estimated to have deployed about 100 launchers for this Minuteman-size ICBM at several operational bases. Each base consists of a number of launcher garages 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.

Sixth-Generation ICBMs

According to DoD, activity at test ranges indicates that further Soviet ICBMs are under development. The Mod 5 SS-18 Follow-On had entered flight test by early 1987. Additionally, follow-on missiles to the SS-24 and SS-25 are anticipated, the latter with MIRVs. All of these missiles are expected to offer better accuracy and greater throw-weights than their predecessors.

AS-4 (NATO 'Kitchen')

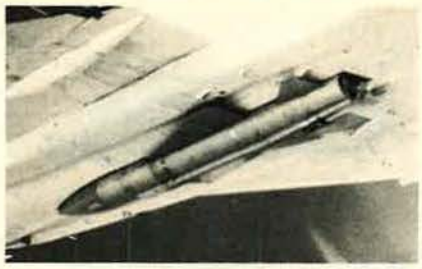
Although 'Kitchen' was first seen on a Tu-22 ('Blinder') bomber nearly 28 years ago, it remains a highly important Soviet standoff weapon, carried by 'Blinder', the Tu-26 'Backfire', and the Tu-95 'Bear-G'. It has an aeroplane configuration, with stubby delta wings and cruciform tail surfaces, and is 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: 13,225 lb.
Performance: max speed Mach 4.6, range 185 miles at low altitude, 285 miles at high altitude.

AS-6 (NATO 'Kingfish')

This advanced air-to-surface missile is standard armament of modified 'Badger-Gs', which carry a 'Kingfish' under each wing. Propulsion is said to be 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 34 ft 6 in.
Weight: 11,000 lb.
Performance: max speed Mach 3, range 135 miles at low altitude.

AS-15 (NATO 'Kent')

After at least seven years of development testing, including launches from 'Backfire' bombers, the Soviet Union began deployment of 'Kent' long-range air-launched cruise missiles on 'Bear-H' strategic bombers



AS-4 (NATO 'Kitchen') missile on Tu-26 ('Backfire-B')

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. Submarine-launched and ground-launched versions are known as the SS-NX-21 and SSC-X-4 respectively. All have a guidance system similar to the US Tercom, making possible a CEP of about 500 ft, and a 200 kiloton nuclear warhead.
Dimensions: span 10 ft 8 in, length 26 ft 6 in.
Weight: 3,750 lb.
Performance: speed subsonic, range 1,850 miles.

AS-X-19

This supersonic cruise missile, with a reported range of 2,000 miles, is being developed as an alternative weapon for the Tupolev 'Blackjack' strategic bomber.

Airborne Tactical Missiles

AS-2 (NATO 'Kipper')

First seen at the 1961 Aviation Day display, this aeroplane-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 aeroplane-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. About 25 were used operationally during the October 1973 war between Israel and the Arab states, when Tu-16s from Egypt launched them against Israeli targets. Only five eluded the air and ground defenses.
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 132 lb high-explosive warhead.
Dimensions: span 2 ft 11½ in, length 11 ft 6 in.
Weight: 650 lb.
Performance: max speed transonic, max range 5 miles.

AS-9 (NATO 'Kyle')

This is a solid-propellant antiradiation missile, with a range of 45 miles at supersonic speed, carrying 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 4 ft 11 in, length 19 ft 9½ in.
Weight: 1,650 lb.

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 carries a 220 lb high-explosive warhead and is operational on MiG-27, Su-17, and Su-24 attack aircraft.
Dimension: length 11 ft 6 in.
Performance: max speed transonic, max range 6.2 miles.

AS-11 (NATO 'Kilter')

Confirmation of the existence of this antiradiation missile was received in 1987, when it was stated to form primary armament of the 'Foxbat-F' defense suppression version of the MiG-25. DoD has listed it among weapons carried by the Su-24 'Fencer'. It is said to resemble the AS-10 'Karen', and to use imaging infrared guidance.

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 air-to-surface missile is carried on the extended wingroot glove pylons of the 'Fencer-D' version of the Su-24. When carried by the MiG-27 'Flogger', it is accompanied by an underfuselage data link pod for guidance of the AS-14, which appears to use laser terminal homing. 'Kedge' is approximately 12 ft 6 in long, with a range of up to 18 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 semi-automatic 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 semi-active 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 6 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. Tube-launched and radio command guided, possibly with semiactive laser terminal homing, it equips the 'Hind-E and F' versions of the Mi-24.
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 20 lb fragmentation warhead are fitted.
Dimensions: length 9 ft 6 in, body diameter 5.12 in, fin span 1 ft 8¾ in.
Weight: 203 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 243 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. Photographs suggest that 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, different in shape from those of 'Foxbat-B', 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')

Second type of missile carried by the MiG-23, and also by late-model MiG-21s, MiG-25s, MiG-29s, MiG-31s, Su-15s, Su-25s, and Yak-38s, 'Aphid' is a highly maneuverable close-range 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.

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.

AA-2D (NATO 'Atoll') missile on MiG-21RF of Egyptian Air Force (Denis Hughes)

AA-3 (NATO 'Anab') missiles on Su-15 ('Flagon-F')

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 new close-range missile was first mentioned by DoD in 1986. No details are available, except that it resembles an uprated 'Atoll'. It can be carried by the MiG-23, MiG-25, MiG-29, and Su-27.

Antihelicopter 'Grail'

In addition to 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 similar 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. Its purpose is to provide a measure of protection for Soviet military and civil central command authorities during a nuclear war, and this has required major upgrading of the system in recent years. 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. When operational, it is expected 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 many of the 25 countries to which it was exported.

Power Plant: liquid-propellant sustainer, burning nitric acid and hydrocarbon propellants; solid-propellant booster.
Guidance: automatic radio command, with radar tracking of target.
Warhead: high-explosive, weight 288 lb.
Dimensions: length 34 ft 9 in, body diameter 1 ft 8 in, wing span 5 ft 7 in.
Launching weight: 5,070 lb.
Performance: max speed Mach 3.5, slant range 31 miles, effective ceiling 82,000 ft.

SA-3 (NATO 'Goa')

Soviet counterpart of the American HAWK, the SA-3 was deployed by the Soviet Union 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 widely used also by the Soviet Navy and is fired from a roll-stabilized twin-round launcher.

Power Plant: two-stage solid-propellant.
Guidance: radio command, with radar terminal homing.
Warhead: high-explosive, weight 132 lb.
Dimensions: length 22 ft 0 in, body diameter 1 ft 6 in, wing span 4 ft 0 in.
Launching weight: 1,402 lb.
Performance: max speed Mach 2, slant range 15–18.5 miles, effective ceiling over 43,000 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, has kept it in service with six 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.

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 28 ft 10½ in, body diameter 2 ft 8 in, wing span 7 ft 6 in.
Launching weight: approx 5,500 lb.
Performance: max speed Mach 2.5, slant range 43 miles, effective ceiling 80,000 ft.

SA-5 (NATO 'Gammon')

In partnership with the low-altitude SA-3, the long-range high-altitude SA-5 constitutes the major part of the Soviet Union's home defense force of more than 9,000 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. More than 2,000 SA-5s are said to be deployed at more than 100 sites in the USSR, with others in Eastern Europe, Mongolia, Libya, and Syria. Those in East Germany pose a particular threat to key NATO reconnaissance and AWACS aircraft, even when they are operating in West German airspace.

Power Plant: two-stage, first stage comprising four wraparound solid-propellant jettisonable boosters.
Guidance: semiactive radar homing.
Dimensions: length 34 ft 9 in, body diameter 2 ft 10 in, wing span 9 ft 6 in.
Performance: max speed above Mach 3.5, slant range 185 miles, effective ceiling 95,000 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 all-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 22 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: 1,212 lb.
Performance: max speed Mach 2.8, range 18.5 miles, effective ceiling 59,000 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. It repeated the process 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 40 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 5.5 lb.
Dimensions: length 4 ft 3 in, body diameter 2.75 in.
Launching weight: 20 lb.
Performance: max speed Mach 1.5, slant range 5–6 miles, effective ceiling 5,000 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 an estimated range of 12–15 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; export customers include Angola, Guinea, India, Iraq, Jordan, Kuwait, Libya, Nicaragua, Poland, and Syria.
Power Plant: probably dual-thrust solid-propellant.
Guidance: command guidance by proportional navigation. Semiactive radar (or possibly infrared) terminal homing.
Warhead: high-explosive, about 90–110 lb weight.
Dimensions: length 10 ft 6 in, body diameter 8.25 in.
Launching weight: 375 lb.
Performance: max speed Mach 2, range 6–8 miles, effective ceiling 20,000 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.)*
Dimensions: length 5 ft 9 in, body diameter 4.75 in.
Launching weight: 66 lb.
Performance: max speed above Mach 1.5, range 5 miles, effective ceiling 16,400 ft.

SA-10 (NATO 'Grumble')

According to DoD, the formidable all-altitude SA-10 offers significant advantages over older strategic surface-to-air missile systems such as the SA-1, 2, and 3 that it is replacing. These advantages include multitarget tracking and engagement, a capability against low-altitude targets with a small radar signature, such as cruise missiles, a capability against tactical ballistic missiles, and possibly a potential to intercept some types of strategic ballistic missiles. Deployment of the initial **SA-10A** (NATO 'Grumble') began in 1980, and about one-third of the current force of more than 150 launch units is 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 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.
Dimensions: length 23 ft, body diameter 1 ft 8 in.
Launching weight: 3,300 lb.
Performance: max speed Mach 6, max range 62 miles.

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. First export customer was Syria.
Guidance: semiactive monopulse radar command.
Dimensions: length 17 ft 6 in, body diameter 1 ft 2 in.
Performance: max speed Mach 3, range 1.9–17 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: solid-propellant.
Guidance: semiactive radar command.
Warhead: high-explosive, weight 330 lb.
Dimensions: length 23 ft 8 in, body diameter 1 ft 8 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 be 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. 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 to that used in the SA-12A system, except for having a longer range. 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 (NATO 'Gopher')

Deployed 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 eight countries.
Power Plant: solid-propellant.
Guidance: infrared homing.
Warhead: high-explosive, weight 13 lb.
Dimensions: length 7 ft 2 in, body diameter 4.75 in.
Launching weight: 121 lb.
Performance: max speed Mach 2, range 0.3–6.2 miles, effective ceiling 165–16,500 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'. No details are available, except that the tracked launch vehicle is related to that of the SA-11.

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 employ either semiactive laser or 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 launch tubes 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.

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. ■

SA-16 (Soviet name Igla) (DoD)

The Commitment Gap

By Gen. T. R. Milton, USAF (Ret.), CONTRIBUTING EDITOR

The Academy is producing outstanding scholars—but too many graduates cut their military careers short for a job with the airlines. The pattern says that something basic is wrong.

In former times, the primary reason for attending a service academy was to obtain the regular commission, awarded at graduation along with the diploma. The free education was an appreciated benefit—even if a monastic lifestyle and institutionalized harassment in the name of discipline did serve as a reminder that nothing in life is truly free—but the commission was the real prize. Regular commissions, with the security they implied, were hard to come by in the 1930s, and while there were other paths to that end, they were chancy; the service academies offered the only sure thing.

Those were simpler days. Today, the motivation to attend a service academy is more complicated, in keeping with our more complicated era. Certainly, a regular commission is no longer the grand prize. Witness the exodus of Academy graduates from the Air Force—in particular, pilots—at the earliest opportunity. The rate of resignation of Academy graduates having less than ten years' service is only fractionally lower than that of Air Force officers as a whole. As for pilots, the airlines' siren song is heard by ROTC and Academy graduates alike, bringing about a sharp change in the record from that of earlier Air Force Academy classes.

Originally, the basic objective of the Air Force Academy was to provide pilot candidates to the Air Force. In the early days, that objective was paramount, with one hundred percent of incoming cadets pilot-qualified and airmanship occupying a significant place in the curriculum. In time, this focus on airmanship gave way to a more rigorous academic program, and only sixty percent of incoming cadets had to possess twenty-twenty vision. That figure is now up to seventy percent, but there has been no relaxation in the academic program. With the exception of an indoctrination course in sailplanes and light airplanes, pilot training takes place after graduation.

Pilot wings, nevertheless, seem to be a principal attraction for a majority of the entering cadets, just as the Academy's founding fathers intended. What they did not intend was that those pilot wings should be simply the symbol of a marketable skill.

The Air Force Academy—any service academy—fails in its purpose if it only provides an education, however excellent that education may be. The principal, and maybe the only, reason to house, feed, educate, and pay 4,000 young men and women is to furnish the service with the foundation and standard for its officer corps.

The Air Force Academy, like its sister academies, is in a buyer's market these days. With more than 4,500 fully qualified candidates competing for the 1,400 slots in the entering class, the Academy can pick and choose. Scholastic aptitude scores have steadily risen to the point where the football team, a haven for the marginally capable in many schools, has an SAT average higher than the average for the entire student body in most colleges. The Academy Cadet Wing is without question a superior group of college students.

Nevertheless, the fact remains that there is something wrong. If the airlines, with their unionized pilot structure, seniority rules, and long years of boring toil and little responsibility, are more attractive than a career in the Air Force, clearly something is amiss. Either the Air Force is not offering enough in the way of challenge and reward, or the Academy is making some mistakes in its admissions screening and later motivation.

Very likely, there is truth in both of these postulates. Few people go through a military career without feeling boredom or frustration and, at some point, entertaining the thought of getting out. The old West Point ballad lamented "promotions very slow," and another, ruder song assured us that one never got rich. Family separations, dislocating moves, and uncertain hours all have their effect on the resignation rate. These problems have always existed, and yet most, particularly the pilots, opted to stick around.

It would appear that what we have nowadays is a lack of commitment on the part of a significant number of Academy graduates. These young people enter the Academy with impressive credentials, they do well in a demanding environment, they take pilot training in stride, and then they begin to count the days. Or so it would seem. A fine education, a few great years flying the world's best airplanes, and, just as the Air Force can begin to capitalize on its investment, its highly trained personnel opt out. The pattern is all too familiar.

Maybe the Academy's aims are too high in the way of academic credentials. With so rich a group to choose from, it is only natural to select the top applicants, measured by academic scores and other achievements. But it is also possible that by concentrating on test scores and other qualifications, attention may be diverted from the young person's true commitment to a military career.

One way to find out might be to raise the service obligation by a significant amount: raise nonpilots' obligation, say, from the present five years to ten, and pilots' to twelve. If that were to reduce the pool of candidates, and in the process the test scores of the entering class, the trade-off might be acceptable so long as the drop were not too dramatic. In any case, the increased commitment would only discourage those who didn't intend an Air Force career in the first place, and that, after all, would be the idea behind it. ■

Properly trained aircrews in good, well-maintained aircraft prove that we can have realism and safety, too.

Realistic Training Is Not Unsafe

BY MAJ. GEN. WALTER E. WEBB III
DIRECTOR OF OPERATIONS, DCS/PLANS AND OPERATIONS

IN TRAINING discussions, we sometimes hear that "safety is paramount." It is vital, certainly, to preserve valuable resources, but it is just as important that we properly train warriors for the next conflict. Training safely and honing the edge of combat capability have often appeared at odds with each other. Can we really train the way we plan to fight while maintaining the necessary safety margin?

My evidence says yes. Air Force efforts to improve air safety have also made significant contributions to our combat capability. There are at least three areas where safety and combat capability have progressed together: equipment improvements, combat-oriented maintenance and logistics, and training. Taken together, these factors have resulted in an all-time low mishap rate and unsurpassed combat capability.

Recent improvements for both man and machine have contributed to these successes. Newer USAF aircraft have greatly improved aerodynamic characteristics and handling qualities that allow pilots to fly safely to the edge of the aircraft's flight envelope. This permits operations in regimes that the enemy often cannot approach. In fact, with our newest fighters, this high degree of sustained maneuverability gives us a distinct advantage over an enemy who is not so well equipped in combat.

This improved maneuverability has reached the point where the pilot's physical tolerance for G-forces sometimes becomes the limiting factor. G-induced loss of consciousness (GLOC) has contributed to some recent fighter aircraft mishaps. Fighter pilots are keenly aware of this and have met the challenge through rigorous physical conditioning programs. USAF is also developing a new anti-G suit system that assists aircrews in sustaining up to nine Gs for longer periods of time. Hence, by confronting a safety problem, we have also gained a distinct combat advantage.

Another equipment improvement that enhances safety and combat capability is the ground collision avoidance system (GCAS). This system, to be installed first on the A-10, will provide a much-needed ground-proximity warning.

Finally, redundant hydraulic and electrical systems enhance peacetime flight safety while making our aircraft more survivable in combat.

In the last decade, a new combat-oriented approach to maintenance

and logistics has improved both the quality and quantity of USAF training sorties. One measure of the quality of our aircraft is the fully mission-capable (FMC) rate—the rate at which all aircraft systems are 100 percent ready for flight. Today, more than eighty percent of our fighter force is FMC twenty-four hours a day every day of the week. This compares with an FMC rate of about sixty percent just five years ago. The B-52 now averages around eighty percent, compared with about forty percent five years ago.

This improved quality of available aircraft pays off every day, and the mishap statistics prove it. The logistics mishap factor, which measures maintenance and logistics causes in USAF flight mishaps per 100,000 flying hours, decreased from 1.06 in 1980 to .64 in 1987.

Better maintenance and logistics also give us the opportunity to fly more training sorties than before. Overall, for every 100 sorties we generated in 1980, we fly 180 today—an increase of eighty percent! Flying better equipped and maintained aircraft at higher sortie rates leads to one thing—greater combat capability with safer flying.

Building on Fundamentals

While these improvements have given us the proper tools, the focus must now shift to the warrior—the ultimate determinant of success in combat. Realistic training—training the way we plan to fight—is the third dimension of combat.

As training intensity increases to match the tempo and complexity of war, we find once again that safety complements the ability to train realistically. Any football coach will attest that the basics of blocking and tackling are the foundation of winning. The same holds true of combat employment. A gradual increase in training difficulty, through a building-block approach, is the key to ensuring that we don't lose proficiency in the basics while advancing to more complex tasks.

Beginning with Undergraduate Pilot Training (UPT), pilots learn basic airmanship and safety in "ground school" well before they fly their first mission. After graduation from UPT, the specific weapon systems training they receive reinforces these fundamentals of aviation. The instincts that pilots gain from "blocking and tackling" at all levels of training are the cornerstone of effective aircraft employment in peacetime as well as in combat.

After mastering these fundamentals, aircrews are ready to advance to more demanding training. Today, combat-ready aircrews are flying in more realistic and challenging scenarios than ever before. For example, Tactical Air Command's Red Flag training program provides the tactical air forces (TAF), SAC, MAC, US Navy, and US Marine Corps with the most advanced and comprehensive training available today. In scenarios involving as many as 150 aircraft, aircrews are put to the test against a vast array of simulated enemy defenses, including the USAF aggressors and ground threat simulators.

Despite the fact that Red Flag has increased tremendously in size and intensity, its safety record has improved dramatically. In 1976, the first full year of Red Flag, the safety record was 32.0 Class A mishaps per 100,000 flying hours, compared to a TAF average of 6.8 mishaps per 100,000 hours during the same period. In 1987, there were no Red Flag Class A mishaps, and the TAF average was down to 3.41 mishaps per 100,000 hours. Considering that the intensity and complexity of training has increased greatly over the past ten years, the Red Flag and TAF results today are indeed impressive.

We are also training a far greater number of aircrews in Red Flag than when it began. In 1976, we trained fewer than 1,000 aircrews in Red Flag; in 1987, we trained more than 5,000. So, while training more than five times as many aircrews in larger, more complex scenarios, USAF has significantly reduced the accident rate.

The Evidence Is Clear

There are other indications that safety and combat capability can be improved simultaneously. Most recently, SAC's B-52s demonstrated that aggressive training, done the smart way, pays off. During Exercise Mighty Warrior '88, B-52s operating from austere locations conducted strikes against distant targets at the Nellis AFB range complex, using low-level ingress tactics to elude "enemy" defenses. The mishap-free exercise once again demonstrated that realistic training can be conducted without compromising safety.

In exercise Team Spirit '88, six MAC C-141s flew nonstop from CONUS to Korea. They airdropped their cargo on time and on target, thirteen hours after takeoff. In total, MAC delivered 33,000 troops and 5,500 tons of cargo in more than 300 missions without a mishap.

Ten years ago, the overall USAF accident rate was 3.16 mishaps per 100,000 hours flown. Last year, it was 1.65. Along with this decrease, combat capability has improved dramatically. The reasons are clear. USAF aircraft are designed with features that improve both safety and combat employment. Higher FMC and sortie rates indicate that we are flying better-maintained, safer aircraft and flying them more often. Our training simulates combat better than ever before, as shown by such exercises as Red Flag and Mighty Warrior '88. Hence, it is clear that accident rates are not directly tied to training intensity. Rather, they are a function of preparation in training.

When comparing safety and combat capability, it is important to remember that safety is *not* an end in itself—mission accomplishment is. Safety *supports* mission accomplishment. Because of this, safety is as important in combat as it is in peacetime. Therefore, if we truly want to train the way we plan to fight, a properly executed mission is *inherently* safe.

Can we really train the way we plan to fight and retain the necessary safety margin? Can we fly smart in peace and war? The answer is a resounding yes! To paraphrase Casey Stengel, "The record is in the book; you can look it up." ■

Maj. Gen. Walter E. Webb III, USAF, is currently the Director of Operations, DCS/Plans and Operations. A command pilot and a distinguished graduate of the Air War College with more than 4,600 flying hours, he served in Southeast Asia and is a recipient of the Distinguished Flying Cross, among many other commendations.

AFLC's $1.7 billion computer modernization should solve a whole bunch of chronic problems.

The Right Part To the Right Place

BY RON FRY, HQ. AIR FORCE LOGISTICS COMMAND

SCENARIO: Hostilities erupt suddenly in the Bering Strait. An F-16 wing deploys to Alaska, where the Arctic cold causes a key radar component to fail on several aircraft. Base stock levels of the part are extremely low. An urgent request for the part is issued.

Frame this scenario in the early 1980s and you see the fighter wing limping through the first days of conflict while logisticians make countless phone calls and shuffle mounds of paperwork tracking down needed parts. Maybe the parts get there in time and maybe not.

Run the scenario today and you see the wing getting its parts in a few hours with minimal interruption to combat readiness. The difference is the Logistics Management Systems (LMS) program of computer modernization, on which Air Force Logistics Command will spend almost $1.7 billion.

LMS, with nine basic systems and five main supporting systems, is improving the way AFLC manages four core functions—logistics requirements, acquisition, distribution, and maintenance. Through its five air logistics centers, AFLC buys, supplies, transports, maintains, and repairs everything needed to keep Air Force weapon systems combat-ready.

"The modernization program is allowing logistics managers to gain access to more complete and reliable information within AFLC's functions," said Brig. Gen. John F. Phillips, who heads the program as both AFLC Deputy Chief of Staff for communications-computer systems and as Commander of the Logistics Management Systems Center. "Completed information systems and modules of the modernization program are already improving the way AFLC does business and, in the process, improving Air Force combat readiness."

The modernization program is replacing some 135 cumbersome, outdated, mostly batch-processed computer information systems, giving AFLC a better overview of its resources, allowing it to "get the right part to the right place at the right time."

General Phillips said that unnecessary downtime for weapon systems will be cut drastically, while

A1C Jody Engstrom, an avionics specialist at Hill AFB, Utah, installs a part on an F-16 Fighting Falcon. By improving its management of four core functions—logistics requirements, acquisition, distribution, and maintenance—AFLC's computer modernization program will make sure people like Airman Engstrom get the parts they need to keep weapon systems ready for combat.


STROM

logisticians and planners at the operational commands will be able to make smarter decisions based on information at their fingertips.

"Big Bang" Busts

AFLC's information management outlook was not always so bright. The command trudged into the 1980s with mostly 1960s-vintage logistics computer systems. AFLC had created hundreds of individual stand-alone computerized data systems, which in turn created mountains of paperwork and information bottlenecks.

This is AFLC's second attempt to update its computerized data systems. The command spent much of the 1960s searching for ways to take advantage of evolving computer technology. A program developed in the late 1960s and early 1970s was supposed to give AFLC managers on-line access to logistics information stored in mammoth databases. Equipment and operating systems of the day couldn't handle the job, though, and in 1975, the program was halted.

General Phillips said AFLC learned valuable lessons from the failure. "We attempted that first modernization under the 'Big Bang Theory.' AFLC tried to do it all at once," General Phillips said. "It taught us that it's better to tap the expertise of the computer contractors and bring the systems on a little bit at a time, in a modular fashion."

That's why LMS is being phased in incrementally—the "fail-safe" approach, as General Phillips refers to it. "We're developing, testing, and implementing each phase before moving to the next," he said. "Money for a new phase is obligated only after a funded phase has been fully tested and implemented."

In the early 1980s, AFLC was confronted with "horror stories" about overpriced hammers, coffee pots, and spare parts. Few procurements of that nature ever took place, but a major controversy ensued. The problem was caused, in part, by outdated data-processing equipment.

By 1982, the Department of Defense had given the go-ahead for the LMS modernization. In six years, LMS has come a long way. While a $55 million cut in funding in Fiscal Year 1988 delayed some parts of the program, schedules have been realigned to meet new budget authorizations.

At Ogden Air Logistics Center, Hill AFB, DeAnn Chapman uses a computer to retrieve one of 61,000 storage bins that contain 217,000 storage locations for stock items.

All of LMS's "Big Nine" systems have reached initial operational capability, and two systems—the Weapon System Management Information System (WSMIS) and the Engineering Data Computer Assisted Retrieval System (EDCARS)—are already fully operational.

By developing "fixes" to readiness and sustainability problems, WSMIS assesses the Air Force's capability to go to war, sustain combat operations, and improve combat capabilities.

Faster and Less Costly

"Peacetime supply problems that used to take sixty to ninety days to identify can now be singled out by WSMIS in just one to seven days," General Phillips said. Aircraft sustainability evaluations can be in the hands of planners and system program managers in as little as six hours. Under the old systems, that took between thirty and sixty days.

EDCARS, a joint AFLC-Army program, will modernize engineering information repositories. Before EDCARS, engineering information was stored in an elaborate manual system of microfilmed aperture cards. The system was cumbersome, inefficient, and much more expensive.

EDCARS stores information on laser optical disks. This allows the automation of requisitioning, indexing, modification, filing, retrieval, and distribution functions of the engineering information bank.

"EDCARS is helping to reduce contracting administration lead time," General Phillips said. The system speeds production of contracting bid sets since it can accept data directly from contractors. EDCARS transmits and displays various drawings in a matter of seconds, instead of the days it took under the old system.

The other LMS programs, although not 100 percent operational, are paying off.

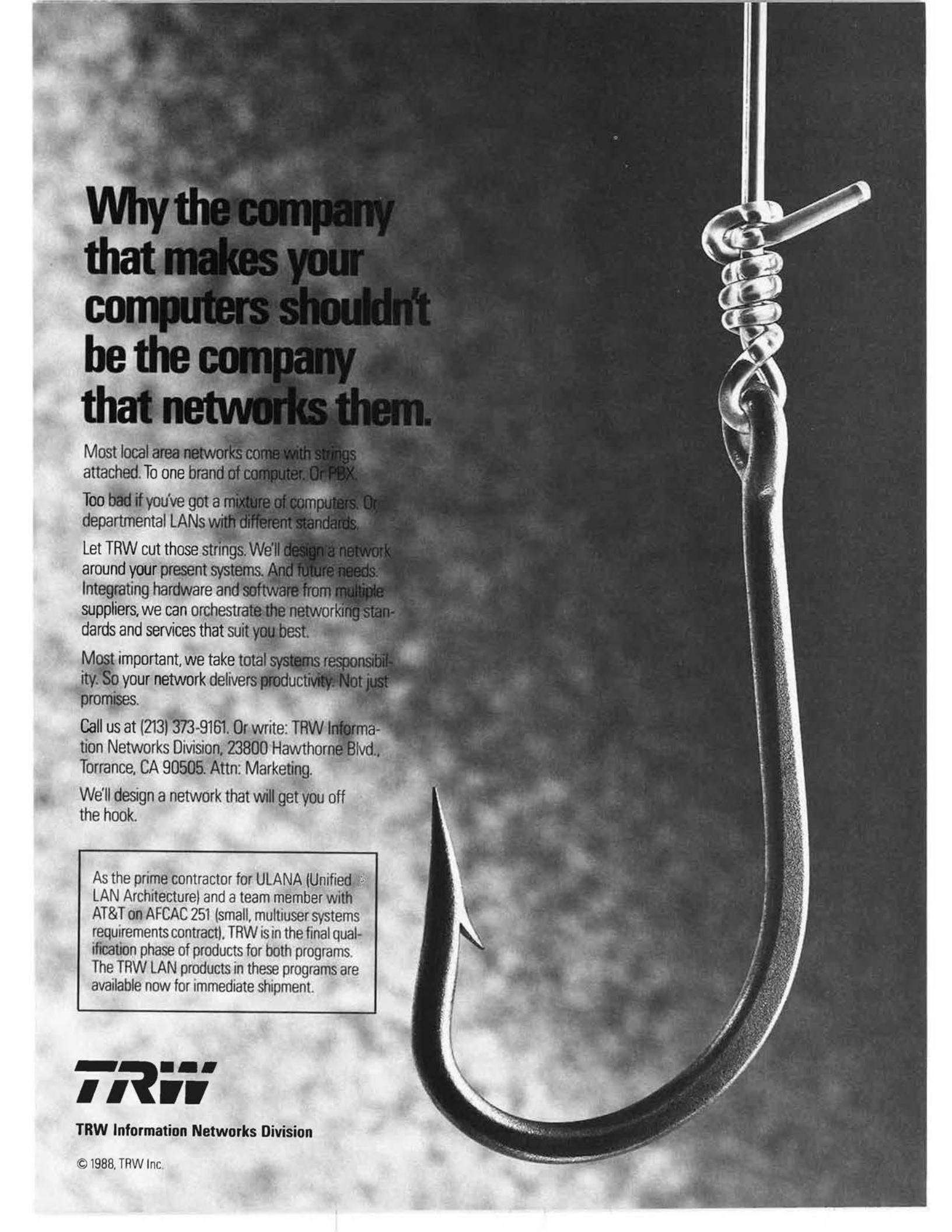
Accurate prediction of needs for spare and repair parts is obviously important, but management information systems of the past were not up to the job. The Requirements Data Bank (RDB) "will interact with other LMS systems to forecast quantitative parts [needs] and budgetary needs," General Phillips said.

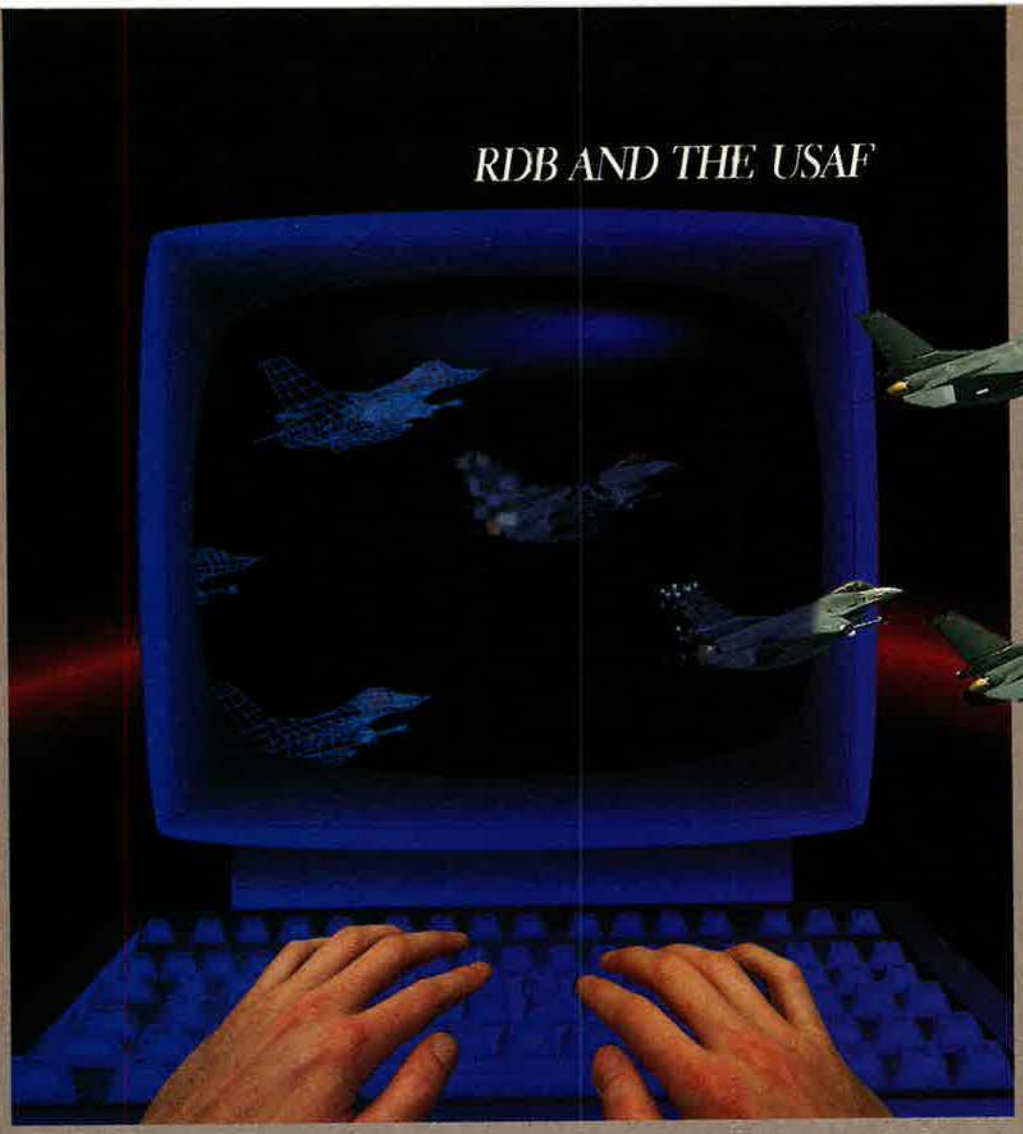
The RDB gives the command a fresh capability to calculate requirements in a way that ties individual item requirements to specific weapon systems support objectives. When fully operational, the RDB will replace twenty-five outdated systems. It will help decision-makers determine when and where certain parts are needed and which aircraft or missiles should be repaired first.

While the RDB won't be fully operational until 1994, "the system is already capable of tracking the 850,000 annual requests for spares," General Phillips said.

AFLC, with more than 300,000 contracting activities annually, will better manage its purchases with the Contracting Data Management System (CDMS). The system, also projected for completion in 1994, replaces nine present systems.

CDMS automates the preparation and processing of procurement documents, including purchase requests and contracts. This helps the Competition Advocate develop more reliable spare-parts target prices while improving procurement competitiveness and reducing


Why the company that makes your computers shouldn't be the company that networks them.
Most local area networks come with strings attached. To one brand of computer. Or PBX.
Too bad if you've got a mixture of computers. Or departmental LANs with different standards.
Let TRW cut those strings. We'll design a network around your present systems. And future needs. Integrating hardware and software from multiple suppliers, we can orchestrate the networking standards and services that suit you best.
Most important, we take total systems responsibility. So your network delivers productivity. Not just promises.
Call us at (213) 373-9161. Or write: TRW Information Networks Division, 23800 Hawthorne Blvd., Torrance, CA 90505. Attn: Marketing.
We'll design a network that will get you off the hook.
As the prime contractor for ULANA (Unified LAN Architecture) and a team member with AT&T on AFCAC 251 (small, multiuser systems requirements contract), TRW is in the final qualification phase of products for both programs. The TRW LAN products in these programs are available now for immediate shipment.
TRW
TRW Information Networks Division
© 1988, TRW Inc.



COMBAT STRENGTH THROUGH LOGISTICS

Think of it this way: an F-16 is actually a collection of 75,000 parts flying in very close formation. Now you can better appreciate the dimensions of the worldwide readiness challenge faced by the Air Force Logistics Command in keeping USAF aircraft flying and systems operating, at affordable cost. That is the real achievement of the AFLC's Requirements Data Bank (RDB), the computerized information management system that helps put all the pieces in the right places at the right time.

RDB is designed to help AFLC forecast and manage spare parts, equipment procurement, and repair requirements for the entire USAF. BDM, the prime contractor and system integrator for RDB, and its teammates Boeing Computer Services and Battelle Technical Support Division have already helped the USAF achieve impressive readiness gains. With RDB, AFLC users are performing complex computations and meeting reporting and readiness requirements in hours rather than weeks. For example, meeting a request for the value of assets in three aircraft programs—say, the B-1B, A-7, and B-52—formerly took six to eight weeks. With RDB, the response time is 40 minutes per program.

A key to the extraordinary improvement in system responsiveness is BDM's approach to RDB software development, embodied in the company's Software Productivity Enhancement Center (SPEC℠). With SPEC, BDM has successfully integrated software engineering tools such as AI, CASE, and desktop publishing to design and produce software that is as near error-free as possible. And match the quality with quantity and timeliness, achieving software productivity gains ranging up to 30%.

Results from nationwide Air Logistics Centers (ALCs) fully confirm the effectiveness, reliability, and responsiveness of RDB. Thousands of ALC users have reported RDB software to be extremely reliable.

Congratulations are due to AFLC and its "Total Quality Commitment." BDM reaffirms *its* commitment to help the AFLC meet and exceed its readiness goals. BDM International, Inc., 7915 Jones Branch Drive, McLean, Virginia 22102. (703) 848-5000.

BDM

A Ford Aerospace Company

future parts costs. CDMS also goes a long way toward achieving relatively paperless contracting.

CDMS will save money by cutting procurement administrative lead time. "It's been validated we'll save $6.7 million for every day we can shave off the procurement process," General Phillips said.

AFLC distribution will be managed by the Stock Control and Distribution system. SC&D will give logistics managers greater inventory control of spare parts and other items by providing information on the quantities and whereabouts of items all over the world. When it is fully operational in 1990, SC&D will control an AFLC weapon system inventory worth some $92 billion.

SC&D allows AFLC to cut the shipping time of spare parts and gives operational commands the immediate status on materials they've requested. "A recent Air Force Audit Agency report stated SC&D will improve logistics support to the extent that it will be equal to adding 103 aircraft to the Air Force inventory," General Phillips noted.

SC&D is complemented by ETADS, the Enhanced Transportation Automated Data System. It allows logisticians to monitor and control the movement of cargo by land, sea, and air. It helps AFLC oversee its Logistics Airlift System and manage transportation funds. It also facilitates the redirection of cargo.

Depot Streamlining

System modifications and depot maintenance are major AFLC responsibilities. Some forty percent of the command's work force is engaged in weapon system maintenance. The Depot Maintenance Management Information System, one of the larger LMS programs, will make these functions efficient and manageable.

"DMMIS allows AFLC to get the optimum maintenance work force, equipment, and facilities," General Phillips said. It modernizes the planning of maintenance schedules, determines skill requirements for specific work loads, and determines the parts needed for each task. DMMIS will forecast and plan maintenance requirements and handle scheduling on depot shop floors.

But the full benefits of all these extensive computer systems cannot be fully realized unless the systems can "talk" to each other. Local area networks, or LANs, tie together the various LMS systems at the command's air logistics centers and at command headquarters. AFLC has installed trunk lines to 177 buildings at six sites. All broadband trunk cable has been installed—308 miles of it.

"The LANs provide not only base-wide communication capability, but also build the foundation

THE LMS BIG NINE

PROGRAM	PRIMARY FUNCTION	MAJOR CONTRACTORS	COC	FOC	ESTIMATED COST
WSMIS	Requirements Forecasting	Honeywell, Amdahl, Dynamics Research, Analytic Sciences	100%	1987	$44 million
EDCARS	Maintenance	AT&T Technologies	100%	1987	$30 million
RDB	Requirements Forecasting	BDM, Systems and Applied Sciences	32%	1994	$248 million
CDMS	Acquisition	Integrated Microcomputer Systems, Applied Sciences	2%	1994	$74 million
SC&D	Storage and Distribution	Computer Sciences, Century Technologies	13%	1990	$203 million
ETADS	Storage and Distribution	(not yet selected)	10%	1991	undetermined
DMMIS	Maintenance	Tandem, Grumman Data Systems, ENTEK	15%	1993	$242 million
LAN	Communications	Information Systems, Network Corp., TRW	83%	1990	$126 million
ISG	Communications	ARINC Research, C³ Inc., Network Solutions	90%	1989	$15 million

COC/Current Operational Capability
FOC/Full Operational Capability

LMS SYSTEMS' TITLES

WSMIS—Weapon System Management Information System
EDCARS—Engineering Data Computer-Assisted Retrieval System
RDB—Requirements Data Bank
CDMS—Contracting Data Management System
SC&D—Stock Control and Distribution
ETADS—Enhanced Transportation Automated Data System
DMMIS—Depot Maintenance Management Information System
LAN—Local Area Network
ISG—Intersite Gateway

Virginia Williamson, program director for the Weapon System Management Information System, can quickly call up a WSMIS program that assesses the wartime capability of any weapon system, projected across various scenarios. Here she views an unclassified chart similar to one used to assess F-16 capabilities. WSMIS became fully operational in 1987.

for base-to-base communications," General Phillips said.

Intersite gateways complete the final link for LMS modernization. The gateways connect the LANs through access to the Defense Data Network, the AUTODIN digital network, and the Defense Communications Telecommunications Network.

Five Support Systems

Five systems are in place to support the nine basic modernization systems.

- The Central Procurement Accounting System improves AFLC's ability to account for procurement funds. CPAS updates and displays central procurement funds status, budget execution, and foreign military sales information.
- The Automated Technical Orders System (ATOS) computerizes the storage and retrieval of technical orders, some 20,000,000 pages of them, and manages an annual work load of 2,000,000 changes.
- The Air Force Technical Order Management System builds on ATOS and gives AFLC the capability to automate and streamline management and distribution of technical orders.
- The Air Force Equipment Management System will be expanded and modernized to encompass eleven computer systems that control all Air Force equipment other than weapon systems, consumables, and fuels. AFEMS will manage a $20 billion inventory of some 13,000,000 items.
- The Reliability and Maintainability Information System, known as REMIS, collects data on weapon systems component failures and provides guidance for locating and correcting reliability and maintainability problems involving major Air Force systems.

LMS at Work

A return to the Alaskan F-16 scenario illustrates how logistics managers would use specific LMS systems. Once the call goes out for the F-16 wing to be deployed, Tactical Air Command uses the Weapon System Management Information System to determine quickly which wing is the most combat-ready. Since WSMIS can project across various scenarios, it also predicts the failure rate of the radar component in extreme cold and alerts the F-16 system program manager and the part's item manager that this may be a critical item.

They then use the Stock Control and Distribution System to locate surplus parts and to determine the best means of quickly transporting them to Alaska. This will take care of immediate needs, but the wing's capability must be sustained.

The Requirements Data Base will show whether funds can be reallocated to purchase additional spare parts. The Contracting Data Management System tells where the parts are most readily available and which vendors have them.

While the modernization program is improving Air Force readiness, it is paying for itself in the process. According to General Phillips, Air Force auditors project that LMS's nine basic systems will save the Air Force about $1.7 billion over the lives of the systems.

Auditors have not completed review of all LMS projects, but they have validated substantial savings in the two fully operational systems. WSMIS will save the Air Force $350 million and EDCARS will save some $150 million.

The nerve center of the LMS will be housed in a new building now under construction at AFLC headquarters at Wright-Patterson AFB, Ohio. The $14 million, 105,000-square-foot center is scheduled for completion in mid-1990. It will house some 400 AFLC employees along with $40 million worth of state-of-the-art computer equipment. The facility will protect the equipment, which in turn means less repair and lower maintenance costs. Similar centers are to be constructed at the air logistics centers.

In this age of quickly evolving computer systems, some systems are obsolete almost as soon as they're unpacked from their shipping crates. General Phillips is confident that won't be the case with the modernized LMS. "Systems and their needs can grow at amazing rates, but we're avoiding early obsolescence by a process called preplanned product improvement, in which we are actually building systems that will be easily upgraded," General Phillips said. "Our systems have growth capability." ■

Ron Fry is a civilian public affairs specialist at Hq. Air Force Logistics Command, Wright-Patterson AFB, Ohio. He has worked in AFLC public affairs since February 1987 and before that as a reporter and editor for daily newspapers in Illinois.

CSC and AFLC . . .
In partnership to ensure combat readiness.

If they can't fly, they can't fight. The partnership of CSC and AFLC is first and foremost dedicated to "keep 'em flying" by getting the right parts to the right place at the right time. The problem is formidable: control a $20 billion inventory of 1,600,000 items and distribute 4,000,000 parts shipments per year to the 2,700 Air Force installations around the world.

The solution is SC&D, the AFLC's program for the total computerization of Stock Control and Distribution. The impact of SC&D is impressive: the Air Force Audit Agency has validated SC&D benefit projections and stated that the improved support is equivalent to adding 103 aircraft, valued at $3.5 billion, to the Air Force inventory.

CSC is now ready to implement the next step in the program: RFPITS, Radio Frequency Portable Input Terminals. Using these handheld bar code readers with transmitters communicating in real time with IBM 3090 computers at AFLC, base air cargo handlers will know immediately what any part is and where it needs to go. There are many more advances still to come, each one contributing to increased mission capabilities through SC&D.

Computer Sciences Corporation
Systems Group
Defense Systems Division

6680 Poe Avenue, Suite 360
Dayton, Ohio 45414
513.890.7700

The gosport was strictly a one-way device. The student pilot could hear—but he couldn't talk back.

The First Intercom

BY C. V. GLINES

IF YOU'D like to prove how long ago you took Air Force flight training, ask one of today's pilots what a gosport is. Chances are it isn't in his aviation lexicon. Those who took primary flight training during World War II, however, know that the gosport was a primitive one-way communication device your instructor used to get your attention when he thought you were engaging in flight without your mind in gear.

The urgent need for an intercom between an instructor pilot and a student was apparent to Wilbur and Orville when they tried to shout instructions over the roar of the engine mounted directly behind them.

When the first mechanized war in the air began in 1914, the British realized they needed an intercom in their training planes. They were taking sixty percent of their combat losses because of pilot error and only two percent as a result of enemy action. Students couldn't hear what their instructors were shouting in those early open-cockpit, tandem-seat planes. The students didn't understand the significance or the extent of their mistakes in flight because the instructor's critiques were delayed until they were on the ground.

Solving the Problem

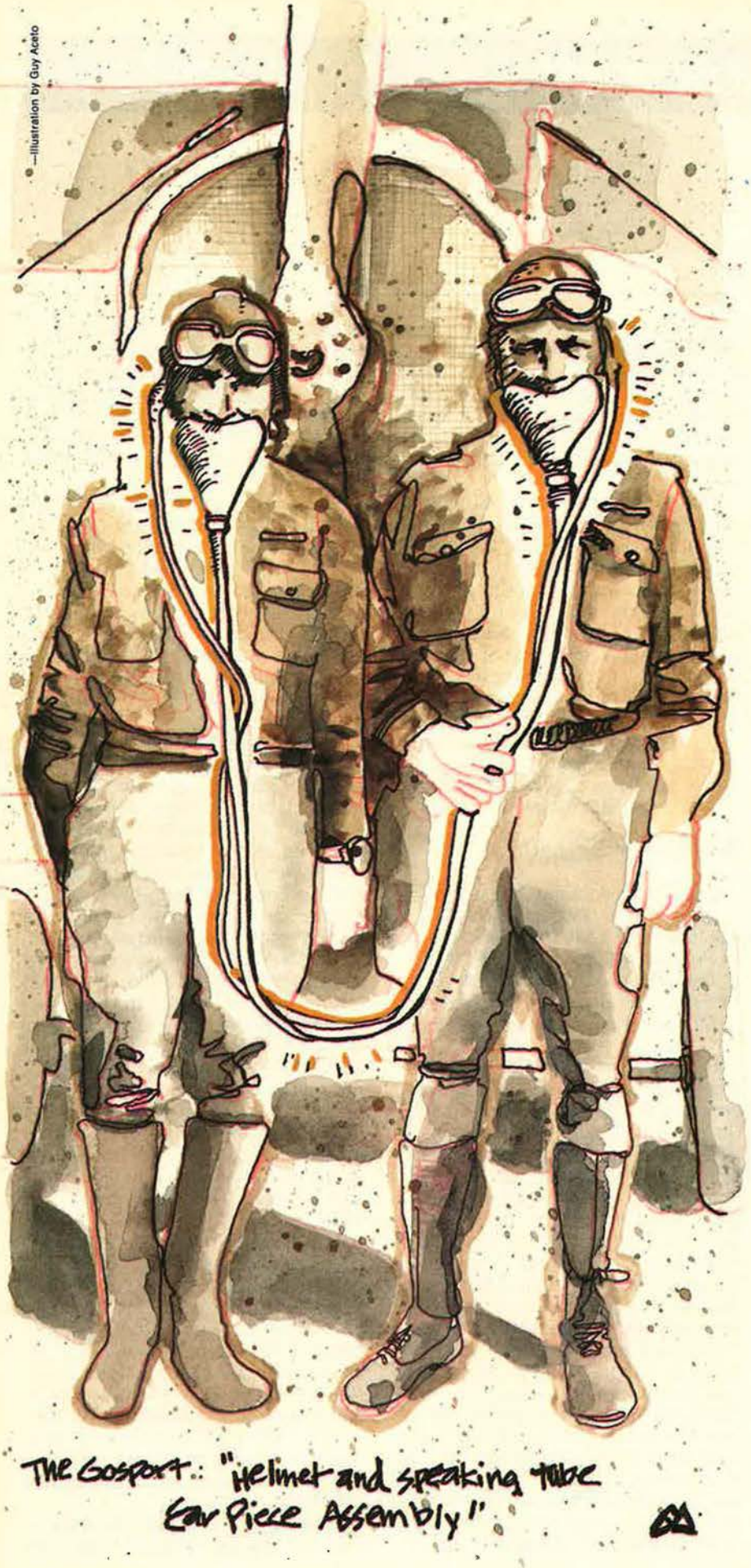
Col. Robert Smith-Barry, commander of a "School of Special Flying" at Gosport, England, solved the problem. Believing communication in flight to be critical, he took a rubber hose and ran it between the seats for instructor and student. He attached funnels to the hose. These funnels were held in place over each pilot's mouth. The hose branched out in front of each pilot, and the two ends were attached to each man's helmet over the ears.

The device became known as the Gosport System. Students and instructors, pilots and crew members could converse after a fashion despite the engine's roar. Students developed confidence and skill faster. The British were able to cut the number of training flight hours from 100 to forty through this and other training improvements; accidents declined significantly.

The Aviation Section of the US Signal Corps, impressed with the device and the British flight training system, sent Capt. Henry H. "Hap" Arnold to San Antonio in August 1917 to choose a site for a "Gosport-type" pilot training school. This field became Brooks Air Force Base.

Various types of two-way and one-way "voice tubes" were tested at Dayton's McCook Field. However, the Air Service was not impressed with some of the tubes sub-

C. V. Glines is a regular contributor to this magazine. A retired Air Force colonel, he is a free-lance writer, a magazine editor, and the author of numerous books. His by-line appeared here most recently with "Closing in on the Airfields" in the January '89 issue.



mitted. One type, manufactured in this country by A. G. Spaulding & Bros., was "not considered suitable for use as an intercommunicating device on either service or training types of airplanes," according to a confidential report. "The voices did not have sufficient volume, sounded metallic, and were very hard to understand."

The report added: "Considerable noise is picked up through the mouthpiece . . . the amount varying with the position of the mouthpiece, as, for example, when the mouthpiece is hanging down in the cockpit and when it is being held up in the slipstream. This change of intensity of the engine noise would be apt to prove very confusing to a pupil receiving instruction in flying."

Don't Talk Back!

The report notwithstanding, the need for interpilot communication overruled the disadvantages, and the devices were procured for open-cockpit training planes. However, military flight instructors decided they didn't want students to talk back or ask questions while airborne.

The gosport became a standard one-way system with a small hand-held funnel on the instructor's end attached to a rubber hose. The student had a special cloth or leather helmet, which was connected to the hose by small curved metal fittings attached over both ears. The supply manuals labeled the system "Helmet and Speaking Tube Ear Piece Assembly."

The instructor could instruct, but the student could not reply. When an instructor became disturbed about a student's performance, he would wave the funnel in the breeze to emphasize a point. At the other end, the student heard a roar in his ears that seemed like an engine wide open at ten paces. This attention-getting method always worked. Ask anyone who took primary flight training in the PT-17s and -19s.

When you graduated to the basic and advanced trainers, you appreciated that the electronics of the day had progressed considerably. You had an intercom system and could talk back, if you dared. The gosports disappeared when the primary trainers were junked at the end of the war. ■

Airman's Bookshelf

American Expeditions

Americans at War: 1975–1986, An Era of Violent Peace, by Daniel Bolger. Presidio Press, Novato, Calif., 1988. 466 pages with illustrations and index. $24.95.

The recent engagement between US and Libyan forces that resulted in the downing of two MiG-23 Floggers by Navy F-14 Tomcats typifies the subject of this book—the use of American military forces as a tool of national policy, particularly in an expeditionary manner, since the end of the Vietnam War. The eleven-year period (1975–86) after the fall of Saigon to Communist forces witnessed seven major US military operations. These include the *Mayaguez* incident, the Iran hostage rescue mission, the Gulf of Sidra air battle, Lebanon, Grenada, the *Achille Lauro* hijacker intercept, and the 1986 raid on Libya.

The author, an active-duty US Army officer and professor of history at West Point, was dissatisfied with the coverage of these significant US military activities in the popular media. Deciding to examine the facts for himself, Daniel Bolger found, and used in his writing, an ample written record of primary sources and US military publications readily available to the general researcher.

Bolger opens with a riveting description of the last twenty-four hours of US military presence in Vietnam, setting the stage for what lay ahead. Only two weeks later, US forces were back in action in response to the seizing of the *Mayaguez* by Cambodian Khmer Rouge gunboats. The author provides detailed coverage of the sequence of events leading up to release of the ship, a complete order of battle for all US forces involved, and a thorough look at the interaction between US military and political elements from the national command authorities down to the helicopters carrying Marines into the action. The chapter closes with an analysis of the military action and the lessons learned from it.

Subsequent chapters each cover one of the major actions listed above, in the same detail. The author also gives complete references and a select bibliography for any reader wanting to do more in-depth study of contemporary American military activities.

Americans at War closes with a comparison of all seven expeditions. The author concludes that the overall record of success (five successes, two failures) was due not to arms or organization, but to people. Like Daniel Bolger, we must all learn that lesson and make the most of our past experiences in order to increase the likelihood of future successes.

—Reviewed by Maj. Don Rightmyer, USAF. Major Rightmyer is editor of Tactical Air Command's safety publication TAC Attack.

Red Stars in Space

The Soviet Manned Space Program: An Illustrated History of the Men, the Missions, and the Spacecraft, by Phillip Clark, Orion Books, New York, N. Y., 1988. 192 pages with appendices and illustrations. $24.95.

The most striking difference between the US and Soviet space programs is man's role as flyer in each. Unlike astronauts, cosmonauts have never gone to the moon. But they have been launched into orbit so many times, for so many purposes, over so many years that space has come to seem like a perfectly natural place for Russians to hang out. They have shown that they are right at home and can live a long time in space stations. Now they also have a shuttle to ride.

Mr. Clark takes us back to the beginning, to April 12, 1961, when Yuri Gagarin, in Vostok 1, became the first human to enter space, and shows us how the Soviet Union built its great advantage in manned spaceflight by sustaining a steady schedule of launches for a wide variety of manned missions through the years. This richly detailed book was written well in advance of the first Soviet shuttle flight last November 12. Even so, its final chapter, "The Future of Soviet Manned Spaceflight," foretells that flight of the *Buran* orbiter and describes the makeup of the *Buran*-Energiya system in impressive fashion.

The author was off the mark in anticipating that the Soviet shuttle, unlike the American shuttle, would be able to make more than one pass in attempting to land. This was a common preflight assumption in Western aerospace circles, however, and should be dismissed as a trivial error in a thoroughly researched, nicely written, and beautifully illustrated piece of work.

For serious researchers, the book's appendices alone are worth the price. They log all Soviet launches and name all crews from day one well into August 1988, provide thumbnail sketches of the principal figures in the Soviet manned space program, and describe the design and performance attributes of the program's launch vehicles in painstaking detail.

Mr. Clark rummages in the remains of the Soviet lunar-landing program, reminding the reader that cosmonauts had every intention of going to the moon until US astronauts beat them there. He tells how the Soviets, no longer moonstruck, began concentrating instead on accomplishing the less-glamorous, earth-orbiting missions that made their manned space program much more muscular than its American counterpart over time.

The manned programs of the two spacefaring superpowers came to a crossroads in the mid-1970s. "By this time," Mr. Clark writes, "the American manned programme had virtually completed operations with Apollo spacecraft. The final mission to Skylab had finished in February 1974, and apart from the Apollo-Soyuz mission in 1975 there would be no more manned American flights until the first flight of the *Columbia* Space Shuttle in April 1981.

"Therefore, although the days of trying to compete with the Americans

in space had been over politically for some years, Soviet space planners knew that the arena of manned spaceflight would be theirs alone for the rest of the decade."

The author shows how the Soviets made the most of this situation. He recounts their every pioneering achievement in manned spaceflight, such as the first woman in space and the first spacewalk, and traces the evolution of Soviet space stations from Salyut 1 through Salyut 7 to today's modular Mir.

Mr. Clark is one of Britain's foremost space experts and analysts. His orientation seems to be chiefly technical, yet he shows a nice touch in treating the political side of the Soviet manned space program as well.

As he writes: "In its early years, the Soviet program was shrouded in secrecy. . . . As a result, it was the subject of much speculation in the West. Some observers viewed it as an enterprise geared simply toward beating the Americans at all costs, while others saw it as a slow, stumbling program based upon a greatly inferior technology."

It comes through loud and clear in this book that the Soviet Union has done very well indeed with space technologies that have turned out to be as practical as they needed to be, if not ideal. The author also leaves us with the notion that the Soviet Union, given its long experience with man in space and its advantage in heavy boosters, may now be in great shape to send crews to the moon and beyond to Mars, and to leave the US far behind.

—Reviewed by James W. Canan. Mr. Canan is a Senior Editor of AIR FORCE *Magazine.*

Fit for the Hangman's Noose

Traitors, by Chapman Pincher. Penguin Books, New York, N. Y., 1987. 346 pages with photos. $7.95.

Fascination with the world of treason and traitors seems both powerful and insatiable, despite the abhorrence with which all but a few view this arguably most despicable breed of criminal. Television returns repeatedly to update and assess the doings of the Walker and Pollard spy rings, the *Spycatcher* controversy continues to rage in Great Britain, and such films as "The Falcon and the Snowman" achieve sustained popularity. Chapman Pincher contributes greatly to the analysis of this murky world with his book *Traitors.*

He wisely constrains his analysis within the confines of a definite period. He avoids the pitfall of trying to detail every act of betrayal from Delilah to Boyce (the aforementioned "Falcon"). Rather, he limits himself mainly to the post-World War II period, particularly the 1980s, which, in Pincher's words, "bid fair to become known as the Decade of Deceivers."

He further limits the scope of his book by concentrating primarily on the motivation of these men and women to commit treason. Pincher dismisses as overly simplistic the classic four reasons for disloyalty: MICE (Money, Ideology, Compromise, or Ego). He offers instead a baker's dozen of motivating factors, each contained in its own chapter, that either alone or, more frequently, in combination can inspire treason. These are not merely subdivisions of the MICE factors. Pincher also takes into account such normally downplayed factors of motivation as character, background, and access.

Pincher concludes with a commonsense plea for greater vigilance in the screening process in order to limit access to materials that could have a devastating effect were they to fall into Soviet hands. He remains pessimistic about the possibility of implementing effective laws to curtail treasonous activity in the future. He sees too many factors, a lack of will on the part of the world's democracies not least among them, working against their implementation.

Even with a subject that is by nature ambiguous, Pincher has no trouble giving concrete and convincing definitions of such abstractions as "loyalty" and "treachery." He does tend to miss some irony, however. For example, despite millions of dollars spent in the West on counterintelligence to stop such men as John Walker, Walker might still be in business if his wife had not confessed all on the air with a television evangelist.

Pincher's clear and concise prose helps the reader navigate in the morass that is modern espionage. One device, borrowed from biological science, is extremely helpful. For each form of motivation he delineates, Pincher introduces a "type specimen," which fixes that motivation in the reader's mind. For example, the type specimen of the "power-lust" motivation is Vidkun Quisling, the Norwegian turncoat. An appendix of brief biographies of the traitors proves invaluable in keeping them straight in the reader's mind.

Some readers may find Pincher's doggedly unreconstructed Cold Warrior world view "a bit over the top," while others will find his staunch anticommunism refreshingly direct; but all should admire how his world view helps his craft remain upright in a sea of ambiguity that is intrinsic to a milieu of "honey-traps" and "romeos," cut-outs, quislings, and deep cover. It is at once a fascinating and repulsive milieu, made more comprehensible by this work.

—Reviewed by Daniel M. Sheehan. Mr. Sheehan is an Editorial Assistant of AIR FORCE *Magazine.*

New Books in Brief

Aerospace Facts and Figures '88–89: Key Technologies: Legacy for the 21st Century, compiled by the Economic Data Service of the Aerospace Industries Association. This thirty-sixth annual statistical abstract of the aerospace industry is once again filled with tables and charts detailing every aspect of the aerospace industry. The book's ten sections cover areas ranging from aircraft production to aerospace funding and finance for both the civil and military sectors in the US. While principally a review of 1987, most of the charts show yearly figures for several years, so trends can be charted. Specifications and a list of manufacturers are included for both civil and military aircraft, helicopters, missiles, and space boosters. Published by *Aviation Week* Magazine for AIA. McGraw-Hill, New York, N. Y., 1988. 180 pages with glossary and index. $16.95.

Reforging the Iron Cross: The Search for Tradition in the West German Armed Forces, by Donald Abenheim. The German military was disbanded after World War II, but political realities of the Cold War provoked a reconsideration, and the German military was reborn in 1954. That presented a quandary to German military leaders—how to discover for the new army an acceptable body of tradition in the proud history of the German soldier without reviving the militarism of the Nazis. This scholarly effort shows how the Bundeswehr, despite many hurdles, was able to accomplish this delicate balancing act. An assistant professor of national security affairs at the Naval Postgraduate School in Monterey, Calif., author Abenheim is well qualified to tackle this project. Princeton University Press, Princeton, N. J., 1989. 316 pages with abbreviations, illustrations, and index. $29.95.

—Reviewed by Jeffrey P. Rhodes, Aeronautics Editor.

The Doolittle Salute honors Medal of Honor recipient Gen. Leon Johnson.

Devotion to Duty

AEF Chairman George Hardy (left) presents a specially commissioned bronze sculpture of Jimmy Doolittle to the 1988 Doolittle Salute honoree, Gen. Leon W. Johnson, USAF (Ret.)

BY ARTHUR C. G. HYLAND

GEN. Leon W. Johnson, USAF (Ret.), a highly decorated command pilot who spent nearly four decades in active service, received the Medal of Honor for his valor during the August 1, 1943, raid on the Ploesti oil refineries in Romania. He later served as the Commander of Fifteenth Air Force, Commander of Continental Air Command (CONAC), and as the Air Deputy to the Supreme Allied Commander, Europe, at SHAPE Headquarters. While commander of CONAC, he chaired a board that laid the groundwork for today's modernized Air Reserve Forces.

Forty-five years after the Ploesti raid, General Johnson was honored at the Aerospace Education Foundation's annual Jimmy Doolittle Salute. The event was held last December at the Smithsonian's National Air and Space Museum in Washington, D. C.

AEF Chairman of the Board George D. Hardy read a special letter from Jimmy Doolittle that read in part, "It's been a privilege to know Leon Johnson since the very early days of military aviation. No man has served his nation with greater devotion to duty. His contributions to USAF and most importantly to his men and women are unsurpassed."

In a specially prepared videotape highlighting General Johnson's career, a member of the 44th Bomb Group that conducted the raid on Ploesti explained how thirty-five out of thirty-six of Johnson's aircraft reached the target area. General Johnson was also recognized for his contributions that helped to form the US Air Force.

As a token of its admiration, the Foundation presented General Johnson with a specially commissioned bronze sculpture of Jimmy Doolittle poised on his Gee Bee racer after winning the 1932 Thompson Trophy.

In his remarks, General Johnson said that "people are [what makes] the Air Force what it is, not the planes." He added, "Looking at these airplanes around us, I wonder how we ever made it!"

In addition, Air Force Secretary Edward C. Aldridge, Jr., received an engraved plate from AFA in recognition of his "inspired leadership." AFA President Jack Price, Board Chairman Sam E. Keith, Jr., AEF President James Keck, and AEF Chairman Hardy made the presentation to the departing Air Force Secretary.

The Doolittle Salute annually honors a distinguished aerospace leader and recognizes the Foundation's Corporate Fellows *(see accompanying box)*. Their contributions help to support the Foundation's ongoing educational outreach programs.

Two Corporate Fellowships were presented at the Salute. Grumman Corp., represented by its Vice Chairman of the Board for Corporate Technology, Dr. Renso Caporali, and Rockwell International, represented by its Vice President of Electronics, Government Affairs and Marketing, Joseph H. Garrett, Jr., were invested as Corporate Jimmy Doolittle Fellows. ■

Corporate Jimmy Doolittle Fellows

American Telephone & Telegraph Co.
Anheuser-Busch, Inc.
Bob Hope, Inc.
Boeing Co.
Fairchild Industries
Ford Aerospace & Communications Corp.
Garrett Corp.
General Dynamics Corp.
General Electric Foundation
Grumman Corp.
The Harry Frank Guggenheim Foundation
Gulfstream Aerospace Corp.
Hughes Aircraft Co.
Hughes Helicopters, Inc.
Lockheed Corp.
Loral Corp.
LTV Aerospace & Defense Company
Martin Marietta Aerospace
McDonnell Douglas Corp.
MITRE Corp.
Mutual of Omaha Insurance Co.
Northrop Corp.
John M. Olin Foundation
Reader's Digest Foundation
Rockwell International
The Singer Co.
Textron Inc.
United Technologies Corp.

Corporate Ira C. Eaker Fellows

Florence Borchert Bartling Foundation
Bendix Aerospace Corp.
Fairchild Industries
General Dynamics Corp.
Hughes Aircraft Co.
Lockheed Corp.
LTV Aerospace & Defense Co.
McDonnell Douglas Foundation
Northrop Corp.
Pratt & Whitney Aircraft Group
Rockwell International

USAF's Most Decorated PJ

In three tours as a pararescue man (PJ), Duane Hackney became one of the legendary heroes of the Vietnam War.

BY JOHN L. FRISBEE

IN June 1965, Duane Hackney graduated from high school at Flint, Mich., president of the student council and the recipient of an athletic scholarship offer. Clearly, great things lay ahead, but no one could have foreseen that he would become one of the most honored heroes of the Vietnam War, the recipient of twenty-eight decorations for valor in combat (more than seventy awards and decorations in all), and winner of the Cheney Award for 1967. (The Cheney award is given annually to a member of USAF for "an act of valor, extreme fortitude, or self-sacrifice in a humanitarian interest performed in conjunction with aircraft.")

It all began when eighteen-year-old Duane Hackney enlisted in the Air Force a few days after graduation, volunteering for pararescue training. An honor graduate in every phase of the tough, year-long course, he had his choice of assignments. The action was in Vietnam. Airman Second Class Hackney turned down assignments in Bermuda and England for Detachment 7, 38th Aerospace Rescue and Recovery Squadron, at Da Nang.

Three days after reporting for duty, Hackney flew his first combat mission. Somewhere on that mission, a .30-caliber slug buried itself in his leg. As the sportswriters say, Duane Hackney came to play, not to sit on the sidelines. To avoid being grounded by the medics, he had one of his PJ friends remove the slug with a probe. That incident set the tone for the more than 200 combat missions he was to fly in three and a half years of Vietnam duty, all as a volunteer.

Five times in the months ahead his helicopter was shot down. He doesn't recall how often he went down into the jungle looking for survivors or how many lives his medical training helped him save. As he became a legend in the rescue world, he earned four DFCs, not for flying a certain number of missions but for specific acts of heroism, and eighteen Air Medals, many for single acts of valor. Then came the Air Force Cross, the Silver Star, the Airman's Medal, the Purple Heart, and several foreign decorations.

Duane Hackney's most celebrated mission was on February 6, 1967. That morning he descended from a HH-3E Jolly Green Giant to look for a downed pilot near Mu Gia pass. The pilot had stopped his radio transmissions, a clue that enemy troops were on his tail. For two hours, Hackney searched for the man, dodging enemy patrols, until the mission was called off because of weather.

Late that afternoon, the downed pilot came back on the air, and Hackney's crew headed for the rescue area. They had to get him out before dark, or the odds on success would drop dramatically. This time Hackney found his man, badly injured but alive, got him onto the forest penetrator, and started up to the chopper, drawing small-arms fire all the way. As the men were hauled aboard, the helicopter took a direct hit from a .37-mm antiaircraft gun and burst into flame. Wounded by shell fragments and suffering third-degree burns, Hackney, knowing that the HH-3 was not going to make it, put his own parachute on the rescued pilot and got him out of the doomed chopper. Maybe he could find another for himself. If not. . . .

On February 6, 1967, Duane Hackney took part in a Vietnam rescue mission that earned him the Air Force Cross.

Groping through dense smoke, he found an oil-soaked chute and slipped it on. Before he could buckle the chute, a second .37-mm shell hit the HH-3, blowing him out the door. He doesn't remember pulling the ripcord of the unbuckled chute before hitting trees 250 feet below, then plunging eighty feet to a rock ledge in a crevasse.

When he regained consciousness, enemy troops were leaping across the crevasse a few feet above him. Once they were gone, Hackney popped his smoke and was picked up by the backup chopper, only to learn that his heroic attempt to save the downed pilot had not succeeded. There were no survivors from the rescue helicopter. Training and experience, helped along by a miracle, saved Hackney himself.

For that mission, Duane Hackney received the Air Force Cross, the second awarded to an enlisted man. The first had gone posthumously to A1C William Pitsenbarger, also a pararescue man. *(See "Valor," October '83 issue.)*

In 1973, Duane Hackney left the Air Force, the most decorated pararescue man of the Vietnam War. Four years later, missing the camaraderie of Air Force life, he enlisted again, returning to duty as a pararescue instructor. In 1981, he suffered a severe heart attack, the result of a rescue operation, and was permanently grounded—but not out.

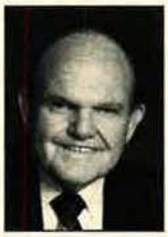
Today, SMSgt. Duane Hackney is first sergeant of the 410th Security Police Squadron at K. I. Sawyer AFB, Mich., still guided by the philosophy that dominated his combat career: a dynamic sense of personal responsibility and compassion for his fellow men. ■

This Is AFA

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

OBJECTIVES: The Association provides an organization through which we as a free people may unite to address the defense responsibilities of our nation imposed by the dramatic advance of aerospace technology; to educate the members and the public at large in what that technology can contribute to the security of free people and the betterment of mankind; and to advocate military preparedness of the United States and its allies adequate to maintain the security of the United States and the free world.

PRESIDENT
Jack C. Price
Clearfield, Utah



BOARD CHAIRMAN
Sam E. Keith, Jr.
Fort Worth, Tex.

SECRETARY
Thomas J. McKee
Arlington, Va.

TREASURER
William N. Webb
Midwest City, Okla.

NATIONAL VICE PRESIDENTS

Information regarding AFA activity within a particular state may be obtained from the Vice President of the Region in which the state is located.

Donald D. Adams
RR-73
39 Chris Lake
Omaha, Neb. 68123
(402) 477-0006
Midwest Region
Nebraska, Iowa, Missouri, Kansas

Gerald S. Chapman
13822 Via Alto Court
Saratoga, Calif. 95070
(408) 379-6558
Far West Region
California, Nevada, Arizona, Hawaii, Guam

Oliver R. Crawford
P. O. Box 202470
Austin, Tex. 78720-2470
(512) 331-5367
Southwest Region
Oklahoma, Texas, New Mexico

Charles G. Durazo
P. O. Box 7367
McLean, Va. 22106-7367
(703) 892-0331
Central East Region
Maryland, Delaware, District of Columbia, Virginia, West Virginia, Kentucky

John E. Kittelson
141 N. Main Ave., Suite 308
Sioux Falls, S. D. 57102
(605) 336-2498
North Central Region
Minnesota, North Dakota, South Dakota

Edward J. Monaghan
2401 Telequana Dr.
Anchorage, Alaska 99517
(907) 243-6132
Northwest Region
Montana, Washington, Idaho, Oregon, Alaska

Jack G. Powell
1750 S. Ironton
Aurora, Colo. 80012
(303) 755-2484
Rocky Mountain Region
Colorado, Wyoming, Utah

James E. "Red" Smith
P. O. Box 775
Princeton, N. C. 27569-0775
(919) 936-9361
Southeast Region
North Carolina, South Carolina, Georgia, Florida, Puerto Rico

Everett E. Stevenson
4752 Cole Rd.
Memphis, Tenn. 38117-4104
(901) 767-1315
South Central Region
Tennessee, Arkansas, Louisiana, Mississippi, Alabama

Kenneth C. Thayer
Box 134A
Ava, N. Y. 13303
(315) 827-4241
Northeast Region
New York, New Jersey, Pennsylvania

Walter G. Vartan
230 W. Superior St.
Chicago, Ill. 60610-3508
(312) 644-8216
Great Lakes Region
Michigan, Wisconsin, Illinois, Ohio, Indiana

Joseph A. Zaranka
9 S. Barn Hill Rd.
Bloomfield, Conn. 06002
(203) 242-2092
New England Region
Maine, New Hampshire, Massachusetts, Vermont, Connecticut, Rhode Island

NATIONAL DIRECTORS

John R. Alison
Arlington, Va.
Joseph E. Assaf
Hollywood, Calif.
Richard H. Becker
Oak Brook, Ill.
David L. Blankenship
Tulsa, Okla.
John G. Brosky
Pittsburgh, Pa.
Richard S. Cain
Hopkins, S. C.
Daniel F. Callahan
Nashville, Tenn.
Robert L. Carr
Pittsburgh, Pa.
George H. Chabbott
Dover, Del.
Charles H. Church, Jr.
Lenexa, Kan.
Earl D. Clark, Jr.
Shawnee Mission, Kan.
M. Lee Cordell
Westchester, Ill.
R. L. Devoucoux
Portsmouth, N. H.
James H. Doolittle
Carmel, Calif.
Russell E. Dougherty
Arlington, Va.
George M. Douglas
Colorado Springs, Colo.
Toby J. duCellier
Dunkirk, Md.
Joseph R. Falcone
Rockville, Conn.
E. F. "Sandy" Faust
San Antonio, Tex.
Jack B. Fisig
Lemont, Pa.
Joe Foss
Scottsdale, Ariz.
Charles A. Gabriel
McLean, Va.
Cheryl L. Gary
Redlands, Calif.
William J. Gibson
Ogden, Utah
Barry M. Goldwater
Scottsdale, Ariz.
David Graham
Laguna Niguel, Calif.
John O. Gray
Washington, D. C.
Jack B. Gross
Hershey, Pa.
Thomas J. Hanlon
Clarence, N. Y.
George D. Hardy
College Heights Estates, Md.
Alexander E. Harris
Little Rock, Ark.
Martin H. Harris
Winter Park, Fla.
Gerald V. Hasler
Albany, N. Y.
H. B. Henderson
Poway, Calif.
Thomas W. Henderson
Tucson, Ariz.
John P. Henebry
Chicago, Ill.
Robert S. Johnson
Lake Wylie, S. C.
David C. Jones
Arlington, Va.
Arthur F. Kelly
Los Angeles, Calif.
Victor R. Kregel
Colorado Springs, Colo.
Curtis E. LeMay
Newport Beach, Calif.
Carl J. Long
Pittsburgh, Pa.
Frank M. Lugo
Mobile, Ala.
Nathan H. Mazer
Roy, Utah
William V. McBride
San Antonio, Tex.
James M. McCoy
Omaha, Neb.
J. B. Montgomery
Newport Beach, Calif.
Bryan L. Murphy, Jr.
Fort Worth, Tex.
Edward T. Nedder
Hyde Park, Mass.
J. Gilbert Nettleton, Jr.
San Diego, Calif.
Ellis T. Nottingham
Atlanta, Ga.
Sam E. Parish
Mount Airy, Md.
J. Michael Phillips
Grand Forks, N. D.
William C. Rapp
Williamsville, N. Y.
Mary K. Readly
State College, Pa.
Julian B. Rosenthal
Atlanta, Ga.
William L. Ryon, Jr.
Cabin John, Md.
Peter J. Schenk
Pinehurst, N. C.
Walter E. Scott
Dixon, Calif.
Joe L. Shosid
Fort Worth, Tex.
C. R. Smith
Los Angeles, Calif.
William W. Spruance
Marathon, Fla.
Thos. F. Stack
Hillsborough, Calif.
Michael E. Stansell
Heath, Ohio
Edward A. Stearn
Redlands, Calif.
Bruce R. Stoddard
Tucson, Ariz.
James H. Straubel
Fairfax Station, Va.
Harold C. Stuart
Tulsa, Okla.
James M. Trail
Oro Valley, Ariz.
A. A. West
Hayes, Va.
Herbert M. West, Jr.
Tallahassee, Fla.
Sherman W. Wilkins
Bellevue, Wash.
Charles L. Donnelly, Jr.
(ex officio)
Executive Director
Air Force Association
Arlington, Va.
Rev. Richard Carr
(ex officio)
National Chaplain
Springfield, Va.
Capt. Paul A. Willard II
(ex officio)
Chairman, Junior Officer Advisory Council
Hanscom AFB, Mass.
CMSgt. Deborah S. Canjar
(ex officio)
Chairman
Enlisted Council
Lackland AFB, Tex.
Scott E. Boyd
(ex officio)
National Commander
Arnold Air Society
University Park, Pa.

Intercom

By J. R. "Doc" McCauslin, CHIEF, FIELD ORGANIZATION DIVISION

Tacoma Chapter's Pro-Am Golf

The Tacoma (Wash.) Chapter recently sponsored the eighth AFA Howard Scott Pro-Am Golf Tournament at McChord AFB. More than 200 people competed for $14,000 in purse and prizes. A new Chevrolet Beretta was nearly won by SSgt. Art Romero when his ball stopped six inches short of the hole. The Tournament Director, Denton D. "Denny" Diestler, was a 1988 AFA Medal of Merit winner.

The annual outing drew young and old (even ninety-six-year-old Terri Hagan), pro and amateur, and resulted in funds for two $750 scholarships to AFROTC cadets at the University of Puget Sound.

Additionally, a $300 scholarship was awarded to a Washington High School AFJROTC cadet, $300 to the Washington Civil Air Patrol for purchase of flying hours, $2,000 to McChord AFB Youth Activities programs, $800 for the base recognition program, $300 to the McChord Air Museum, and $300 to support the 62d Military Airlift Wing in Airlift Rodeo and the 318th Fighter Interceptor Squadron for the William Tell competition.

A special grant of $350 was also given to the 62d MAW in order to lower the ticket cost for lower-grade airmen to attend a Wing Dining Out featuring USAF Strolling Strings.

Secretary of State George P. Shultz (right), winner of AFA's highest award to a civilian, the W. Stuart Symington Award, presented to him at last fall's AFA National Convention, poses with AFA Board Chairman Sam E. Keith, Jr., and Mrs. Keith.

Christmas at Mount Clemens

The Mount Clemens (Mich.) Chapter entertained more than fifty underprivileged children from Macomb County at Christmas. The Chapter arranged for Santa Claus to arrive on a Selfridge ANGB fire truck with fruit, candy, cookies, and gifts. The children also received a tour of an Air National Guard C-130 aircraft. Chapter President TSgt. Thomas C. Craft explained that the Mount Clemens AFA Chapter has sponsored this annual Christmas party for the children for fifteen consecutive years "because it makes you realize that there are needy families out there, and this can help them get into the Christmas spirit."

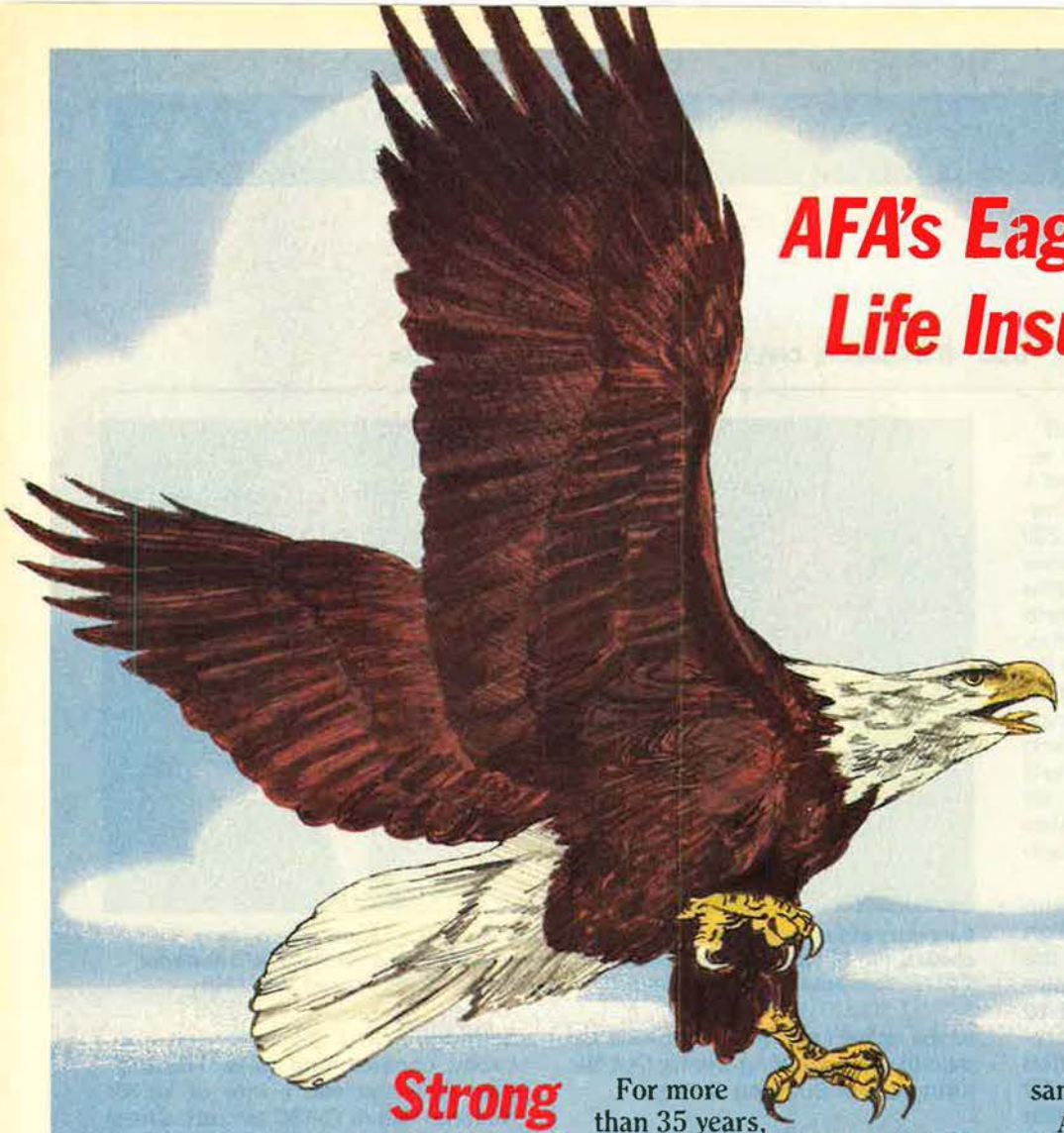
At a recent meeting of the West Palm Beach, Fla., Chapter, aerospace industry and active-duty requirements people were honored guests. Here, from left, are Don Carson, Chapter President; Brig. Gen. Joseph W. Ralston, TAC's DCS/Requirements; John P. Balaguer, Executive Vice President of Pratt & Whitney's Government Engine Business; and Don Anderson, AFA Virginia State President, who was visiting Florida.

Tribute to Zack Mosley

The Indian River (Fla.) Chapter recently extended membership and a special tribute to honor cartoonist Zack T. Mosley. His syndicated comic strip "Smilin' Jack" first appeared in 1933, and its central character matured from a shy, young Jack to a seasoned pilot constantly involved in adventure.

Mosley is an accomplished pilot who devotes his time and artistic talents to promotion of the Civil Air Patrol. At the age of eighty-one, he was unable to travel to Vero Beach, Fla., for the honors, so Florida AFA State President Roy Whitton and Chapter President Bob Stiastny arranged to videotape a coordinated meeting/presentation in Mosley's studio in Stuart, Fla., for members around the state.

AFA's Eagle Series Life Insurance



Strong and Dependable Protection for Your Family

For more than 35 years, AFA has helped members build a solid foundation for the hopes and dreams they hold for their loved ones.

AFA Eagle Series Group Life Insurance offers you an opportunity to build an immediate estate of up to $400,000, affordable for even a fledgling family. It's available to flyers and non-flyers alike for as little as 54 cents a year per thousand dollars of insurance.

And families covered under the Eagle plan who need added protection are eligible to apply for Eagle II coverage—a supplementary program providing up to $200,000 in level term insurance.

Ask for Your Personal Eagle!

If you are covered under AFA Eagle Series Life Insurance, we'll be happy to send you this handsome eagle lapel pin commissioned and cast exclusively for insured members. Just check the appropriate box on the coupon.

Air Force Association, Insurance Division, Box 3A, 1501 Lee Highway, Arlington, VA 22209-1198

- ☐ Please send me complete information about AFA's Eagle Series Life Insurance.
- ☐ I'm already covered under the Eagle Program. Please send me:
  - ☐ Information about AFA's Eagle II Supplement Plan
  - ☐ An AFA Eagle Lapel Pin

Name _____

Address _____

City _____

State _____ Zip _____

For Complete Information, Mail the Coupon Today!

AFA Wisconsin and the state Aviation Hall of Fame recently honored former NASA astronaut Donald K. "Deke" Slayton. From left are AFA State President Gilbert Kwiatkowski, aviation pioneer Leonard Larson (also honored), former Apollo astronaut Thomas P. Stafford, Mr. Slayton, and Hall of Fame Vice President Chuck Marotske.

Kentucky's State Convention

The Lexington (Ky.) Chapter hosted the State Convention in Shakertown, Ky., at a restored Shaker village and historical landmark near Lexington. Convention activities included a briefing on the history and culture of the Shakers, a tour of the village, a dinner in the Shaker Inn, and a boat ride on the Kentucky River in a paddlewheel riverboat.

The following month's chapter meeting was held at Spindletop Hall, a classic southern mansion whose owner donated the building and land to the University of Kentucky. The guest speaker for the meeting was Col. Ronald C. Hoover, USAF, a Professor of Aerospace Studies at the University of Kentucky.

An F-4 pilot in Southeast Asia during the Vietnam War, Colonel Hoover presented a slideshow/talk giving insight into a pilot's attitude, feelings, and experiences during a combat tour.

New Heritage Park Dedicated

The San Bernardino Area (Calif.) Chapter cosponsored the dedication of a new missile heritage park in honor of Brig. Gen. David B. Englund. Prior to his untimely death in 1985, General Englund was Vice Commander of the Air Force Systems Command's Ballistic Missile Office (BMO) at Norton AFB and Program Director for the Small Intercontinental Ballistic Missile.

AFA representatives at the park dedication included AFA President Jack C. Price. Maj. Gen. Edward P. Barry, USAF, the current BMO Commander, addressed the 700 attendees. The widow of General Englund was accompanied by California AFA State President John Lynch and local chapter officials.

Open House on Guam

The Guam Arc Light Chapter celebrated the anniversary of Guam's liberation from Japanese control with tours of the Heritage Room at Andersen AFB and numerous displays for local civilians, who are normally restricted from the base. The Chapter also welcomed the return of USAF Brig. Gen. Ben Gann, 43d Bomb Wing Commander. Arc Light Chapter President Tom Foster recalled General Gann's strong support of AFA when the General was Deputy Air Division Commander on Guam.

AFA activities on the island have included hosting the annual "Commanders Run," through which about $1,500 in pledges are garnered from the civilian community. The Chapter rounded out activities by building and staffing a pavilion in the Chamorro Village where memorabilia of aviation history on Guam were displayed.

Don Steele Award Winners

Congratulations to these AFA chapters that have received the prestigious Donald W. Steele, Sr., Memorial Award as AFA Unit of the Year:

1976—Scott Memorial Chapter, Illinois.

1977—Thomas B. McGuire, Jr., New Jersey.

1978—Thomas B. McGuire, Jr., New Jersey.

1979—General Robert F. Travis Chapter, California.

1980—Central Oklahoma (Gerrity) Chapter, Oklahoma.

1981—Alamo Chapter, Texas.

1982—Chicago-O'Hare Chapter, Illinois.

1983—Charles A. Lindbergh Chapter, Connecticut.

1984—Colorado Springs-Lance Sijan Chapter, Colorado.

1984—Scott Memorial Chapter, Illinois.

1985—Cape Canaveral Chapter, Florida.

1986—Charles A. Lindbergh Chapter, Connecticut.

1987—Carl Vinson Memorial Chapter, Georgia.

1988—General David C. Jones Chapter, North Dakota.

During a chapter meeting, Col. Charles G. Tucker, USAF, Tokyo AFA Chapter President (far right), presents mementos of their visit to AFA Board Chairman Sam E. Keith, Jr. (second from left), and AFA Executive Director Chuck Donnelly. At far left is Brig. Gen. Keith B. Connolly, Vice Commander of PACAF's Fifth Air Force.

AFA National President Jack C. Price, left, continued AFA's support of USAF's Senior NCO Academy at Gunter AFB, Ala., with presentation of the original artwork used in the booklet **The Chiefs,** *published in 1984 by AFA's Enlisted Council. From left are Mr. Price; Lt. Gen. Ralph Havens, Air University Commander; and CMSgt. Frank Guidas, Commandant of the Senior NCO Academy. In addition, each of the 1,100 people attending class 89A's graduation received a complimentary copy of The Chiefs.*

AEF Symposium Announced

The Aerospace Education Foundation (AEF) will hold a National Aerospace Symposium for Educators June 22–25, 1989, at the Stouffer Concourse Hotel in Arlington, Va. Titled "Aerospace Education—Capitol Ideas to Touch America's Future," the symposium will feature many noted speakers from the National Aeronautics and Space Administration (NASA), the Federal Aviation Administration (FAA), the Civil Air Patrol (CAP), the Young Astronaut Program (YAP), and Capitol Hill.

The symposium is open to teachers of all grades and subject areas and is designed to offer ideas and curriculum materials to help them direct their students' vision toward the twenty-first century.

A noted international aerospace expert, Dr. Mervin K. Stricker, will keynote one session on Cosmonaut and Astronaut Education. The 1988 AEF Christa McAuliffe Award winner, John Barainca, will discuss his "Starlab" program. Other topics to be covered include space art, classrooms of the future, a model aerospace classroom dramatization, math/science anxiety among female students, and avoiding teacher burnout.

The symposium is limited to the first 300 applicants. Registration fee is $150 (includes conference materials, special hotel rates, three continental breakfasts, one luncheon, and a reception/banquet). A portion of the expenses will be defrayed as a result of a generous contribution from Jack Gross.

For more information, contact AEF Program Director Susan Marler at (703) 247-5839, or write to AEF at 1501 Lee Highway, Arlington, Va. 22209-1198.

Cross Country

Air Capital (Kan.) Chapter member and businessman Charlie Blosser of Concordia, Kan., is *still* flying his 1928 open-cockpit biplane as he did when he helped save those stranded in the Republican River flood of 1935. Mr. Blosser, ninety-three, is reputed to be the oldest licensed pilot in the US. He was recently awarded the Kansas Aviation Honors Award for his pioneering aviation achievements.

AFA's **Cleveland (Ohio) Chapter** held its monthly meeting aboard the *Nautilus II* cruising along the Lake Erie shoreline and the Cuyahoga River. Fifty-five members enjoyed the buffet, meeting, and cruise. Subsequent chapter meetings were held at the Demille Aviation Conference Room and the Coast Guard Enlisted Club. Following the latter chapter meeting, members were entertained by a fellow chapter member and his colleagues' performance of a Broadway play.

AFA chapters in **Blytheville, Ark.,** and **Pueblo, Colo.,** have been renamed. The former Blytheville Chapter has become the **General Ira C. Eaker Chapter** in honor of the staunch AFA supporter who passed away August 6, 1987. The AFA Chapter in Pueblo has become the **Mel Harmon Chapter.** Col. Melvin Harmon, USAFR (Ret.), was a valued elected AFA official in Colorado until his untimely death in mid-1988.

The **Panhandle (Tex.) Chapter** was treated to a special airshow when a B-1 went on display alongside an ancestor, the B-29. The only B-29 still flying, *Fifi* was built in the mid-1940s, while another B-29, the *Enola Gay,* was dropping an atomic bomb over Hiroshima, Japan, on August 6, 1945.

The **Permian Basin (Tex.) Chapter** held its chapter meeting in conjunction with the Annual Meeting of the Permian Basin Petroleum Association. Gen. John L. Piotrowski,

Coming Events

April 14–15, **South Carolina State Convention,** Shaw AFB; April 21–22, **Washington State Convention,** Tacoma; April 28–30, **Alabama State Convention,** Montgomery; May 12–13, **Tennessee State Convention,** Nashville; May 19–20, **Mississippi State Convention,** Biloxi; May 19–20, **New York State Convention,** Buffalo; June 16–17, **Louisiana State Convention,** Bossier City; June 16–18, **New Jersey State Convention,** Cape May; June 23–24, **Maine State Convention,** Bangor; July 14–15, **Arkansas State Convention,** Blytheville; July 21–23, **Pennsylvania State Convention,** State College; July 21–23, **Texas State Convention,** South Padre Island; July 22–23, **North Carolina State Convention,** Seymour Johnson AFB; July 29–30, **Florida State Convention,** Daytona Beach; August 4–6, **North Dakota State Convention,** Grand Forks; August 11–13, **Arizona State Convention,** Sedona; August 12, **Indiana State Convention,** West Lafayette; August 11–12, **Utah State Convention,** Wendover; August 24–26, **California State Convention,** San Francisco; September 18–21, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.

AFA announces a new membership benefit for...

PERSONNEL in TRANSITION

THE AFA INTRODUCES...

...a NEW resource for employers...
...a NEW no cost alternative for Air Force personnel in transition...
...The ETS "Data Base".

A NEW ALTERNATIVE

People in search of employment are usually advised to consider outplacement counseling, working with agencies, classified ads, extensive mailings and networking. Retiring or separating military personnel are further advised to construct a professional resume that expresses their work experience in civilian terms. Personnel in transition could use all of the above but should also be certain to take advantage of the free alternative offered by AFA—the ETS Data Base and Employment Transition Service.

THE ETS DATA BASE

ETS has created a software program which is unique—it can translate military work experience into terms more understandable to civilian employers. In addition, ETS maintains a staff of military personnel specialists to insure that its clients in industry fully appreciate the unique skills and extraordinary training acquired during military service.

ETS MARKETS TO INDUSTRY

ETS does so at no cost to the job seeker and on very attractive terms to employers. The ETS marketing plan is designed to create a base of industrial clients which will have needs at all skill levels and at locations throughout the USA and overseas.

A SIMPLE STEP

AFA members can now take advantage of this unique service. Call the toll free number or return this coupon for detailed information.

1-800-727-3337

☐ Yes, Please send me information on ETS

Name

Address

City State Zip

Employment Transition Service
c/o Air Force Association
1501 Lee Highway
Arlington, Va. 22209-1198

CINCNORAD and Commander in Chief of US Space Command, was guest speaker. The General, a member and strong supporter of AFA, spoke about negotiations with the USSR and compared the military of the two countries. In attendance were AFA members and guests, including Republican Reps. Joe Barton, Larry Combest, and Lamar Smith and Democratic Rep. Charles W. Stenholm.

AFA's Keystone (Okinawa) Chapter held its busy chapter meeting with AFA Chairman of the Board Sam E. Keith, Jr., and AFA Executive Director Charles Donnelly as special guests. Mr. Keith reflected on his assignment on Okinawa in 1945 during the Army invasion, and he updated chapter members on AFA positions with Congress and DoD. He also discussed the importance of retaining good people in the Air Force and supporting civilian employees. General Donnelly was Fifth Air Force Commander at Yokota AB, Japan, prior to his assignment as CINCUSAFE (Ramstein AB, Germany) and his subsequent retirement in 1987.

Congratulations to these new senior enlisted advisors: **CMSgt. Waldberg N. Bryant,** 32d Tactical Fighter Squadron, Soesterberg AB, the Netherlands; **CMSgt. Lionel Grant,** 401st Tactical Fighter Wing, Torrejon AB, Spain; and **CMSgt. William R. Reed,** 42d Air Division, Grand Forks AFB, N. D.

How to Have Your Say

Contributions to "Intercom" should be sent to J. R. "Doc" McCauslin, AFA Headquarters, 1501 Lee Highway, Arlington, Va. 22209-1198. ■

Unit Reunions

Adair AFS, Ore.
Personnel assigned to Adair AFS, Ore., will hold a reunion July 1–4, 1989. **Contact:** J. Taylor, 920 Springhill Dr., Albany, Ore. 97321. Phone: (503) 928-4457.

AFLC/GEEIA-MDA
The Air Force Logistics Command's Ground Electronics Engineering Installation Agency (GEEIA) and Mobile Depot Activity (MDA) will hold a reunion August 5, 1989, at the Applewood Restaurant in Oklahoma City, Okla. **Contact:** Sophia Bronson, 13501 S. E. 29th St., Box 83, Choctaw, Okla. 73020. Phone: (405) 736-2511 or 736-3149. AUTOVON: 336-2511 or 336-3149.

Caterpillar Ass'n
The Caterpillar Association will hold a reunion July 14–15, 1989, at the Clarion Hotel in Colorado Springs, Colo. **Contact:** Johnny Brown, P. O. Box 1321, Kenosha, Wis. 53141. Phone: (414) 658-1559.

Yuma AAF
Former officers and cadet graduates of Yuma Army Air Field will hold a reunion April 6–8, 1989 in Yuma, Ariz. **Contact:** Lloyd D. Collins, 325 Myrtle St., Laguna Beach, Calif. 92651. Phone: (714) 494-4695.

9th Troop Carrier Command
The 9th Troop Carrier Command Pathfinder Group Association will hold a reunion May 4–7, 1989, at the Marine Memorial Club in San Francisco, Calif. **Contact:** Col. Veto Pedone, USAF (Ret.), P. O. Box 2733, Arlington, Va. 22202. Phone: (703) 979-1992.

11th Air Refueling Squadron
The 11th Air Refueling Squadron (Abilene AFB, Tex./Dover AFB, Del.) will hold a reunion May 6–7, 1989, at Dyess AFB, Tex. **Contact:** David F. Gray, 2800 S. Peninsula Dr., Daytona Beach, Fla. 32018.

25th Fighter Squadron
The 25th and the 26th Fighter Squadrons ("China Blitzers") of the 51st Fighter Group will hold a reunion July 13–15, 1989, at the Hilton Hotel in Sacramento, Calif. **Contacts:** Roy R. Santin, 5420 Marmith Ave., Sacramento, Calif. 95841. Phone: (916) 334-3400. Gordon V. Sortommie, 1206 41st St., Sacramento, Calif. 95819. Phone: (916) 452-2621.

Class 41-1
Members of the Aeronautical Engineering Cadet Class 41-1 who attended either the Purdue or New York University programs will hold a reunion May 22–24, 1989, at the Edgewater Hotel in Gatlinburg, Tenn. **Con-**

Reunion Notices

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, a time and location, and a contact for more information.

tact: Wilton R. Osborn, 206 Englewood Lane, Oak Ridge, Tenn. 37830. Phone: (615) 483-0930.

Class 43-E
Former pilots, bombardiers, navigators, and instructors of Cadet Class 43-E have scheduled a reunion in May 1989 in San Antonio, Tex. **Contact:** Paul J. Murphy, 7013 Bellrose N. E., Albuquerque, N. M. 87110. Phone: (505) 884-5687.

47th Bomb Group Ass'n
Members of the 47th Bomb Group, 12th Air Force (World War II), will revisit former military sites in Sicily and Italy May 16–June 1, 1989. **Contact:** Costa Chalas, 71A Trapelo Rd. (Cushing Square), Belmont, Mass. 02178. Phone: (617) 484-5620.

P-47 Thunderbolt Pilots Ass'n
The P-47 Thunderbolt Pilots will hold a reunion May 12–14, 1989, at the Minneapolis Marriott (City Center) in Minneapolis, Minn. **Contact:** Marvin Rosvold, 600 S. 13th, Norfolk, Neb. 68701. Phone: (402) 371-6633 (office) or (402) 379-2825 (home).

Class 49-B
Members of Class 49-B will hold a reunion July 1–4, 1989, in Colorado Springs, Colo. **Contact:** Lt. Col. John A. Stolly, USAFR (Ret.), 11323 Cotillion, Dallas, Tex. 75228. Phone: (214) 681-8290.

50th Fighter-Bomber Group
The 50th Fighter-Bomber Group will hold a reunion and monument dedication on June 6, 1989. **Contact:** Dr. Gilbert H. Mudge, RR 1, Box 154, Lyme, N. H. 03768. Phone: (603) 795-2154.

53d Fighter Group
Members of the 53d Fighter Group (World War II) will hold a reunion in May 1989 in Tampa, Fla. **Contact:** Elmer E. Johnson, 1815 S. E. 6th Terrace, Cape Coral, Fla. 33990. Phone: (813) 574-4044.

55th Fighter Group
Members of the 55th Fighter Group and 442d Air Service Group (1941–46) will hold a V-E Day reunion May 4–7, 1989, in Omaha, Neb. **Contact:** Brig. Gen. Regis F. A. Urschler, USAF (Ret.), 1312 Camp Gifford Rd., Bellevue, Neb. 68005.

58th Bomb Wing Ass'n
Members of the 58th Bomb Wing (World War II) and associated units will hold a reunion August 21–27, 1989, at the Omni Waterside in Norfolk, Va. Please send a self-addressed, legal-size, stamped envelope for information. **Contact:** John Roman, Jr., 106 Cassidy Ct., Cary, N. C. 27511. Phone: (919) 469-3436.

58th Fighter-Bomber Group
The 58th Fighter Group (World War II) and 58th Fighter-Bomber Group (Korea) along with the 69th, 310th, and 311th Fighter Squadrons will hold a reunion June 1–4, 1989, in Dayton, Ohio. **Contacts:** Roger Warren, 7550 Palmer Rd., Reynoldsburg, Ohio 43068. Phone: (614) 866-7756. Anthony J. Kupferer, 2025 Bono Rd., New Albany, Ind. 47150. Phone: (812) 945-7649.

314th Troop Carrier Wing
Members of the 314th Troop Carrier Wing/TAW will hold a reunion May 26–28, 1989, at the Marriott Hotel in Nashville, Tenn. **Contact:** Bart McCarthy, 361 Monaco Dr., Hermitage, Tenn. Phone: (615) 885-3689.

363d Fighter Group
The 363d Fighter Group and service organization personnel supporting the 363d who served during World War II in Staplehurst, England, and Maupertuis (A-15), France, will hold a reunion November 1989. **Contact:** Jim Tipton, 1318 Lake Clay Dr., Lake Placid, Fla. 33852.

410th Bomb Group
The 410th Bomb Group (World War II) will hold a reunion April 20–23, 1989, in San Antonio, Tex. **Contact:** Russ Fellers, SSR Box 95, Weatherford, Tex. 76086.

482d Bomb Group
The 482d Bomb Group (Alconbury, England) will hold a reunion October 4–9, 1989. Former Alconbury Station 102 personnel are also welcome. Please send a self-addressed, stamped, business envelope for information. **Contact:** Dennis R. Scanlan, Jr., One Scanlan Plaza, St. Paul, Minn. 55107-1629. Phone: (612) 298-0997.

820th Bomb Squadron
Members of the 820th Bomb Squadron, 41st Bomb Group, will hold a reunion May 17–21, 1989, at the Holiday Inn in Dayton, Ohio. **Contact:** William W. Childs, 3637 Patsy Ann Dr., Richmond, Va. 23234. Phone: (804) 275-6012.

6th Strategic Recon Wing
For the purpose of planning a seventieth anniversary banquet, the 6th Strategic Reconnaissance Wing is trying to locate former members of the 6th Strategic Wing, 6th Strategic Aerospace Wing, 6th Bomb Wing, or 6th Observation Group.
Please contact the address below.
Capt. Stephen M. Morrisette, USAF
Hq. 6th Strategic Reconnaissance Wing/MAS
Eielson AFB, Alaska 99702-5000

15th Fighter-Interceptor Squadron
For the purpose of organizing a reunion, I would like to hear from former members of the 15th Fighter-Interceptor Squadron assigned to Davis-Monthan AFB, Ariz. Also, I am trying to obtain photos and/or information on the 15th.
Please contact the address below.
George L. Clasey
2140 N. 58th St.
Lincoln, Neb. 68505

741st AC&W
For the purpose of organizing a reunion in August 1989, I would like to hear from members of the 741st Aircraft Control and Warning Squadron assigned to Lackland AFB, Tex., from 1955 through 1957.
Please contact the address below.
Col. Charles X. Suraci, Jr., CAP
9839 Campbell Dr.
Kensington, Md. 20895
Phone: (301) 585-0081

MOVING?

Let us know your new address six weeks in advance so that you don't miss any copies of AIR FORCE.

Clip this form and attach your mailing label (from the plastic bag that contained this copy of your magazine), and send to:

Air Force Association
Attn: Change of Address
1501 Lee Highway
Arlington, VA 22209-1198

Please fasten your mailing label here

Please print your NEW address here:

NAME

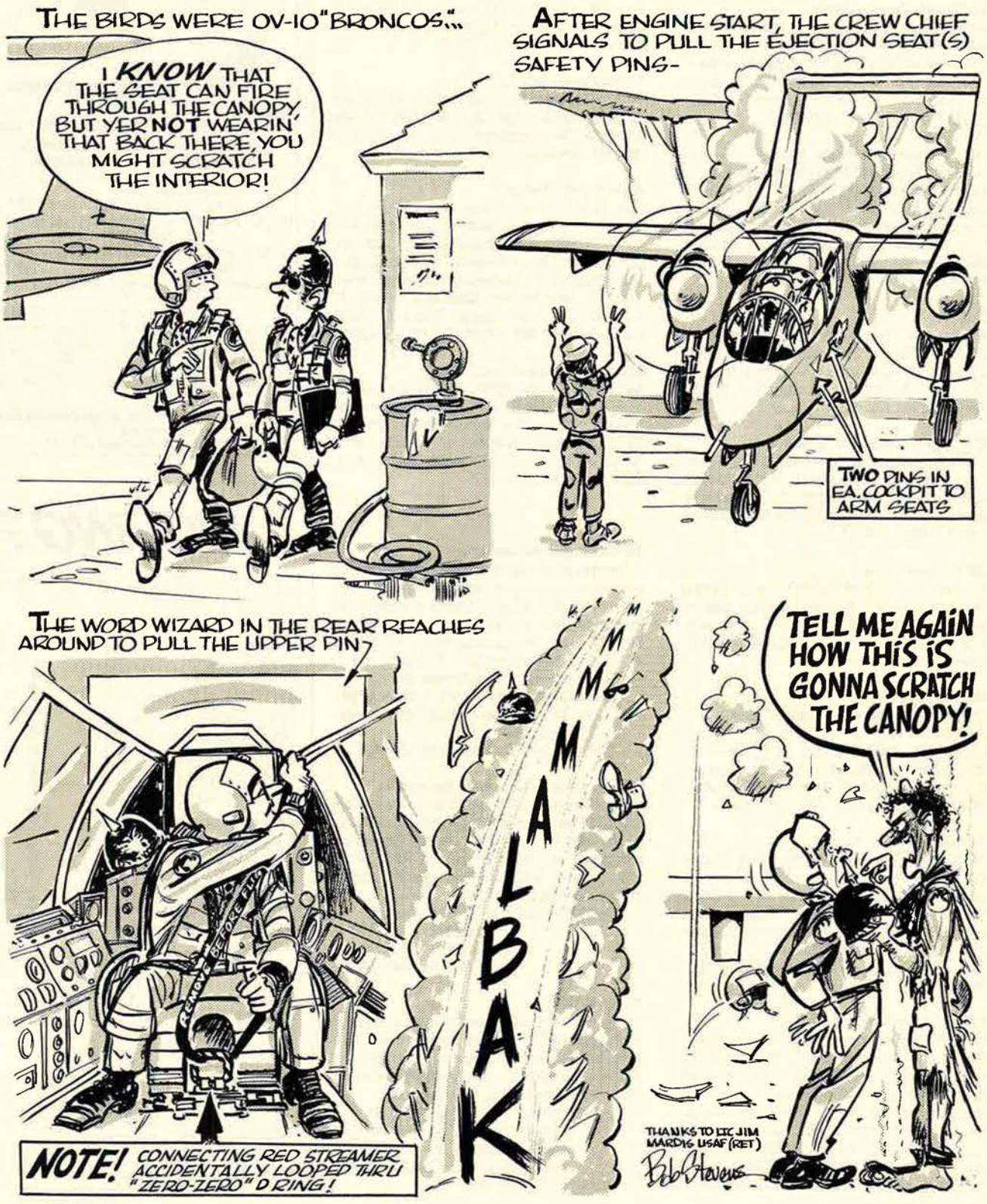
ADDRESS

CITY, STATE, ZIP CODE

Bob Stevens'

"There I was..."

THIS AMAZING STORY MADE THE ROUNDS IN 'NAM. IT OCCURRED AT EITHER BIEN HOA OR TAN SON NHUT AIR BASE. IT SEEMS THERE WAS THIS PIO-TYPE WHO KEPT BUGGING COMBAT CREWS FOR A BACK SEAT RIDE ON A MISSION (WE *TOLD* YOU IT WAS AN AMAZING STORY!). HIS WISH WAS FINALLY GRANTED. HERE'S THE BIT - WITH SOME ALTERATIONS:



Today, America's tactical and strategic aircraft are well-protected by advanced ECM systems from ITT.

The mission is clear.

That's why over a thousand American military aircraft depend on electronic countermeasure systems from ITT for protection against hostile threats.

With the ALQ-172, the Strategic Air Command's B-52 fleet will realize enhanced survivability for a long time to come.

Our lightweight ALQ-136 jammers are providing Army aircraft with nothing less than top-flight ECM capability.

The ALQ-165 ASPJ, now in production verification, will protect Navy and Air Force front-line tactical aircraft well into the next century.

ITT ECM systems are deployed and working now. With technical excellence, sophisticated production technology and support, ITT makes sure our forces are out of sight.

ITT Avionics
500 Washington Avenue
Nutley, New Jersey 07110 • 201-284-5555

ITT
DEFENSE

SEAT OF LEARNING...

TO SEAT OF POWER.

You're in the cockpit of our KC-10 tanker/cargo plane—simulated, and the real thing.

Advanced flight simulation is just one of the areas of expertise which McDonnell Douglas Training Systems and Services brings to aircrew and maintenance training. Our aircrew training systems are designed by career airlifters—people who have led the missions, trained the crews and pounded the ramps to keep the mission promise. They know how to implement computer-based academics, simulation and training management systems. By combining this knowledge with McDonnell Douglas engineering, operational and support capabilities, we now offer a team with the total leadership, civil and military, required for the 21st century.

We've been chosen to train aircrews for F-15s, OV-10s, F-111s, A-10s, F-4s, KC-10s and C-17s. The C-141 aircrew training systems we propose will lead to new levels of efficiency and proficiency—capability that stems from four decades of training men and women who fly.

MCDONNELL DOUGLAS

A Company of Leaders