



### CAN YOU VALIDATE YOUR VISION OF THE FUTURE?

Prepare to fight the air battles of the 1990s and beyond. With more of them than us. Against advanced aircraft, advanced SAMs and air-to-air missiles. And do more than survive. Dominate.

These battles are being fought today at Northrop's new \$92 million flight simulation laboratory. A unique facility where real-time trade-off studies can be made of integrated aircraft systems in a multiple threat, high fidelity environment.

Proprietary software and enormous computing power allow test configurations to be revised within a simulation or for an entirely different aircraft program. Versatility that reduces development time and costs dramatically.

Capability to test next generation aircraft in all their complexity before building actual hardware. Meeting customer requirements with designs based on hard facts, not assumptions.



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

© 1988 Northrop Corporation

### "The Data General difference: rugged systems plus..."

### ... the building blocks you need for your C<sup>3</sup>I applications.

10 PJ88 Data General Corporati

When you need high-performance and reliability in computers designed for difficult, deployable and mobile stations, look to Data General.

Only Data General's rugged systems give you powerful 32-bit, real-time systems that are also standards-adherent, easily upgradable from 2 to 6 MIPS in the field, and meet or approach Mil-SPEC at a fraction of the cost.

But Data General doesn't stop there. We give you more of the critical building blocks you need for C<sup>3</sup>I. Such as multiple environments, including TEMPEST and commercial off-the-shelf products. We offer software compatibility across the entire line. Industry and Mil-standard communications and languages. Development and target systems.

Plus, everything we offer is backed by superior service and support, and priced to make the most of your budget. Find out how the Data General difference can work for your pro-

gram. For a copy of "Building Blocks for Tomorrow's C<sup>3</sup>I," send the coupon below. Or call 1-800-DATAGEN.



Durate second is the official technical computer sponsor of the United Stat Olympic Committee, 36USC380

儲



### Systems that search, sense, seek...and succeed.

Moveable fins

Guidance control system

### Copperhead

Copperhead, Hellfire, the Navy Guided Projectile— Martin Marietta laser technology guides them all —with adverse-weather, first-round accuracy.

– Laser seeker

Electronics withstand firing forces up to 9,000G

### TADS/PNVS

Martin Marietta has pioneered the application of laser, infrared and other electro-optical technologies for navigation and fire control systems like TADS/PNVS. It guides pilots of advanced attack helicopters to targets, day or night, and in adverse weather.

Forward-Looking Infrared (FLIR) Night sensor system Day sensor system Unict view TV

### LANTIRN

LANTIRN is a system which incorporates Martin Marietta's advanced sensor technology to increase the mission effectiveness and strike capability of attack aircraft. It will allow pilots to operate at night and under the weather to find and destroy ground targets.

Navigation pod

FLIR

Central electronics unit

Targeting pod

Sensors and seekers aimed at tomorrow

Today, Martin Marietta is developing new generations of all-weather guidance and control systems employing state-of-the-future advances in electro-optics, millimeter-wave and infrared technologies. Whatever the mission, whatever the threat, Martin Marietta systems know how to search, sense, seek...and succeed.

Masterminding tomorrow's technologies



LANTIRN pods

Forward-Looking

Infrared

Radar antenna

Martin Marietta Corporation 6801 Rockledge Drive, Bethesda, Maryland 20817, USA

### In the entire world, there's but one company that can meet all of your GPS range tracking needs. Interstate.

Interstate Electronics is supplying these major DOD programs with GPS range tracking systems: TRIDENT, ERIS, EATS, GRDCUS, MAFIS, and SABIR.

Whatever your range tracking requirements, we're the only company capable of providing you a complete line of advanced, yet cost-effective, TSPI systems designed specifically for range tracking. Regardless of the number of vehicles to track. Regardless of vehicle dynamics. Whatever your configuration. In all environments.

We can offer you time and space positioning information derived onboard a test vehicle utilizing our GPS receivers, or provide a translator-based tracking system utilizing our GPS translator and ground-based processing stations. Interstate Electronics is the undisputed leader in applying GPS technology to range tracking. We're the only company with experience both as a user and developer of GPS-based tracking systems. We're the people who brought GPS to the ranges.

To find out how Interstate can meet all of your tracking requirements, contact: Director of Business Development, Range Systems, Interstate Electronics Corporation, 1001 East Ball Road, Anaheim, CA 92803. Telephone (714) 758-0500.

### INTERSTATE ELECTRONICS CORPORATION A Figgie International Company

Bringing GPS to the Ranges of the World

Copyright © 1987 Interstate Electronics Corporation

### MARCH 1988 VOLUME 71, NUMBER 3



Page 48



Page 98



About the cover: A universal symbol of impenetrability, the Kremlin introduces AIR FORCE Magazine's "Soviet Aerospace Almanac 1988." (Photo © Peter Turnley/UNIPHOTO)

## PUBLISHED BY THE AIR FORCE ASSOCIATION MAGAZINE

### **Special Section: Soviet Aerospace Almanac**

Gorbachev's Economy / By Robert S. Dudney The Soviet military will accept reforms in hopes of sustaining its power.

Another Look at the USSR's "Defensive" Doctrine / By William F. Scott 48 Soviet protestations about "reasonable sufficiency" have a familiar ring.

The Politburo / By Harriet Fast Scott54The composition of power in the Kremlin is known only to the men who wield it.54Top Leaders of the Soviet Armed Forces / By Harriet Fast Scott60Organization of the Soviet Armed Forces / By Harriet Fast Scott61Senior Military Leadership Changes for 1987 / By Harriet Fast Scott64Soviet Aerospace Almanac 1988 / Compiled by Colleen Bollard65Gallery of Soviet Aerospace Weapons / By John W. R. Taylor75

### Features

<b>Discriminate Deterrence</b> / Editorial by John T. Correll A blue-ribbon panel suggests radical change to US strategy.	6
Backlash from the R&D SuperStandard / By James W. Canan Tighter budgets may kill promising programs at the first sign of trouble.	92
<b>Cautious Indecision</b> / By Gen. T. R. Milton, USAF (Ret.) Washington seems not to have realized the futility of a timid strategy.	97
<b>Fly by Light</b> / By John Rhea USAF program managers look to fiber optics for the aircraft of the 1990s.	98
Valor: The Quiet Hero / By John L. Frisbee Brig. Gen. Fred Castle showed that there is no common mold for heroism.	107
<b>"A Real Hero"</b> / By Arthur Hyland Eminent actor/aviator Jimmy Stewart is honored at the Doolittle Salute.	108

Departments

Airmail	9	March Anniversaries	28	Valor	107
Washington Watch	17	Senior Staff Changes	32	Intercom	109
Capitol Hill	22	Index to Advertisers	36	Coming Events	112
The Chart Page	25	Viewpoint	97	Unit Reunions	114
Aerospace World	26	Airman's Bookshelf	105	There I Was	120

All FORCE Magazine (ISSN 0730-6784) March 1988 (Vol. 71, 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 \$3 per year additional). Regular issues \$2 each. Special issues (Soviet Aerospace Almanac, USAF Almanac, ISAF Almanac, 1999) \$5 each. Change of address requires four week's 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. Trademark registered by Air Force Association. Copyright 1988 by Air Force Association, All roles and convention.

40

### **An Editorial**

### **Discriminate Deterrence**

By John T. Correll, EDITOR IN CHIEF

PENTAGON filing cabinets are full of studies on the battlefield of the future. There are all sorts of master plans and road maps about how forces ought to be organized and equipped twenty years from now. For the most part, though, these studies concentrate on weapons, tactics, and other purely military matters. They are usually interesting—and sometimes brilliant in their particulars—but they tend to employ a predictable framework of analysis. The tomorrow that they project looks a lot like today, except that the technology has gotten better.

"Discriminate Deterrence," a report submitted to the President January 12 by a blue-ribbon Commission on Long-Term Strategy, presents a vision of broader scope. It foresees a world in which the distribution of power has shifted. The United States and the Soviet Union are no longer so dominant as they were in 1988. China and Japan have become economic superpowers, with options to be military superpowers if they wish. Perhaps forty nations are able to build nuclear weapons. US access to foreign airspace and bases abroad has diminished. Space is a prime arena for military action.

The Commissioners believe that in the twenty-first century, we will worry less about extreme threats—major conflict in Europe or apocalyptic war with the Soviet Union—and more about contingencies in remote corners of the globe. They say that we must be prepared to deliver both nuclear and conventional force over vast distances with great precision and selectivity. The Soviets may mount limited military challenges on the flanks or at points of perceived advantage far from the lines of confrontation in Central Europe. The report speculates that a regional clash of arms between the US and the USSR might be kept within bounds and would not escalate inevitably to worldwide or nuclear war. Even in Europe, the Commissioners say, we should regard theater nuclear weapons mainly as instruments to defeat an invasion rather than assume that their use is an automatic tripwire for Armageddon.

This is scary stuff, and it is too soon to know how much influence the Commission will eventually have on policy. One of the Commissioners, former National Security Advisor Zbigniew Brzezinski, thinks that "five years from now we will look back and say this was the beginning of the next phase in US nuclear and defense posture." He could be right, but more cautious strategists will find the Commission's bolder ideas too radical to accept.

The Europeans are already in an uproar. They see the call for discriminate application of force as removing the guaranteed backup of US strategic nuclear forces to deter a conventional attack on Western Europe. "This is precisely what European worriers have all along accused America of wanting to do and precisely what two generations of NATO statesmen have tried to fashion alliance strategy to avoid," said *The Economist* in its commentary. "For many people, the possibility of mutual annihilation is what deterrence is all about, and anything that makes a nuclear war look less catastrophic increases the chance of having one."

The report contains enough ifs, ands, and buts to support a less severe interpretation, but the Commissioners are telling us clearly that the strategy of the past will not do for the future. Soviet power and influence have bypassed the static lines drawn at the end of World War II. Third-World turbulence endangers US interests in the Persian Gulf, the Mediterranean, and the Western Pacific. Small and comparatively unstable nations may soon have their fingers on the nuclear trigger. We will need a greater choice of responses to an expanding range of threats.

The Commission's view of Third-World conflict stirs strong emotions. The Boston *Globe* terms it "insanity," calling the Commissioners "troglodytes" whose "methods look a lot like terrorism." What the report says is that fighting is more likely in the Third World than anywhere else and that US forces will seldom be direct combatants. It proposes that we double or triple our financial support for friendly local forces with the understanding that we may not officially acknowledge our backing for insurgents:

"By designating the US support as a 'Special Activity' (also known as a 'covert action'), the US government can maintain official silence." Even those who are receptive to changing strategies for changing times may find this notion difficult to choke down.

As the title of the report implies, though, the heart of the strategy is exercise of force in a more "discriminate" or selective manner. The Commission says that "current technology makes it possible to attack fixed targets at any range with accuracies within one to three meters." It urges the procurement of tens of thousands of precision standoff weapons with ranges significantly beyond those needed in the European theater. Thus armed, the United States might be able to eliminate threats almost anywhere, perhaps with conventional warheads and without reliance on overseas bases. The report says we must overcome the "horse cavalry" syndrome that leads to conservatism in innovation and spend more on aggressive research and development.

Secretary of Defense Frank C. Carlucci hit a harmonious chord with this general idea January 25 in his report to Congress on support of NATO strategy in the 1990s. Mr. Carlucci made his pitch at a less ambitious level, but advocated a "Win Early" concept to defeat an invasion of Europe by employing Advanced Conventional Munitions (ACMs) against airfields and other targets deep in enemy territory. He said conversion of all our munitions to ACMs is unaffordable but that effective use of smart weapons in the opening rounds of war might reduce the total number of them that would be needed.

Whatever we think of the report as practical strategy, we should give careful attention to its underlying observations. This Commission is not a bunch of shirttail amateurs. In addition to Mr. Brzezinski, its members include former Secretary of State Henry Kissinger, former National Security Advisor William Clark, former Deputy Secretary of Defense Graham Claytor, Adm. James Holloway, and Gens. John Vessey, Andrew Goodpaster, and Bernard Schriever. Its cochairmen are Fred Iklé, then-Under Secretary of Defense for Policy, and Albert Wohlstetter, whose strategic credentials have long commanded respect in Washington. Other perspectives are represented on the panel by Ambassador Anne Armstrong, Prof. Samuel Huntington of Harvard, and Joshua Lederberg, President of Rockefeller University.

If we do not like their ideas—and few of us will be willing to agree with them in their entirety—then we are obligated to search with some urgency for answers we like better. The Commission's greatest service may turn out to be having alerted us to the new varieties of danger that lie ahead and having shown us that, in our present condition, we are unprepared for the changes we are about to encounter.

### WE PUT OURSELVES IN YOUR POSITION. COLLINS GPS.

Whether you're in the air, on land or sea, field-proven Collins military Navstar Global Positioning System (GPS) user equipment meets your precise navigation requirements.

Our family of 1-, 2- and 5-channel GPS equipment has been selected by the DoD for initial production. In over 9000 hours of field tests, we've demonstrated better than 16 meter accuracy, with anti-jam capability. And we are inserting the latest technology to keep Collins GPS state-of-the-art.

19 .....

Collins new computer - integrated, 75,000 sq. ft. manufacturing facility helps reduce production costs. And commonality in over 75% of hardware and 90% of software helps ensure low life-cycle costs.

For information on the only completely field-tested and proven military GPS user equipment, contact: Collins Government Avionics Division, Rockwell International, 400 Collins Road NE, Cedar Rapids, Iowa 52498. (319) 395-2208. Telex 464-421. COLLENGR CDR.

**COLLINS AVIONICS** 



...where science gets down to business

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



Introducing the smallest MATE 1750A Computer yet The Harris FLEX-MATE fits in the palm of your hand and contains all these advanced features.

- Fully MATE compliant
- SEAFAC qualified

ŋ

11 (9)

- Eurocard packaging
- Supports most common peripherals
- IEEE-488 and peripheral controllers

Computer demonstrations in MATE ATE are now available.

AT HARRIS ... MATE WORKS

-----

Harris Government Support Systems Division 6801 Jericho Turnpike Syosset, New York 11791 516-364-0400 1-800-4-HARRIS, Ext. 2540



©Harris Corporation 1988

### Airmail

### Two Musts . . .

Bravo!

The January 1988 issue of AIR FORCE Magazine contains two items that should be compulsory reading for every American who professes to be concerned about the cost and managerial effectiveness of the "military establishment." The articles are John T. Correll's editorial "The \$65,671 Man" and Fred Reed's article "The Reformers."

If it has not already been done, I would urge the Air Force Association to provide reprints of these two items to every member of Congress. The points raised by Mr. Reed about the military "reformers" can also be applied to almost all such self-appointed advocates of societal interests, regardless of their espoused cause.

Thank you for these excellent items. Let's have more of the same ilk.

Col. Richard C. Simmonds, USAF (Ret.)

Rockville, Md.

• Members of Congress receive copies of AIR FORCE Magazine as a matter of course.—THE EDITORS

#### The Reformers

Hurrah for Fred Reed for neatly putting into words what many of us on the receiving end have felt (see "The Reformers," p. 106, January '88 issue). I still recall speeches in Congress predicting that a certain USAF aircraft would never fly—the same aircraft that has been the mainstay of tactical interdiction forces for these past twenty years.

I suspect, however, that exposing the "reformers" is unlikely to accomplish anything besides spurring them on to greater heights (or depths). Theirs is a form of debate that, like a one-way street, permits criticism in a single direction only.

Bert Z. Goodwin Miami, Fla.

#### The \$65,671 Man

I am writing to add one comment to the editorial "The \$65,671 Man" in the January '88 issue.

Did the General Accounting Office

(GAO) take into consideration how many hours of work that "sum" may have entailed? Probably not!

As a lieutenant new to the Air Force, it hasn't taken me long to figure out that there are many things we military members do that go uncompensated for in dollar amounts. If one stops to consider the many projects and additional duties for military members, plus the countless hours and effort put forth, then that salary may not seem so large.

It seems to me that if, after fifteen years, the actual dollar amount in that major's pocket was \$65,671, then it would be well deserved. I'm sure others will agree, despite what GAO says.

2d Lt. Barbara E. Peakall, USAF

Portales, N. M.

#### **Talking With Airplanes**

Re: "Talking With Airplanes" by David S. Harvey in the January 1988 issue.

I was fascinated by the list of 656 words that cover "just about every eventuality in air-to-air and air-toground missions," but I feel I must comment on the following.

"Hahn" (a USAFE air base), "Ramstein" (a USAFE air base), and "Rhein" (the German spelling of Rhine) are on the list. From this I find it hard to believe that the list was taken from fifty-four Air National Guard and Air Force Reserve pilots, who should be more likely to say "Fargo" or "Hill" than "Hahn."

"Missile," "AMRAAM," "Sidewinder," and "Sparrow" are on the list. "Armament," "flare," "gun," "ord-

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 conclse, 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. nance," "snakes," and "weapon" are on the list, but "bomb," "rocket," and either "cluster" or "CBU" are not. What do these apparently USAFE airto-ground guys carry?

And how do they use it? No names of likely air-to-ground targets are listed, such as "tank," "APC," "truck," or "troops." Nor are there any words necessary to communicate with a FAC, such as "mark," "marker," and "smoke."

"East" and "north" are on the list, but "west" and "south" are not. . . .

As I stated earlier, I was fascinated by the list—but hardly impressed. Additional work in the real world is clearly needed.

> Col. William C. Ferguson, USAF (Ret.) Port Angeles, Wash.

Your article on voice interaction, "Talking With Airplanes," prompts me to write.

Men have had to talk to aircraft since the first flight. I wonder what Orville's first words were.

I can remember a few words said to B-17s, B-26s, B-29s, B-50s, and KC-135s: "Come on, old girl, get us home" or "Come on, baby, get off the ground." Now we have a 656-word vocabulary to make these new birds do what is wanted of them.

In checking over this new vocabulary, I find that one word is missing—a word that would cut time and the use of so many other words to make an aircraft fly, a word that has moved men and planes the world over, a word that would do wonders for all. Gentlemen, you forgot "roger"!

Roger, honey, be right there! Gotta go; dinner is ready.

SMSgt. Dick Quick, USAF (Ret.) Kalispell, Mont.

l enjoyed David S. Harvey's "Talking With Airplanes" very much.

In the article, there was a reference to "Speckled Trout." Mr. Harvey stated that the reason for the name "Speckled Trout" was lost in the folklore of the Air Force. I hope that I can add to that folklore.



Publisher John O. Gray

Associate Publishers Charles E. Cruze, Richard M. Skinner

Editor in Chief John T. Correll

Senior Editors James W. Canan, Robert S. Dudney

> Aeronautica Editor Jeffrey P. Rhodes

Staff Editor Colleen A. Bollard

Military Relations Editor James A. McDonnell, Jr.

**Contributing Editors** John L. Frisbee Brian Green

Gen. T. R. Milton, USAF (Ret.) John W. R. Taylor ("Jane's Supplement") Robin L. Whittle

Managing Editor Richard M. Skinner

Assistant Managing Editor Hugh Winkler

**Director of Production** Robert T. Shaughness

> Art Director **Guy Aceto**

Research Librarian Pearlie M. Draughn

Editorial Assistants Grace Lizzlo, Daniel M. Sheehan

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

Director of Marketing Services Patricla Teevan-703/247-5800

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

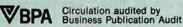
AREA ADVERTISING MANAGERS East Coast and Canada By Nicholas-203/357-7781

Midwest William Farrell-312/446-4304

West Coast Gary Gelt-213/641-7970

UK, Benelux, France, Scandinavia, Germany, and Austria Richard A. Ewin David Harrison Overseas Publicity Ltd. 91-101 Oxford Street London W1R 2AA, England Tel: 1-439-9263 Telex: 24924 Telefax: 01-734-7389

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



### Airmail

Speckled Trout is the airplane designated for the Air Force Chief of Staff. Since Congress did not appreciate the Air Force Chief of Staff having a private plane, it is also designated as an avionics test-bed. As Mr. Harvey pointed out, its worldwide mission in support of the Chief of Staff makes it an ideal test platform.

The name Speckled Trout is not really that mysterious. It was assigned many years ago. Speckled was an official Air Force nickname. Trout refers to the lady at AFLC who was responsible for providing logistics support to the Chief of Staff's airplane. Yes, she is the little old lady with the green eyeshade.

Mrs. Trout did her job with dedication and professionalism for many years. The Chief of Staff's airplane was named in her honor when she retired. Hence the name Speckled Trout.

I am sure there are still many people at Hq. AFLC who may know even more details on this story. .

E. R. Laase Melville, N.Y.

### The CAS Requirement

The comments attributed to Army Under Secretary James Ambrose in the January '88 "Washington Watch" were typical of him-interesting, cogent, and straightforward. I think most would agree that, fairly early in the budget-cutting process, one has to consider force-structure reductions. Otherwise, you're left with the skeleton of a fighting unit and no muscle. Therefore, to maintain the fighting capability of the remaining units, force reductions are sometimes necessary.

Moreover, the concern expressed by Secretary Ambrose relating to the future Air Force fixed-wing CAS aircraft is understandable. The decision not to equip the A-10 with LANTIRN severely reduced its future capability to perform CAS twenty-four hours a day in adverse weather. In my opinion, the F-16 equipped with LANTIRN is not the solution to the CAS requirement either.

The operators in the Air Force need to articulate the requirement for CAS. The development community should respond to the operational need. Our objective should not be to figure out some way to use another variant off some hot aircraft production line. If the solution works out that way, finebut that shouldn't be the entering argument.

Why don't we develop an unbiased statement of need and see what industry proposes? It's worth a try-assuming it can get into the budget. We may be pleasantly surprised. The solution may very well be innovative, effective, and affordable.

The CAS requirement will be met. The question is by whom. The ball is in our court.

> Col. Ross Peeler. USAF (Ret.) Fort Myers, Fla.

#### Lest We Forget

Your monthly "Valor" articles by John L. Frisbee are excellent. I wish that they were available to every citizen of this country. Today, as much as ever, we clearly need people who have performed heroic acts as examples to look up to.

The January 1988 article "Valor in Two Dimensions" was of particular interest to me. I was chief pilot in the Spooky squadron (4th Air Commando Squadron) at the time of the flight described in the article. Capt. Willard M. "Steve" Collins and 1st Lt. Delbert 'R. Peterson were close, personal friends of mine. Steve was my copilot during deployment, and I had flown with Del two days earlier on a mission and had checked him out as a crew commander. They were both exceptional individuals.

Thanks for recognizing them and the crew of Spooky 70. I, for one, will not forget.

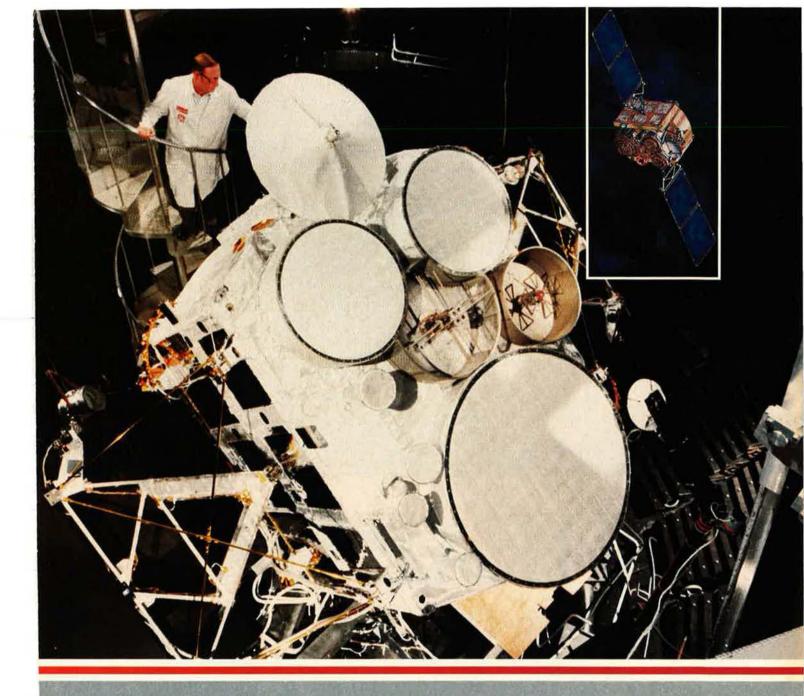
> Charles A. Riley Weaverville, N. C.

#### **Tom Lanphier**

I want to thank you and your staff concerning the obituary of Thomas Lanphier, Jr., carried on page 37 in the January '88 issue of AIR FORCE Magazine. I read with considerable concern the reporting of his death by various syndicated news agencies.

Tom Lanphier was a good Air Force officer, but to expand his accomplishments, as the various news reports did, is a disservice to Tom and an embarrassment to all of us who know the record. Tom is officially credited with five and a half aircraft destroyed, just as AIR FORCE Magazine reported, not seventeen enemy planes as reported by the media.

As additional information from the Japanese has emerged over the years, the Air Force Credit Review Board has found enough evidence to reassign the destruction of the Yamamoto aircraft, with a half credit going to Tom Lanphier and a half credit to Rex Barber. In the last few years, more evidence has surfaced that will likely justify another review.



### We Build Survivable Spacecraft.

Military space communications rely on the optimized, secure services of the third generation Defense Satellite Communications System (DSCS III).

As the U.S. Air Force contractor for the spacecraft segment, GE Astro-Space Division has infused the most current technologies to provide exceptionally flexible, anti-jam communications capabilities. An industryunique survivability qualification program provides the necessary assurance that these capabilities remain intact in threat-level radiation environments.

From electronics to systems level, our hardening design and test program enables the DSCS III spacecraft to perform their vital communications mission under highly stressed circumstances.



Demonstrated Excellence in Space

**GE Astro-Space Division** 



# CHEAP SHOT

### LTV's Hypervelocity Missile: Fast, accurate and affordable.

The column of enemy tanks is still several miles away when the attacking aircraft swings onto its firing run. Its FLIR is already tracking their heat signatures. Less than three seconds later, with the aircraft still safely out of range, the missiles slam into their targets with uncanny accuracy.

#### Low Cost, High Firepower

One of the most awesomely effective weapons ever developed for Close Air Support/Battlefield Air Interdiction, the Hypervelocity Missile (HVM) weapon system was designed to deliver maximum firepower at a cost far below anything in our current inventory. A product of the Missiles Division of LTV Missiles and Electronics Group, HVM is a masterpiece of simplicity and ingenuity. It carries no warhead, relying instead on its blistering 5000-foot-per-second speed to blast a penetrator rod through heavy multi-plate armor, even at highly oblique angles at extreme range.

Its guidance system is a simple  $CO_2$  laser, mounted on the aircraft. With only an aft-looking receiver on the missile, the amount of expensive "throwaway" hardware is held to an absolute minimum. And because HVM is a "wooden round" with no warhead, storage and handling are simpler, safer and cheaper.

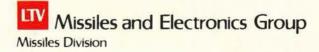
### **Multiple Targets, Maximum Effect**

The system can track and attack multiple targets simultaneously any ground vehicle, fixed or mobile. In live fire tests an HVM was purposely aimed more than 100 feet off-target. Automatic guidance brought the missile to impact near the target center.

With no bulky on-board guidance system or warhead, the HVM is small enough to permit a large loadout—up to 24 per aircraft, at a low installed drag.

No other weapon system has ever given the CAS/BAI pilot the HVM's unique advantages in speed, accuracy and survivability advantages matched only by its cost-efficiency and low susceptibility to countermeasures.

LTV Missiles and Electronics Group, Missiles Division, P.O. Box 650003, Mail Stop MC-49, Dallas, Texas 75265-0003.



LTV: LOOKING AHEAD

I again want to thank the editors of AIR FORCE Magazine for their sensitive approach to this whole matter.

David Lee "Tex" Hill San Antonio, Tex.

#### **The Retention Crisis**

Pilot retention is rapidly reaching crisis proportions in the Air Force. The inability or unwillingness of the current Air Force leadership to realize this and take proper action is at the heart of the problem. This letter will show, from the point of view of a junior officer, what the major retention problems are. These problems are not impossible to solve, but they will require our current leaders to take some risks and change "the way we've always done things" in order to stop the mass exodus of pilots.

One big retention factor is our promotion system. It has turned into a square-filling exercise instead of a process that selects only the best people for increased rank and responsibility. OERs are perceived as being totally worthless-and rightly so. Such square-fillers as PME and master's degrees now count more toward promotion than does a pilot's primary job.

What the promotion system communicates to pilots is that the primary mission of the Air Force is not to fly and fight but to construct a good image on paper. Some may say, "Well, we want good officers, not just good pilots." Well, what we are getting are good square-fillers-individuals who learn early in their careers that their primary job, flying, is not important.

Along with the problems with the promotion system is a problem of loyalty. Individuals are expected to show loyalty up the chain of command, but they don't get the same loyalty down the chain in return. This is not true in all cases-indeed, I have had some of the best commanders I could ever hope for. But our promotion system has fostered a competitive spirit to the point that commanders think more about their careers than they do about their people (careerism rather than professionalism).

It is extremely rare to see commanders "go to the wall" for one of their people (whether it is for an assignment or a job within the wing) if their involvement could hurt their career. Commanders can't expect their people to show them or their organization loyalty if they don't give it first.

Another retention factor is our assignment process. Pilots perceive the assignment process as an impersonal, random affair, done with the purpose of filling slots rather than trying to put the right person in the right job-unless you know someone, in which case it becomes a process of favoritism. The commanders' favorites get the choice assignments, and the rest of us get what is left over. Extenuating personal circumstances are not considered. Again, you can't expect loyalty if you don't give it.

The unfortunate fact about all of this is that these problems are not new. They have existed for quite some time. The only reason that we are even looking at them now is because pilots have a viable alternative to putting up with all of these headaches.

There are solutions to these problems, but it will require the Air Force leadership to change the way we have always done things. (Leather jackets are not a solution.) These changes will benefit not only pilots but the rest of the Air Force as well.

Capt. (Maj. selectee) Matthew P. Geddie, USAF

Randolph AFB, Tex.

#### **Recycle Those Issues!**

For many years, I kept back copies of AIR FORCE Magazine and found that I rarely, if ever, went back to look at the magazines again. I would eventually run out of space and throw them in the trash.

For the past year, I have been taking my old copies of the magazine to the library of the local high school. The librarian tells me that AIR FORCE Magazine has generated considerable interest among senior high school students not only as "interesting reading" but as references for research as well.

I would like to suggest to other subscribers that they undertake a similar effort. If someone is already donating to the local high school libraries, try the municipal libraries.

Who knows-the magazine could pique the interest of students enough to prompt them into joining the Air Force. It's a good recruiting tool!

Richard B. Enzian Tabernash, Colo.

#### Ploesti B-24

I am attempting to find out the fate of a veteran aircraft of the famous low-level bombing mission against the oil fields at Ploesti, Romania, on August 1, 1943. The aircraft in question is a B-24D-5, serial number 41-23795. She was called The Squaw and served with the 344th Bomb Squadron of the 98th Bomb Group during World War II.

This aircraft survived the war and

was returned to the US, where she ended up at Bush Field, Ga. In March 1946, this aircraft was purchased by the city of St. Augustine, Fla., to be displayed at the municipal airport. The aircraft was ferried to St. Augustine and put on display for several years. It is believed to have been scrapped some time later.

Does anyone know the final fate of this famous aircraft? I hope to learn what actually happened to this plane and to obtain copies of any documents or photos relating to the plane when it was on display. Any help would be appreciated.

> Steven D. Nylen 7652 Muirfield Dr. Las Vegas, Nev. 89117

#### **Camp John Hay**

Members of the 6020th Support Squadron (formerly Det. 1, 3d Combat Support Group) at Camp John Hay in the Philippines are looking for their "lost sheep.'

The squadron is already making plans for a colossal centennial week in the year 2003 to celebrate Camp John Hay's 100th birthday and is seeking anyone who was ever assigned to Camp John Hay. It is hoped that enough names can be gathered to establish an alumni month every year, leading to a grand reunion for the 100th anniversary.

Contact has been lost with many of those who served at Camp John Hay over the years. Any military or civilian who worked there is asked to send his or her name, address, dates served at John Hay, and current duty section to the address below.

6020th Support Squadron/PAO APO San Francisco 96298-5000

#### 425th TFTS

The 425th Tactical Fighter Training Squadron is presently setting up a display of the squadron's history. The squadron began in 1943 as a nightfighter squadron, flying the Northrop P-61 Black Widow. Its present role is to train foreign students in the F-5.

We wish to contact people with any information or memorabilia on the 425th NFS, 4441st CCTS "Skoshi Tigers," and the early 425th TFTS. Any names, photos, patches, or past memories will be extremely appreciated.

We are also interested in hosting a reunion here at Williams AFB, Ariz.

2d Lt. Anthony J. Murch, USAF 425th TFTS/CC Williams AFB, Ariz. 85240-6477

### Airmail

### **Republic Airport**

The Long Island Republic Airport Historical Society, a newly formed organization, is planning for the sixtieth anniversary (1928–88) of Republic Airport at Farmingdale, N. Y., on June 25, 1988.

This airport and area have been important to aviation history, to the Army Air Forces during World War II, and to the Air Force up to the present day.

We are gathering a history and would appreciate hearing from anyone connected with Republic Airport or companies that produced aircraft there.

Charlotte C. Geyer President, LIRAHS Administration Bldg. Suite 16, Republic Airport E. Farmingdale, N. Y. 11735-1580

#### 480th TFS

The 480th Tactical Fighter Squadron "Great Warhawk Nation" is in the process of assembling a comprehensive history of the 480th TFS to be displayed in our new operations building.

The "Warhawks" boast a proud rec-

ord of more than nineteen years as the leader of America's fighting units. We are looking for pictures of the squadron's personnel, aircraft, insignia, and facilities. Photographs will be copied and returned. We would also greatly appreciate any documents, official or not, that would lend flavor to the proud heritage of the "Warhawks."

> Capt. Mike Wilson, USAF 480th TFS

APO New York 09126-5000

### 8478th Troop Transport Sqdn.

I would like to contact anyone who was a member of the 8478th Troop Transport Squadron based at Miami, Fla., from 1956 to 1963 and of the 90th Aerial Port Squadron (the present designation) from 1964 to 1979.

I am completing a compilation of our unit's history and would appreciate any materials, photographs, or correspondence that readers could provide.

Please send all responses to the address below.

TSgt. Roberto J. De Paz, USAFR 6540 W. 27th Ct., #23 Hialeah, Fla. 33016-2873

#### WW II Nose Art

The 36th Tactical Fighter Wing (USAFE) is searching for pictures, drawings, or recollections of aircraft nose art from World War II.

We are searching for nose art from P-36, P-39, P-40, and P-47 aircraft assigned to the 22d, 23d, and 53d Fighter Squadrons during WW II.

Anyone with any information on these aircraft and their nose art is asked to contact me at the address below. All photographs will be returned.

> MSgt. Gary R. Akin, USAF 36th TFW/HO APO New York 09132-5000

#### **Roll Call**

I am looking for Charles P. Crowley. He was an Air Corps pilot with the 530th Fighter-Bomber Squadron, 311th Fighter-Bomber Group. I would greatly appreciate learning the whereabouts of Mr. Crowley or his family.

Please contact me at this address: Lt. Col. R. P. Michaels, Jr.,

USAF (Ret.) 503 N. Main St. P. O. Box 396 Bethel, N. C. 27812-0396

### YOUR CRITICAL NEEDS OUR PROVEN EXPERIENCE



RATTLER- Power



PYTHON - 3ALA musile .

LITENING - Autome

infrared targeting basingation pod



T.F. guided glide bomb

Effective air defense must depend on proven capabilities in the development and manufacture of weapon systems, and military solutions must conform to strict national defense budgets. For many decades Rafael has dealt successfully with the operational and economic demands of Israel's tough, active military. Rafael can put this battle-born expertise to work for you – in joint ventures or turn-key projects.



 Rafael Armament Development Authority

 P.O.B. 2082, Haifa 31021, Israel. Tel: (4) 706965.

 TIx: 471508 VERED IL. Fax: (04) 794657.

 U.S.A. Tel: (202) 364-5571.

 TIx: 25-904152. Fax: (202) 364-5529.

 Europe, W. Germany Tel: (228) 823312.

 TIx: 885421 ISRA D. Fax: (228) 823353.

 Singapore. Tel: (65) 734-9120.

 TIx: RS55125 RAFSIN. Fax: (65) 734-8861.



### AT&T's STU-III. Because all secure phones are not created equal.

The only STU-III that transmits clear as well as secure data.

The only STU-III with a 4.8 Kb/s transmission rate for optimum voice quality and faster data transmission.

The only STU-III that accommodates up to 32 crypto-ignition keys per terminal. independent key sets to handle multiple programs and security levels.

The only STU-III with four

The only STU-III that allows you to use the same crypto-ignition key in more than one terminal. / / The only STU-III that provides a remote interface to data processing equipment.



AT&T's new Security-Plus Telephone gives you features and capabilities no other secure phone can offer.

It's also flexible. Easy to use. And provides true information security assurance that your phone conversations and data transmissions remain secure.

Which should come as no surprise. Because AT&T's STU-III was developed by a company with more than 75 years of telecommunications experience, plus the unmatched resources of AT&T Bell Laboratories. And it's supported by AT&T's Security-Plus Customer Service Center to ensure optimum operation.

For more information, write: AT&T, Federal Systems Division, P.O. Box 20046, Greensboro, NC 27420. Or call 1 800 262-3787. In North Carolina, call collect 919 279-4194. © 1987 AT&T



# AN/ALE-47

### AN INNOVATIVE SOLUTION TO TRI-SERVICE REQUIREMENTS





a WESTMARK company

Tracor Aerospace, Inc. 6500 Tracor Lane Austin, Texas 78725-2070 Telephone 512: 929 2268 Telex: 77 6410 TWX: 910 874 1372

### FIRST IN COUNTERMEASURES TECHNOLOGY

### Washington Watch

### **A Lesson From the Eagles**

### By James W. Canan, SENIOR EDITOR

The first F-15 operational commander—now the USAF Chief of Staff—recalls his mid-1970s experience and says it's unrealistic to expect perfection from a system until it matures.



Washington, D. C. Col. Larry D. Welch took charge of the first USAF operational wing of F-15 Eagles at Langley AFB, Va., on August 1, 1975. Today, as Air Force Chief of Staff, General Welch re-

calls "lots and lots of headaches" with those hot new fighters through the two years of his command. At their best, his wing's F-15s were the worldbeaters they were supposed to be, but they weren't at their best often enough. Their newly minted F100 engines generated terrific thrust, but were all too temperamental, tending to falter in high-performance flight.

Critics of the F-15 program had a field day.

The fighter's problems were resolved with the passage of time. Its unparalleled air-superiority attributes are now taken for granted. They have been universally acknowledged and admired for so long that the F-15's growing pains have subsided into the past.

General Welch draws "an interesting lesson" from the Air Force's initially troubled but ultimately triumphant experience with its Eagles, a lesson he wishes that critics of all new weapons encountering problems would keep in mind.

As he expressed it in a recent interview: "Today's weapon systems are highly complex. A maturing process is required during their testing and following their introduction into the force. It is unrealistic to expect perfection of them at the point of their introduction.

"There is no possibility of testing a

AIR FORCE Magazine / March 1988

new weapon system in an environment that will cover all of the circumstances—all of the things that it will be subjected to—in an operational environment. We expect the maturing process to continue in that environment, and we believe that this is the most effective approach for us to take.

"The time and cost that would be involved in trying to introduce initially perfect weapons into the operational environment would be prohibitive."

The Chief of Staff's point is especially pertinent at this time. Now that money is tight and military forces and requirements are being reassessed with an eye to paring expenses, the capabilities and costs of emergent weapons are being scrutinized ever more sharply.

General Welch welcomes the scrutiny and notes that the Air Force is a prime participant. But he would like the critiques of weapon systems to be more enlightened and more objective than he believes those outside of the Air Force and the Department of Defense as a whole have been in the past.

He is moving to set the stage for this.

In General Welch's mind, critics have been wayward in their harsh judgments of such high-priority Air Force systems as the B-1B bomber, the Peacekeeper ICBM, and the Advanced Medium-Range Air-to-Air Missile (AMRAAM). He would like to prevent this from happening in the assessments to be expected of equally important Air Force systems now coming to the fore, most notably the B-2 Stealth bomber and the Advanced Tactical Fighter (ATF).

The first B-2 may be flying by the end of this year. The ATF is well along in development. Because both aircraft will break new ground in several technologies and their integration, they will almost certainly exhibit some flaws that will need correcting as they come of age in the air.

As history has shown, much good can come of this, if only the critics would realize it and not leap to premature conclusions. Back to the F-15. "Not too many years ago," says General Welch, "we regarded the useful life of an air-superiority fighter as being five to seven years—and here's a fighter that's a lot older than that and is not only still useful but still the finest."

He attributes this to "our ability to exploit technology during its maturing process. We were able to make its engine better and better—and more reliable—by incrementally introducing new technology."

He also points out that lessons learned in improving on the engines of the originally operational F-15s helped the Air Force to move ahead with programs for more advanced powerplants and to revitalize competition among fighter engine contractors.

As a result, he says, "Today we have a tremendously healthy situation in engines."

#### **Defending Against Attacks**

General Welch has felt duty-bound to defend the Air Force against attacks on its blue-ribbon programs, but he would rather not be compelled to do so. "I don't want to spend my time being a critic of the chorus of critics," he says, adding:

"It's a very healthy situation when people outside the Air Force discover and call our attention to things that need to be fixed. But in almost every case that I know of, the information used by the chorus of critics has come from some Air Force report.

"So there is usually not much disagreement about the facts. But the critics tend to invent their own sets of consequences, their own views of the military impact of the facts.

"The most visible example of this in recent years is the B-1 program. I can't remember a program that has attracted so much attention. All the B-1's problems came to light in Air Force reports of test results and deficiencies that needed to be corrected. The only problem that really warranted extensive attention was in the defensive avionics. The rest of the fixes were straightforward.

"So the issue was not the facts.

#### Washington Watch

They were gleaned from Air Force reports and were not in dispute. But the chorus of critics concluded that the impact of the facts was that the B-1 is not able to do its assigned job.

"The fact is that it is fully capable of doing that job today. It remains essential that rigorous B-1 testing be done, and it is being done and will continue to be done."

The Chief of Staff describes the controversy generated by Peacekeeper test results as "probably the most graphic example" of what he considers to be outlandish expectations on the part of the missile's detractors.

"The chorus of critics declared that the accuracy of the missile was in question, because a group of five test shots produced accuracy results that were only ten percent better than the mature specifications called for, whereas an earlier group of test shots had produced accuracy that was twenty percent better.

"Lost in this was the fact that it was the first time in history that initial tests of any ballistic missile anywhere produced accuracy that met the mature specs. So it's a tremendously positive outcome. The facts are very straightforward."

There have been suggestions that the Air Force may not be above fudging or concealing facts about its systems in order to make those systems look better. General Welch bridles at this.

"We continue to be very open about the facts," he declares. "We have to be, because we have to ensure that our development and test programs produce weapon systems that will serve the nation for a long time—typically, twenty-five to thirty years."

This also means, he says, that the Air Force "can't afford to respond to the pressures of the critics in any way that would sacrifice the rigors of our development and testing programs, because what we are doing in those programs is trying to ensure that our weapons will do the job in the long term."

### **Testing AMRAAM**

Last year, there were allegations on Capitol Hill that the Air Force had relaxed some requirements in its testing of AMRAAM to make sure that the missile would pass muster in its test scores and be funded for production by Congress.

"We certainly did not," General Welch asserts. "The AMRAAM test program is the most complex, demanding one ever devised for an airto-air missile. It is coming closer than any other—ever—to covering everything that the missile will have to do in the operational environment. And AMRAAM is doing very well."

The Chief of Staff acknowledges, however, that conditions were conducive to compromising the AMRAAM test program, because the missile had had a close brush with untimely death.

As he explains it: "After a series of successful tests, there were two backto-back failures. For a time after that, every ordinary test of AMRAAM became a political event in Washington, D. C. In fact, it reached the point that a single failure could have threatened the life of the program.

"That's not a very healthy environment for the test community. Those kinds of situations require our great emphasis on ensuring that the test community doesn't respond to the transitory clamor of the critics. Instead, the test community must remain firmly focused on the fact that the weapon system will be an important part of our inventory and that the testing must be done right."

The AIM-7 Sparrow radar-guided missiles that AMRAAMs will supplant on fighters are also examples of weapons that were improved following their introduction into the force.

General Welch recalls that the original Sparrows were designed only to shoot down bombers flying straight and level and "did that job very well." Over time, however, the Sparrows were also called on to hit highly maneuverable fighters flying high and low.

This required "significant upgrades," says General Welch, and "today, the AIM-7F and the AIM-7M [Sparrows] do reasonably well, particularly considering their original design."

The Air Force can cite many such object lessons for critics of its systems. All across the board, says General Welch, "programs that by any definition are remarkably successful and that have given us great capabilities had problems at the start."

For example: "The commanders of the first F-16 wing and the first AWACS wing experienced the same kinds of things that I experienced with the first F-15 wing."

The Chief of Staff emphasizes that he is not seeking surcease from justifiable criticism and that the Air Force is not going soft on its own systems.

"We are never going to ease the pressure to try to introduce weapon systems in as capable a condition as we can have them," he declares. "I don't want the Air Force to be forever carping at the chorus of critics," General Welch says, "but I do intend to ensure that we continue to respond appropriately."

#### Some Smoldering Issues

It is worth reaffirming here that misgivings about military programs are by no means confined to unenlightened circles outside the defense establishment.

Jaundiced views are quite often expressed by high-level people of impeccable credentials and credibility who wear uniforms or who deal directly with—and solidly support—the military.

Just such people are now spreading the word about some smoldering issues in the fighter-development world that could catch fire before too long.

Those issues have to do with the Air Force's ATF program, the Navy's A-12 Advanced Tactical Aircraft (ATA) program, and their political interplay.

The central question afoot is this: Will the two services follow through on their mutually expressed willingness to buy and deploy each other's fighters—the ATF for air superiority and fleet air defense and the A-12 for surface attack—when push finally comes to shove in the next decade?

By all accounts, the odds are still in favor of this happening. For example: "I think the Air Force and the Navy can get together," says Gen. Robert D. Russ, Commander of USAF's Tactical Air Command. "I'm willing to buy ATAs when they become available and put them into our operational inventory."

But the odds may be getting longer. In fact, there are others in the know who now predict that the Air Force will not see its way clear to buy the A-12 when the time arrives in the coming decade.

It is no longer a secret at the Pentagon and around Washington that the Air Force takes a dim view of some of the A-12's performance characteristics.

Nor is the Navy all that sanguine about eventually assimilating the Air Force ATF. It is keeping a close watch on the ATF program. It suspects that the Air Force will not be able to have it both ways with the supremely sophisticated ATF—either the fighter's cost will have to go up or its capability will have to be compromised.

The Navy holds all but the barest details of the A-12 program close to its vest and says nothing in public about the aircraft's attributes. Bedek Aviation: Cost-effective maintenance, repair, overhaul, conversion and testing of commercial and military engines and components. Computerized control, strict inspection, expert personnel, customer consultation.

Engine Type	Overhaul	Mainten- ance	Test Cell	Training	Spare Parts
JT3D/JT8D	+	. *		+	
JT9D		4	+		Δ
F100-100/200	+	+	+	+	Δ
J79	+	+	+		+
ATAR 9C	+	+	+	+	
PT6	.+	+	+	+	+
ALL 250	+	+	+	+	

+ Full Capability APartial Capacity Ben Gurion International Airport, Israel 70100 Tel: 9711240 Telex: ISRAVIA 371114 Cables: ISRAELAVIA

BEDEK AVIATION DIVISION

ISRAEL AIRCRAFT INDUSTRIES LTD

**Total Aero-Engine Service Capabilities** 

Bedek Aviation: Customized conversions of heavy transport aircraft to various configurations for multimission military applications — passenger, cargo, refueling tankers, passive and active EW missions and aerial surveillance including ELINT/SIGINT.

### Heavy Transport Aircraft Conversion

CONVERT TO	B-707 320-B	B-707 320-C	B-707 320-C	C-130
TANKER			•	
PASSENGER		# 1		
CARGO			•	
PASS/CARGO			•	
SIGINT		•		
SIGINT/CARGO			•	
AIRBORNE C <sup>3</sup>	•	•	•	

Ben Gurion International Airport Israel 70100



Bedek Aviation designs and implements cost-effective customized aerial tanker retrofit programs for 707-300 B/C, C-130, and other transport aircraft — substantially increasing internal fuel capacity and reducing operational limitations in time, range and payload.

Available configurations include two-point probe/drogue (wing tips/wing stations) or three-point probe/drogue (wings and fuselage), flying boom with optronic system, combined boom and probe/drogue or other options to customer specifications.

### **Aerial Tanker Retrofit**

Airport, Israel 70100 Tel: 9711240 Telex: ISRAVIA 371114 Cables: ISRAELAVIA ISRAELAVIA

BEDEK AVIATION DIVISION

Ben Gurion

International

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/CTYPE	Overhaul	Accessories	Upgrading
M3/M5/M50/M3NG	+	+	+
KFIR	+	+	+
F-4	+	+	+
F-5	+	+	+
A-4	+	+	+
FOUGA/AMIT	+		1/4

**Military Aircraft Upgrading and Maintenance** 

Ben Gurion International Airport Israel 70100 Tel: 9711240 Telex: ISRAVIA 371114 Cables: ISRAELAVIA

BEDEK AVIATION DIVISION



### **Affordable performance**

### **The PILATUS PC-9**

meets the demanding performance requirements of the U. S. Air Force Next Generation Trainer (NGT) at an affordable price, today!

### PERFORMANCE

Reliable Pratt & Whitney PT-6A power provides an initial climb rate of over 4,000 ft per minute at sea level, 300 knots cruise at 25,000 ft, with an approach speed of only 90 knots.

### AVAILABILITY

In production now, with deliveries of this third generation trainer already taking place for the air forces of five nations.

#### COST

Less than half of competitive pure jet trainer acquisition cost, and similar savings on operation and maintenance costs = the best life cycle cost/performance combination on the market.

### THE BOTTOM LINE

PILATUS PC-9 provides an "off-the-shelf" capability to train jet pilots, which no other competitor can match for performance, life cycle cost, and availability.





For more information contact: Pilatus Aircraft Ltd. CH 6370 Stans, Switzerland, Telephone: 041 63 61 11. Telex: 866 202 PILCH

### Washington Watch

The Air Force has been far more forthcoming about the ATF. It has acknowledged, for example, that the fighter's price could prove troublesome and that cost-performance trade-offs are constantly being analyzed and made.

USAF has also been relatively open, in a general way, about its aspirations for the ATF's speed, range, maneuverability, and stealthiness.

In late 1986, the Navy made an eventful move that caused the Air Force to stir uncomfortably. The Navy lowered its original requirements for the subsonic A-12's top speed and maximum range.

The decision to do this was made by John F. Lehman, Jr., who was Secretary of the Navy at the time. His purpose was to restrain the cost of the 450-aircraft A-12 program and to attract all possible aerospace companies to compete for ATA development contracts.

Some companies had told the Navy that they preferred not to take part in the competition. They were not confident that they could profitably develop and build the A-12 to do the things that the Navy wanted it to do and at prices that the Navy seemed willing to pay.

Once the A-12's performance specifications were eased, those companies pitched in.

The Navy settled for significantly less range and speed than the Air Force (which isn't crazy about subsonic fighters in the first place) believes the A-12, as a replacement for USAF's F-111 and F-15E, will need to carry out the deep interdiction missions foreseen for it.

Indeed, the A-12 is said to be shaping up as not a great deal faster or farther-ranging than the venerable A-6 attack aircraft that it is destined to replace aboard aircraft carriers in the 1990s.

This reportedly discomfits a fair number of naval air and surface officers as well.

According to an official who had firsthand knowledge of the Navy's action with the A-12, it means that "the carriers will have to go just about as far toward shore as they ever did" to launch the A-12 and make ready for its return from inshore strikes.

What the A-12 will have going for it, though, is a high degree of stealth. It is best described, says one source, as "a very stealthy A-6."

The aircraft's low observables would weigh heavily in its favor. In making the A-12 capable of sneaking up on targets, the stealth properties But once the A-12 has made known its lethal presence in enemy territory, coming home through hostile airspace may be quite another matter, according to A-12 program watchers.

A little extra speed could make all the difference, they say, and this would apply with a vengeance on Air Force long-range sorties amid Soviet interceptors and SAMs.

Meanwhile, there is no lack of speed in the A-12 program itself.

Late last year, the Navy chose McDonnell Douglas and General Dynamics to work as a team in building the A-12, which could be flying around the turn of the decade. A Grumman-Northrop-LTV team lost out in the competition.

McDonnell Douglas and General Dynamics had been unwilling to enter the competition until the Navy eased the A-12's performance specs, whereas Grumman and Northrop had been ready to go all along, says a high official close to the program.

The Navy fighter-bomber will be powered by a much-different derivative of the afterburning F404 engine that General Electric produces for the Navy F/A-18. On the A-12, the engine will not have an afterburner—but it will have nozzles that address what is called "the back-end problem" in designing and building low-observable aircraft.

This has to do with cloaking the aircraft against detection by infrared, heat-seeking sensors and by radar. It necessitates masking the heat of the engine exhaust and preventing radar signals from penetrating to and returning from the whirling turbine blades, which are extremely good radar reflectors.

The back-end problem is said to be easier to solve on a subsonic aircraft than it is on a supersonic fighter with afterburners. The nozzles of the latter must be much more resistant to heat, and they require more engineering artistry in their internal shaping.

This problem may be a big one for the Air Force's ATF.

"The Air Force is working the nozzle problem very hard," says a well-informed source. "Without specially designed nozzles, the [ATF's] signature would go way up. This would give it a lot of problems against Mach 5 Soviet SAMs" when it tries to dash home from deep over enemy territory.

The Navy is said to be keeping a weather eye on the ATF's development fortunes in this regard.

At this writing, the ATF program's competing contractor teams—Northrop-McDonnell Douglas and Lockheed-Boeing-General Dynamics are just about ready to begin building their respective prototype aircraft. The competing engine companies— GE and Pratt & Whitney—have been ground-testing their prototype ATF powerplants for some time.

USAF is shooting for initial operational capability of the ATF around 1995 and intends to produce 750 of the fighters at a unit flyaway cost of \$35 million, as measured in Fiscal Year '85 dollars and predicated on a production run of seventy-two ATFs a year. The Air Force has set a weightceiling goal of 50,000 pounds for the ATF.

Hardly anyone believes that USAF's cost and weight limitations on the ATF can be honored. In fact, the Air Force originally believed that the ATF would have to weigh about 55,000 pounds and would cost about \$40 million each at a minimum—and those parameters are still "more like it" in terms of realistic expectations, says an official who keeps close tabs on the program.

The Air Force has already reduced the ATF's combat radius by twenty percent in order to keep its cost in bounds.

Despite whatever misgivings the Navy and the Air Force may have about cross-procuring their two fighters, economic considerations may dictate that they do so for the sake of getting the most out of their ultraexpensive aircraft resources.

It is becoming obvious, however, that the Air Force would still have to spend much additional money to make changes to its liking in the A-12 and that the Navy would have to do the same to convert the ATF to a carrier aircraft, including beefing up the landing gear and the airframe associated with the landing gear—thus adding significant weight.

So the jury is still out on what are described as "very emotional issues" in the whole affair. Meanwhile, both services are doing their best to accommodate one another and are lying low with their concerns.

They realize that the political success of their respective fighter programs depends on their continued public expressions of good faith in both.

One last observation: The Air Force designed its ATF from the beginning as a fighter that can be readily converted to the air-to-ground mission if it ever comes to that.

### **Capitol Hill**

#### By Brian Green, CONGRESSIONAL EDITOR

### Washington, D. C.

**INF Hearings** A parade of senior officials, including Secretary of Defense Frank Carlucci and Chairman of the Joint Chiefs of Staff Adm. William Crowe, forcefully defended the recently signed Intermediate-range Nuclear Forces (INF) Treaty, arguing that it represents a "net plus militarily" for the US and that verification provisions are adequate to detect any violations before they become militarily significant. Secretary Carlucci, however, stated that he believed that the Treaty would "probably add somewhat to the US defense budget."

Senate criticism of the Treaty focused in part on the provisions that permit the US and Soviets to salvage the "physics package"—the warhead and guidance system—while destroying only the INF missiles and launchers. Sen. Jesse Helms (R-N. C.) of the Foreign Relations Committee has been particularly vocal on this point.

Secretary Carlucci, testifying before the Senate Armed Services Committee (SASC), argued that these provisions are in the best interest of the US and were included in the Treaty "basically at our behest." The US ability to produce fissionable materials for nuclear weapons has been limited by technical problems in its production facilities.

The debate has also focused on the effect of the Treaty on the NATO-Warsaw Pact balance. Secretary Carlucci argued that the Treaty "highlights the risk of neglecting" NATO conventional deficiencies. Admiral Crowe noted that elimination of Soviet INFs would reduce Warsaw Pact capability to attack targets deep in NATO's rear, such as depots of prepositioned military equipment and seaports and airports critical for NATO resupply.

Sen. Dan Quayle (R-Ind.) expressed concern that the Treaty's "noncircumvention" clause would prevent modernization of other NATO nuclear weapons, such as the short-range Lance missile. Sen. Edward Kennedy (D-Mass.), however, questioned the "political and military wisdom" of such modernization efforts, predicting they would generate political protests throughout Europe. Soviet Foreign Minister Eduard Shevardnadze recently suggested that NATO nuclear modernization would "scuttle" recent arms-control progress, a pronouncement dismissed as "propaganda" by Secretary Carlucci.

Other concerns included:

• Ambiguities in the Treaty that relate to future INF-capable systems (new "types" of missiles—such as the SS-25—have been a source of controversy in SALT II).

• The accuracy of the Soviet-supplied data base detailing their own weapons deployments.

 Reports of Soviet interference with US satellites needed to verify Soviet compliance.

• A persistent lack of a US compliance policy—a plan of action should the US determine that the Soviets are violating the Treaty.

Senior Air Force officers have pointed out that the Treaty will likely result in greater reliance on conventional forces for deterrence in Europe. Correcting conventional imbalances, however, may be difficult in view of expected declines in the defense budget.

#### **NATO Reports**

Sen. Carl Levin (D-Mich.) issued a report identifying significant NATO advantages over the Warsaw Pact in quality of weapons and personnel, readiness, reliability of allies, and economic strength that he believes indicate that NATO is not a "conventional basket case." But, he said, "if we can't [mount a conventional defense], then the course is clear. Let's put in the symbolic tripwire and nuke the hell out of [the Soviets] if they come."

The report estimates that "the Warsaw Pact has a superior capacity for launching a surprise attack with little mobilization compared to NATO's capacity to defend against such an attack if its forces have not mobilized." Soviet forward deployments and an emphasis on short-warning attack are judged to pose the greatest conventional threat to NATO. The report cites the complex politics of mobilization as a NATO "Achilles' heel" and argues that maldeployment of NATO forces complicates NATO's forward defense.

In testimony before the SASC, Senator Levin suggested that US nuclear guarantees to Europe had lost much of their credibility. A report on NATO strategy submitted to Congress by Secretary Carlucci, however, argues that US "strategic forces must remain the backbone of NATO's deterrent." It emphasizes that "NATO relies on the combination of its full range of nonnuclear, nuclear, and dual-capable capabilities . . . to deter." But, the report warns, continued deterrence is contingent on "NATO's ability to act decisively to sustain both conventional and nuclear modernization."

It concludes that although NATO conventional capabilities have improved over the past few years, "major limiting factors remain." In related testimony, Secretary Carlucci stated that "we're a little uncomfortable with the high degree of risk" in the current European conventional balance.

#### Nunn Favors BMD

SASC Chairman Sen. Sam Nunn (D-Ga.), in a recent speech, expressed support for a limited ballistic missile defense designed to protect the nation against accidental or unauthorized launches of nuclear-armed missiles, should such a system prove "both technically feasible and affordable." He argued that a limited system could be deployed within the terms of the ABM Treaty, perhaps with "modest amendment."

Senator Nunn also supported continued ICBM modernization—but warned that both US ICBM programs are politically vulnerable. "It would be a supreme irony . . . if the United States and the Soviet Union resolved their differences over START . . . only to discover that both the Midgetman and rail-mobile MX had been killed in an act of domestic political fratricide," he said. Without a deployable mobile ICBM, he argued, options for improving strategic stability under a prospective START agreement would be greatly reduced.



"I'm in Washington talking with a Deputy Director in the Defense Department. It's budget time and he's trying to get his part of a \$312 billion budget passed through Congress. He's frustrated...and believe me, he's got reason to be. The budget information he needs is coming from computers all over the world that can't talk to each other. It's a serious problem but I assure him Wang has solved it over and over again. I take him through the whole set-up—add a Wang VS which will bring in data from his IBM mainframe through SNA, access his DEC systems through DDN, and run his UNIX" applications. And... at the same time get his IBM and Zenith PCs talking to each other. He mentions that some of the information is classified so I tell him about Wang's full line of TEMPEST computers and security solutions... Everything it will take to get his budget passed through the top brass. Well, you'd have though the'd been given a Presidential Citation or something..."

> 1-800-522-WANG GIVE US A DAY TO MAKE IT WORK FOR YOU.



Give us a day to make it work for you. Call Wang's Federal Systems Division Executive Briefing Center in Bethesda, Maryland where Gene Shugoll's organization can create a customized demonstration, showing how Wang can make your computers and your organization work better. Now and in the future. They can also provide additional examples of how Wang made it work for other government organizations. Call them at **1-800-522-WANG**.

### Why enemy pilots don't sleep well.

If you have to fly against the F-16, you'd better be wide awake. In its air-to-air configuration, this proven combat fighter is designed to incorporate the most advanced avionics and weapon systems technologies, including the APG-68 multimode radar, electronic target identification equipment and beyond-visual-range AMRAAM and AIM-7 missiles.

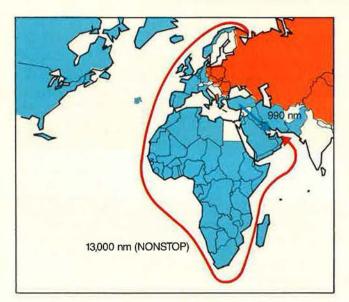
It also flat out-maneuvers any other bird in the sky.

Pilots of 12 Free World nations are currently flying the F-16. And that's giving their counterparts on the other side nightmares.

GENERAL DYNAMICS A Strong Company For A Strong Country

### The Chart Page

Edited by Colleen A. Bollard, STAFF EDITOR



HIGH CONFIDENCE SOVIET ACCESS

WESTERN-ALIGNED: U.S. ACCESS

HIGH CONFIDENCE U.S. ACCESS

UNCERTAIN, BUT BLOCKING SOVIETS

These maps compare US and Soviet access to airfields or airspace in the mid-1950s (left) and today (right). Thirty years ago, the US could count on bases and overflight rights to reach the Persian Gulf quickly and could respond to a crisis well before the arrival of Soviet forces. Today—when access is more important than ever—the Soviets have the advantage. With US access to bases and airspace uncertain, we must anticipate that intercontinental airlift would be required to insert ground troops and that the Soviets would be there first.

Source of Data: The Commission on Integrated Long-Term Strategy

### THE DROP IN DEFENSE SPENDING

Defense Budget Authority (Dollars in Billions)

FISCAL YEAR	THEN-YEAR DOLLARS	CONSTANT '88 DOLLARS	PERCENT REAL CHANGE FROM PRIOR YEAR
1980	\$143.9	\$208.0	PROM PRIOR TEAR
1981	180.0	234.0	12.5
1982	216.5	262.2	12.1
1983	245.0	286.2	9.2
1984	265.2	301.1	5.2
1985	294.7	323.4	7.4
1986	289.1	310.4	-4.0
1987	291.0	304.1	-2.0
1988	292.0	292.0	-4.0

The Reagan Administration's defense recovery program—launched to correct the devastating military shortfalls of the 1970s—topped out in 1985. When the effect of inflation is factored out, defense budget authority has dropped by ten percent in the last three years. The services have been told to cut their budget requests by ten to twelve percent in each of the next five years, and the budget actually approved may take Pentagon spending even lower than that.

Source of Data: Senate Appropriations Committee

### A WIDENING GAP TO THE GULF

### Aerospace World

#### By Jeffrey P. Rhodes, AERONAUTICS EDITOR

### Washington, D. C.

★ After long and sometimes acrimonious negotiations, the US and Spain reached an agreement in principle on January 15 for a new defense and mutual cooperation treaty. In return for some other concessions, the US reluctantly agreed to remove the 401st Tactical Fighter Wing from Spanish soil. The new treaty, once signed, will take effect in May, when the old pact expires.

It appeared for some time that the Spanish government might require the US to pull out of Spain completely, but when the joint US-Spanish statement was made, the only US assets affected were the 401st TFW's seventy-two F-16s at Torrejon AB, near Madrid. The US naval base at Rota, the training facilities at Zaragoza AB, and the tanker operations over Spanish territory were unaffected.

The US must move the 401st TFW within three years after the treaty goes into effect. While no specific plans for the wing were announced, Belgium, Portugal, Morocco, as well as Greece and Turkey have been suggested as possible relocation sites. Congress, however, has prohibited the use of any military construction monies to move the 401st TFW to another country. The appropriations bill says that the North Atlantic Treaty Organization (NATO) should pay the moving costs.

In return for the US's removal of the fighters, the Spanish have agreed to concessions in a number of areas.

In addition to a "hands-off" policy on the other installations, the Spanish agreed to crisis and wartime use of Spanish installations and territory by the US in support of NATO reinforcement plans. The new treaty will be in effect for a longer term than the previous one—eight years instead of six—with provisions to extend it for successive one-year periods.

The Spanish also agreed that military or economic assistance in the form of grants or credits would not be tied or related to the new defense treaty. Furthermore, future educational, cultural, scientific, and technological cooperation will be based on new and equitable formulas and will also be separate from the new defense agreement.

Final discussions and details of the treaty were scheduled to be worked out in early February in Madrid.

★ New recruits joining the armed forces will be required to give a little bit more of themselves because of a little-noticed amendment to the military authorization bill signed in early December. Starting in June, recruits will be required to submit to urinalysis, and any who show signs of marijuana or cocaine abuse before being sworn in will not be allowed to enter the military.

This preenlistment urinalysis is in addition to the already extensive program of random testing of new trainees.

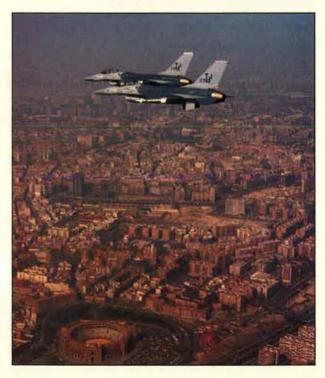
Critics of the new program claim that the tests can easily be circumvented and will cost several million dollars at a time when budget dollars are scarce. The measure was added to the appropriations bill by Sen. Ernest F. Hollings (D-S. C.), who said that "the time to start catching the users is before they join the armed forces, when the government has no obligation to them."

The Pentagon was to have drawn up the comprehensive testing program by late January, and it is to be implemented by the June deadline.

In a related note, the Army has become the first of the services to establish a formal policy for periodic retesting of servicemen for exposure to the Acquired Immune Deficiency Syndrome (AIDS) virus. Under the new policy, all soldiers will be retested for the disease at least once every two years. The Army was the first service to complete testing of all of its members for AIDS.

★ Morton Thiokol and the National Aeronautics and Space Administration got what amounted to a lump of coal for Christmas when a major flaw was discovered in the redesigned Space Shuttle solid rocket motor (SRM) after a test firing. This flaw was serious enough to postpone the next Shuttle launch from June until August or early September.

Now looking for a new place to land, these F-16s flying over Madrid are part of the seventy-two aircraft from the **401st Tactical Fighter** Wing that will have to be removed from Spain in the next three years. The US presence at Torrejon AB was the only thing affected in the new treaty signed with Spain late last year.



After the December 23 test firing at Thiokol's Wasatch Operations facility near Brigham City, Utah, it was discovered that a three-and-a-half-footlong, nine-inch-wide piece of the outer carbon phenolic ring that anchors a protective boot over the exhaust nozzle swivel joint had broken off. Pieces of the ring were found in the aft solid rocket segment casing and on the ground.

The pieces are believed to have broken off when the nozzle was swiveled ("slewed") seven degrees left and right of center. The nozzle would be slewed this much in flight only if there were a launch abort.

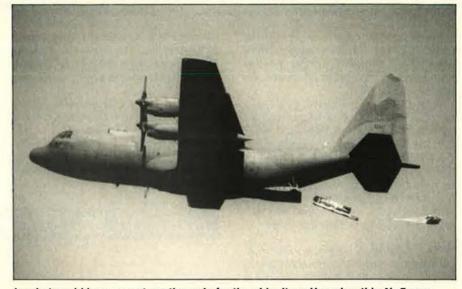
While the field joint that caused the *Challenger* accident had to be completely redesigned, NASA had another boot nozzle ring design already in the works, so the delay is expected to be minimal.

In other Shuttle news, the first of three modified Rocketdyne Space Shuttle Main Engines (SSMEs) to be used when Discovery does indeed lift off was delivered to the Kennedy Space Center in Florida in early January. The other two engines will be delivered in February. Each of the engines has been started three times in tests conducted at NASA's National Space Technology Laboratory in Mississippi. On the final test for each of the SSMEs, the liquid hydrogen/liquid oxygen-fueled engines were fired for a flight duration burn of 520 seconds.

And finally, Rear Adm. Richard H. Truly, NASA Associate Administrator for Space Flight, has announced that the maximum allowable landing weight for the Shuttles has been increased to 230,000 pounds from 211,-000 pounds. This increase was made possible by an ongoing structural analysis of the Shuttle Orbiters. Admiral Truly said the new limit will "add considerable flexibility and efficiency to our Space Transportation System."

★ The Over-the-Horizon Backscatter (OTH-B) radar at Moscow, Me., began limited operations in early December of last year. The radar, developed by Air Force Systems Command's Electronic Systems Division at Hanscom AFB, Mass., can detect aircraft out to 2,000 miles away over the Atlantic.

The OTH-B radar bounces its signal off the ionosphere to "see" almost ten times farther than conventional ground-based radars. The three 3,600-foot-long transmit antennas at Moscow are paired with three milelong receiving antennas approximately 100 miles away in Columbia Falls, Me. The operations center for the radar is at Bangor ANGB, Me.



In what could become yet another role for the ubiquitous Hercules, this Air Force C-130H is dropping a dummy defensive mine in a recent test for the Navy off the east coast of Florida. The gravity-drop High Volume Mine Layer (HVML) system was designed by Babcock Power Ltd. of England and Lockheed Aeronautical Systems Co. in Marietta, Ga., and uses roll-on modular pallets. The test was successful.

Tactical Air Command, the end user of the radar, has nearly 170 people training with the radar at Bangor, and two of the OTH-B's three sections (facing northeast and southeast) are now running at about eighty-five percent of capacity. The third sector (which faces east) should be completed by General Electric's Radar Systems Division later this year. The remaining software design work should be finished and operational testing of the entire system begun by late 1989.

In the meantime, the Air Force was scheduled in January to begin testing how well the radar can spot cruise missile-size targets. Teledyne Ryan AQM-34M drones, launched from an NC-130 aircraft based in Puerto Rico, will be used to simulate Soviet cruise missile attacks. The radar will be evaluated for its ability to report speed, heading, and position of the drones.

### March Anniversaries

• March 11, 1918: Lt. Paul Baer of the 103d Aero Squadron becomes the first Army Air Service member to be awarded the Distinguished Service Cross.

• March 19, 1918: The 94th Aero Squadron (The Hat-in-the-Ring Squadron) makes the first US operational flights across the front lines in France.

• March 1–9, 1928: USAAC Lt. Burnie R. Dallas and Beckwith Havens make the first transcontinental flight in an amphibious airplane. Total flight time in the Loening Amphibian is thirty-two hours and forty-five minutes.

• March 2-4, 1943: A Japanese attempt to reinforce Lae, New Guinea, is foiled by aircraft of the Southwest Pacific Air Forces during the Battle of the Bismarck Sea. More than sixty enemy aircraft are destroyed and some 40,000 tons of Japanese shipping sunk.

• March 10, 1943: Fourteenth Air Force is formed under the command of Maj. Gen. Claire Chennault.

• March 19, 1943: Lt. Gen. Henry H. "Hap" Arnold is promoted to four-star general, a first for the Army Air Forces.

 March 6, 1953: The first production Northrop SM-62 Snark intercontinental missile is accepted by the Air Force after four previous successful launchings.

 March 16, 1953: Republic delivers the 4,000th F-84 Thunderjet to the Air Force. The F-84 had been in production since 1946.

• March 2, 1968: The first of fifty-eight C-5A Galaxy transports is rolled out at Lockheed's Marietta, Ga., facility.

• March 31, 1968: President Lyndon B. Johnson announces a partial halt of bombing missions over North Vietnam and proposes peace talks.

• March 23, 1978: Capt. Sandra M. Scott becomes the first female aircrew member to pull alert duty in SAC.

• March 23, 1983: Flight testing with the second prototype Rockwell B-1A resumes at Edwards AFB, Calif. This aircraft is modified to take part in the B-1B development effort.

### Aerospace World

Fifteen drones have been modified for the tests. Approximately forty tests at all altitudes, during the day and at night, and from all directions will be conducted.

Four OTH-B systems will eventually be built. Construction began on the west coast system in 1986, and work is scheduled to begin on radars in the central United States and in Alaska in 1989. In addition to covering a broader area, the last two radars will cover a 500-mile gap between the coastline and where the eastern and western OTH-B sets begin their coverage.

★ The AIM-120A Advanced Medium-Range Air-to-Air Missile (AMRAAM) development effort passed two more significant tests in early December and, in the process, brought the program's success rate up to the eightyfour percent mark.

In the December 8 test conducted at the Pacific Missile Test Center at Point Mugu, Calif., two missiles were ripple-fired from an F/A-18 against two dissimilar targets. This test showed that multiple AMRAAMs launched against targets with different radar cross sections wouldn't engage the same target and also verified the F/A-18 aircraft-to-missile data link in a multiple launch.

The F/A-18 was flying at Mach 0.9 at 28,000 feet, and the two target drones, a QF-86 and a QF-4, were both traveling at Mach 0.7, but at different altitudes. The QF-86 was flying at 1,000 feet, while the QF-4 was described as flying at "low altitude." Both AIM-120s passed within lethal range of their respective targets.

Two days later, at the Naval Weapons Center at China Lake, Calif., an F/A-18 launched a single AMRAAM in a look-down/shoot-down engagement. The QF-86 target was traveling at Mach 0.7 at an unspecified low altitude, while the launch aircraft was flying at 15,000 feet and traveling at Mach 0.85. The missile passed within lethal range of the target.

These latest tests give the AMRAAM development program forty-three successes in fifty-one attempts. The Air Force plans eventually to acquire 17,000 AIM-120s, while the Navy will require an additional 7,000 of the missiles. Hughes is the AIM-120's prime contractor, and Raytheon is the second-source manufacturer.

In other Air Force missile news, the Rockwell AGM-130A rocket-propelled glide bomb completed its sixshot engineering flight-test phase with a successful full-mission profile on December 17 at Air Force System Command's Armament Division at Eglin AFB, Fla. The AGM-130 is a powered variant of the GBU-15 and uses a Mk 84 2,000-pound bomb as its warhead.

Four of the six engineering flight tests were marred by problems. In the first three tests, the rocket motor failed to separate. The weapon's autopilot failed on the fourth test. All of the problems, however, were unrelated. The fifth test was a success. The sixth launch tested the weapon's performance throughout its glide-boost-glide profile, jettison of the expended solid rocket motor, and guidance to the target. The weapon was launched from an F-4E and was guided to the target by a weapon systems operator (WSO) in another F-4E.

The AGM-130 will now undergo a series of development, test, and evaluation (DT&E) launches from F-4E and F-111 aircraft as well as ten initial

### Senior Staff Changes

PROMOTIONS: To be Lieutenant General: Ellie G. Shuler, Jr.

To be Major General: Joseph A. Ahearn; Robert M. Alexander; Billy J. Boles; Lester P. Brown, Jr.; Richard E. Carr; James E. Chambers; James R. Clapper, Jr.; John A. Corder; John M. Davey; Robert S. Delligatti.

Thomas R. Ferguson, Jr.; George B. Harrison; Harald G. Hermes; Frank J. Kelly, Jr.; George W. Larson, Jr.; Nathan J. Lindsay; Robert H. Ludwig; Charles A. May, Jr.; Gary H. Mears; William J. Porter.

Donald A. Rigg; Alan V. Rogers; James G. Sanders; John P. Schoeppner, Jr.; Charles J. Searock, Jr.; William H. Sistrunk; Joseph K. Spiers; Dale C. Tabor; Walter E. Webb III.

RETIREMENTS: B/G Richard S. Beyea, Jr.; L/G Harley A. Hughes; ANG M/G William G. Work.

CHANGES: Col. (B/G selectee) Dennis C. Beasley, from Cmdr., Airlift Communications Div., and DCS/C<sup>3</sup> and Computer Sys. (MAC), Hq. AFCC, Scott AFB, Ill., to Dir., C<sup>3</sup> and Computer Sys., Hq. USTRANSCOM, Scott AFB, Ill. . . . . M/G James S. Cassity, Jr., from Dir., Sys. Integration, Log., and Support (J-4/J-6), Hq. USSPACECOM, and DCS/Sys. Integration, Log., and Support, Hq. AFSPACECOM, Peterson AFB, Colo., to Cmdr., Hq. AFCC, Scott AFB, Ill., replacing retiring M/G John T. Stihl . . . Col. (B/G selectee) John W. Douglass, from Dir., Defense Prgms., NSC, Washington, D. C., to Dir., Planning and Integration, OSAF, Washington, D. C., replacing B/G Thomas W. Honeywill. . . L/G Michael J. Dugan, from DCS/P&R, Hq. USAF, Washington, D. C., to DCS/P&O, and Cmdr., AFCOS, Hq. USAF, Washington, D. C., replacing retired L/G Harley A. Hughes.

B/G Thomas W. Honeywill, from Dir., Planning and Integration, and Acting Dir., S&T, OSAF, Washington, D. C., to Dep. Cmdr., Launch and Control Sys., SD, AFSC, Los Angeles AFB, Calif., replacing B/G Donald G. Hard. . . B/G John R. Hullender, from Dep. Dir., Ops., NMCC, J-3, OJCS, Washington, D. C., to Dep. Dir., Legislative Liaison, OSAF, Washington, D. C., replacing B/G Burton R. Moore . . . Col. (B/G selectee) Ronald W. Iverson, from Cmdr., 3d TFW, PACAF, Clark AB, the Philippines, to Dep. Ass't DCS/Pers. for Eval. Prgms., Hq. AFMPC, Randolph AFB, Tex. . . . B/G Jay W. Kelley, from Sr. Mil. Advisor to Dir., ACDA, Washington, D. C., to Ass't DCS/Plans, Hq. AFSPACECOM, Peterson AFB, Colo.

M/G Michael C. Kerby, from Dir., Legislative Liaison, and Dir., Air Force Issues Team, OSAF, Washington, D. C., to Vice CINC, Hq. PACAF, Hickam AFB, Hawaii, replacing M/G (L/G selectee) James B. Davis . . . L/G James P. McCarthy, from Cmdr., 8th AF, SAC, Barksdale AFB, La., to DCS/P&R, Hq. USAF, Washington, D. C., replacing L/G Michael J. Dugan . . . B/G Burton R. Moore, from Dep. Dir., Legislative Liaison, OSAF, Washington, D. C., to Dir., Legislative Liaison, and Dir., Air Force Issues Team, OSAF, Washington, D. C., replacing M/G Michael C. Kerby . . . Col. (B/G selectee) Ben Nelson, Jr., from Cmdr., 50th TFW, USAFE, Hahn AB, Germany, to Ass't DCS/Plans, Hq. TAC, Langley AFB, Va., replacing Col. Thomas R. Griffith.

B/G Carl G. O'Berry, from Joint Prgm. Mgr., WWMCCS Info. Sys., and Ass't for WIS, OSAF, Washington, D. C., to Dir., C<sup>3</sup> and Computer Sys., J-6, Hq. USEUCOM, Vaihingen, Germany, replacing B/G Victor S. Stachelczyk. . . B'G Jon A. Reynolds, from US Defense and Air Attaché, USDAO, DIA, Beijing, China, to Mil. Ass't to Sec'y of the Air Force, OSAF, Washington, D. C., replacing B/G James S. Allen . . . M/G (L/G selectee) Ellie G. Shuler, Jr., from DCS/Ops., Hq. SAC, and Dep. Dir., Ops., STRACOS, Offutt AFB, Neb., to Cmdr., 8th AF, SAC, Barksdale AFB, La., replacing L/G James P. McCarthy. . . B/G Victor S. Stachelczyk, from Dir., C<sup>3</sup> and Computer Sys., J-6, Hq. USEUCOM, Vaihingen, Germany, to Dir., Sys. Integration, Log., and Support (J-4/J-6), Hq. USSPACECOM, and DCS/Sys. Integration, Log., and Support, Hq. AFSPACECOM, Peterson AFB, Colo., replacing M/G James S. Cassity, Jr.

### You Can't Win If You Haven't Prepared.

erretenan

Loral has been preparing for the ALE-47 Countermeasures Dispensing System competition for over 20 years.

Our experience applies directly to the problem of replacing countermeasures dispensing systems on U.S. tactical aircraft with a common design:

 Demonstration of an ALE-47 prototype that incorporates both 1553A and 1553B data buses.

Successful flight testing on an F-16 of an ALE-47 prototype



itterererer

manning

- that incorporates a MIL STD 1750 microprocessor.
  Interfacing of the ALE-47 with ALR-69 and modified ALR-56C Radar Warning Receivers.
- Ongoing risk reduction program.
- A direct demonstration of performance: Our existing ALE-39 System exceeds spec requirement on MTBF by a factor of more than 3X.

As a specialist in countermeasures and other areas of defense electronics, we bring a bias to action to every project—a management emphasis on "no surprises," a reputation for bringing in projects on time, on budget, on spec.

Loral: We're not only prepared. We're committed.

For more information, contact Business Development, 1210 Massillon Road, Akron, Ohio 44315-0001, 216/796-6624.



### SCIENCE SCOPE®

A new simulation demonstration lets U.S. Air Force pilots and air crews experience the hazards and difficulties in flight operations of large cargo aircraft in the vicinity of battle areas. The MAC-BARON simulation, developed by Hughes Aircraft Company, creates the battle environment and duplicates the sensor and navigational information available to the aircrew. The crew must then "fly" the aircraft to avoid detection and engagement by enemy airborne interceptors. Among the simulation's attributes, MAC-BARON emphasizes the importance of situational awareness to potential airlifters.

Carried aboard a new satellite, positioned to detect storms threatening the East Coast, are two experiments. The Geostationary Operational Environmental Satellite (GOES) H, designed and built by Hughes for the National Oceanic and Atmospheric Administration, includes a space environment monitor (SEM) and an experimental receiver. The SEM assesses magnetic field strength and direction, solar x-ray fluctuations, and particles in its vicinity that make up solar wind and radiation belts around the Earth. The receiver will be used to aid in international search and rescue missions by monitoring radio distress signals from troubled ships or aircraft throughout most of North and South America. GOES H is in geosynchronous orbit above the Atlantic seaboard.

<u>A new relay pod will enable real-time, two-way data transfer</u> between ships and remotely piloted vehicles (RPVs) at altitudes as low as 500 feet, and ranges up to 350 nautical miles. Designed by Hughes, the relay pod could be carried by a Grumman A-6 aircraft for the U.S. Navy mid-range RPV program to transmit video and infrared reconnaissance data. Using the relay pod on such missions gives a commander access to data in near real-time. Principles and concept for the design were demonstrated in 1987 during the U.S. Army Intelligence-Early Warning RPV program at Ft. Huachucha, Arizona. Successful airborne and ground relays of tactical data were completed in conjunction with the Development Sciences Corporation Skyeye RPV.

A new electronic warfare receiver is increasing the probability of intercept of threat radar emitters in dense signal environments. The Microscan Receiver, built by Hughes, allows detection of low-level signals even in the presence of much larger in-band signals. Pulses as short as 50 nanoseconds can be detected with 100 percent probability over an instantaneous bandwidth of 500 MHz, using the Microscan Receivers. All standard pulse descriptor words, including angle, are presented as digital word outputs from the receiver. These pulse descriptor words can be processed by Hughes' Emitter Characterizer, which provides emitter identification parameters. The result is positive emitter identification, or classification as an "unknown" if no comparison can be made.

<u>NASA's Magellan Mission will carry only one scientific instrument</u> during its detailed mapping exploration of the planet Venus. The Hughes-built synthetic aperture radar (SAR) will gather data in greater detail than any of the previous 20 U.S. and Soviet Venus probes. It will transmit images 30 times sharper than those gathered by the Hughes-built Pioneer Venus, which provided the first extensive scientific study of the planet. In a fixed polar orbit, Magellan will take 243 days to map nearly all of the planetary surface, taking pictures for 37 minutes during each of its three-hour orbits. The remaining time in orbit will be spent transmitting the data back to scientists on Earth.

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



Subsidiary of GM Hughes Electronics

### Aerospace World

operational test and evaluation (IOT&E) launches at Eglin during the remainder of the year.

★ The Navy has also been shooting some missiles lately. Three BGM-109 Tomahawk cruise missiles were launched in one week during mid-December, but the Trident II sealaunched ballistic missile program had its first failure after eight successful launches.

The December 11 Tomahawk test demonstrated the missile's conventional land-attack capability with submunitions. The Tomahawk was launched from an undisclosed surface ship, flew a fully guided mission of approximately 700 miles, and then engaged multiple targets at the Naval Weapons Center at China Lake, Calif. The nearly twenty-one-foot-long missile then performed a terminal dive on a ground target.

Two days later, another Tomahawk was guided to China Lake by its own onboard inertial navigation system. Once over land, the navigation set was updated by the terrain contour matching (TERCOM) system, which guided the missile to a designated area. The Tomahawk carried an inert warhead, and the missile was recovered and will be refurbished for later use.

The third BGM-109 carried a 1.000pound conventional warhead from an AGM-12 Bullpup missile and attacked a target ship hulk near the Pacific Missile Test Center at Point Mugu, Calif., after a 250-mile flight. The test, carried out December 15, marked the first time an operational ship had fired a Tomahawk from the deck-mounted Vertical Launch System (VLS). The Ticonderoga-class Aegis cruiser that launched the missile was not identified.

The Tomahawk cruise missiles are manufactured by General Dynamics and McDonnell Douglas.

After a month's delay, the eighth consecutive successful test of a Lockheed UGM-133A Trident II, or D5, SLBM was carried out on December 10 from a flat pad at Cape Canaveral AFS, Fla. The missile carried an instrumented test package and impacted in the Eastern Test Range in the Atlantic. The ninth test on January 21 was the program's first failure. The missile had to be destroyed by the range safety officer three minutes into the flight. The cause of the malfunction is under investigation.

\* APPOINTED—Earl W. Briesch has been appointed to be Air Force Lo-



### "The Spirit of Attack"

### AN UPDATED VERSION OF THE CLASSIC F-16 LITHOGRAPH BY MATTHEW AND MARK WAKI

"Only the spirit of attack born in a brave heart will bring success to any fighter aircraft, no matter how highly developed it may be.'

-Adolph Galland

The original "Spirit of Attack" is a 7' x 17' mural painted by the Waki Brothers for the 16th Tactical Fighter Training Squadron in March of 1980. Developed in the minds of the 16th TFTS pilots, the painting has become a classic with the original lithograph run of 1000 selling out in less than a year. After becoming the first F-16 squadron in the world, the 16th TFTS later became a combat ready fighter squadron and transitioned into block 15 Fighting Falcons. In the summer of 1986 the 16th TFS was disbanded and its number retired. In tribute to the 16th TFS the Wakis painted an update of the "Spirit of Attack."

"The Spirit of Attack" depicts a multi-bogey engagement, viewed from the fringe. The central figure is an F-16A in a hard left hand climbing turn-having just gunned a MiG-23MF Flogger and is now "pitching back" into a second engagement taking place at his left 7 o'clock two miles. The primary F-16's pilot is bracing his left hand on the canopy "towel rack" hand hold to assist in overcoming the g forces to observe this engagement. In this engagement the primary F-16's wingman is behind a Su-27 Flanker in a level right hand turn and has just launched an AIM-9L Sidewinder which is now tracking its

prey. Overhead of this fight is another SU-27 which is converting in the vertical to the lethal cone of the engaged F-16 (wingman). Timely entry into this fight by the primary F-16 (leader) is a prerequisite to the wingman's longevity. As a fight draws a crowd so does an aerial engagement, except that the crowd becomes participants. The painting is completed with the entry into the area by two F-16s from the left and two more MiG-23s, high center right, which are attracted by the fur-ball.

The scenario was "created" by the first fighter pilots to fly the F-16 and painted by the artists to represent a "spirit" to all those who trained with the 16th TFTS. The 16th TFS is gone, but the spirit will continue. It is a spirit of selfconfidence, teamwork and aggressiveness which makes American fighter pilots among the best in the world.

The updated "Spirit of Attack" was printed in a limited edition of 1000 and became available in March of 1986. LESS THAN 300 OF THE PRINTS REMAIN AS OF MARCH 1, 1988. This 16" x 34" lithograph is printed on acid-free paper and is signed and numbered by the artists. Because of the limited supply orders will be filled by post marked date. Order now.

Send \$48.00 check or money order to:

**AVIATION ILLUSTRATORS** 53 Scott Avenue Salt Lake City, Utah 84115

gistics Command's first-ever chief scientist and engineer. He will advise AFLC Commander Gen. Alfred G. Hansen on broad technology matters involved in keeping Air Force weapon systems in a high state of combat readiness. Among the avenues Mr. Briesch hopes to explore are the development of a ten- to twenty-year "technology road map" for the command, improved contact with the sister services, and a closer relationship with Air Force Systems Command. Mr. Briesch is currently Assistant Deputy Chief of Staff for Material Management at AFLC headquarters at Wright-Patterson AFB, Ohio, a position he will retain.

Manfred Wörner, the West German Minister of Defense, has been appointed Secretary General of the North Atlantic Treaty Organization.

### Aerospace World

Secretary Wörner, fifty-three, is the first German to assume NATO's top political position in the nearly fortyyear history of the Alliance. Born in Stuttgart, Germany, he studied law in Heidelberg, Paris, and Munich. Fluent in both English and French, Secretary Wörner earned his doctorate in international law at Munich University. He was elected to the Bundestag in 1965. Secretary Wörner replaces Britain's Lord Carrington as NATO's top civilian.

★ AWARDED—The Wright Brothers Memorial Trophy, awarded annually since 1948 by the National Aeronautic Association (NAA), was presented to Allen E. Paulson, Chairman and Chief Executive Officer of Gulfstream Aerospace, on December 11. The award recognizes lifetime achievement in aviation. Mr. Paulson was cited for "being instrumental in promoting general growth and heightening public interest in aviation affairs ... and he has been a promoter of general aviation safety."

★ MILESTONES—After being in a "deep freeze" for more than seventeen years, a Lockheed LC-130F that crashed on takeoff in Antarctica was dug out, repaired, and flown out on January 12 (see "Aerospace World," May 1987 issue). The plane took off from a site designated D-59, about 800 nautical miles from McMurdo Sound. After a high-speed taxi test, the ski-equipped LC-130 was flown to Williams Field, Antarctica, before being ferried to Christchurch, New Zealand. It was then flown back to the US for modernization. Pilot for the de-



The Wright Brothers Memorial Trophy was awarded in December to Allen E. Paulson (second from right), Chairman and CEO of Gulfstream Aerospace, for his lifetime achievement in aviation. Presenting the award are (left to right) Jim Gormley, President of the Washington Aero Club; Lee Iacocca, Chairman and CEO of Gulfstream's parent corporation, Chrysler; and Clifton von Kann, President of the National Aeronautic Association.

parture was Navy Cmdr. Jack Rector.

A Royal Air Force VC-10 tanker passed two milestones on a roundtrip flight from England to the Falkland Islands in late December. The VC-10 arrived at Mount Pleasant AB in the Falklands fifteen hours and forty-five minutes after leaving Britain on December 19 on what is believed to be the first nonstop north-to-south sortie on this route. The plane then shaved more than two hours off the old time for the return trip the next day when it took the crew fourteen hours, fifty-eight minutes to fly back to RAF Brize Norton.

What are thought to be the last Cessna O-2As in the Air Force inventory were retired on December 3. The three planes were flown from Ed-



The canopy for the first Bell-Boeing V-22 Osprey flight-test article was recently installed at Boeing's Philadelphia, Pa., facility. The canopy frame is constructed of titanium and weighs 160 pounds, excluding the transparencies, which are resistant to birdstrikes. The flight-test article was later shipped to the Bell Helicopter plant in Fort Worth, Tex., where it will get its wings and engines. First flight is scheduled for the middle of this year.

wards AFB, Calif., where the pushpull, twin piston-engine aircraft had been used for logistical and test-support work, to Kelly AFB, Tex. Ferry pilots were Maj. John Litton, Capt. Scott Eshelman, and Capt. Jim Banas. The Air Force originally purchased almost 350 of the twin-boom O-2s, which were military versions of the Cessna Model 337 Super Skymaster, during the Vietnam conflict for use in the forward air control mission.

On December 2, Test Cell 4 at the Air Force Weapons Laboratory at Kirtland AFB, N. M., was opened for business. Test Cell 4 had been modified to accept the installation of the initial hardware for the EMRLD ("emerald") laser, a technology effort being considered for ground-based laser applications pertaining to the Strategic Defense Initiative. EMRLD (Excimer Moderate-powered Ramanshifted Laser Device) is designed to produce laser beams of both high power and excellent atmospheric penetration by generating a beam, splitting it, processing it, and then rejoining it.

The first of sixteen Sikorsky S-70B-2 Seahawk helicopters for the Royal Australian Navy made its first flight on December 4. Two of the Seahawk helicopters will be built at Sikorsky's main plant at Stratford, Conn., with the remainder to be built under license at Hawker-deHavilland's plant in Bankstown, Australia. The Seahawk, a derivative of the US Army's UH-60 Black Hawk, will be used by the Australian Navy for antisubmarine and other naval missions. Sikorsky was also recently awarded a \$983.2 million Army contract for 252

# E RIGHT STUFF

CHOO O DH

Rolls-Royce & Turborneca. Part of the T45TS team.

How in future will student pilots learn to fly with aggression and confidence into the blue without putting the training budget into the red?

Introducing the Adour in the T-45A 'Goshawk' trainer for the U.S. Navy.

The T-45A with the uniquely-designed Adour turbofan, enhances the student pilot's flying skills.

While it will help train 600 pilots a year, 42% fewer aircraft will be needed.

25% fewer flight hours. 15% less time to train, which add up to high percentage savings on in-flight training.

The Adour has exactly the right cycle for low fuel burn and high thrust through the flight envelope. Sipping 60% less fuel than the Navy's current trainers. What's more, the Adour's modular design helps reduce downtime and gives a 20% reduction in spare engine requirements.

And while the student will enjoy freedom of engine handling to manoeuvre like a member of the famous Red Arrows aerobatic display team, the end result will be training at half the cost.

So while the student will be learning, the U.S. Navy will be saving. Megabucks.

This evolved engine has over 2 million flight hours training pilots, in the most extreme conditions worldwide. No wonder the T-45A was the winning candidate in the U.S. Navy VTXTS competition. It's the very stuff of the right stuff.



ROLLS-ROYCE INC., 475 STEAMBOAT ROAD, GREENWICH, CONNECTICUT 06830. TURBOMECA, BORDES, 64320 BIZANOS, FRANCE.

### **COST-EFFECTIVE** Grumman Data Systems creates information systems to meet your budget and schedule. And

we've been doing it for more than 25 years. We design, develop, integrate, operate and maintain large-scale systems to solve the most complex problems. Systems that are cost-effective, user-friendly, dependable and expandable. In short, value-added systems that do more than meet program requirements. For more information,

contact Grumman Data Systems, 1000 Woodbury Road, Woodbury, NY 11797. (516) 682-8500.



Data Systems A registered trademark of Gromman Corporation

M M A N

#### Aerospace World

additional Black Hawks to be delivered by 1991. Nearly 1,200 UH-60s have either been delivered or are on order.

Russian **Cosmonaut Yuri Ro**manenko returned to earth on December 29, thus setting a human endurance record of 326 days in space. Mr. Romanenko, along with Cosmonaut Alexander Alexandrov (who had been aloft since July) and safety pilot Anatoly Levchenko (who had lifted off only a week before with the crew of Soyuz TM-4), returned to earth from the Mir ("Peace") space station aboard the Soyuz TM-3 capsule. The balance of the TM-4 crew will remain aboard the station.

The return of Mr. Romanenko now gives the USSR nearly three times more man-hours in space than the US. The Soviets have six cosmonauts with more than 300 days in space. By comparison, the US record-holders— Astronauts Gerald Carr, George Gibson, and William Pogue—are pegged at eighty-four days in space.

★ NEWS NOTES—According to the Utah Department of Employment, Hill AFB is once again Utah's largest employer. With more than 20,400 employees, the base easily outdistances the University of Utah (11,000 employees) and the largest private, civilian employer, Morton Thiokol (8,000). The base had a payroll of \$586 million in FY '87, with some \$467 million of that figure going to civilian employees.

Late last year, Air Force Systems Command's Aeronautical Systems Division at Wright-Patterson AFB, Ohio, awarded the Boeing Military Airplane Co. in Wichita, Kan., a \$41.9 million contract for twenty-three additional Common Strategic Rotary Launchers (CSRLs). This is the third production increment in the CSRL program. BMAC will build 104 of the launchers through 1992. The launchers will be installed in B-52H aircraft, but will include conversion kits to allow installation in the B-1B bomber. The first B-52H to be fitted with a production CSRL will be delivered to Strategic Air Command in April and will be stationed at Carswell AFB, Tex.

The Strategic Air Command has changed its missile crew assignment policy, and mixed male/female launch crews will now be allowed in Minuteman and Peacekeeper missile silos. The change was implemented on January 1. Previously, two women or two men had filled the launch crew slots for the two intercontinental ballistic missile systems. One reason for the change was to al-

AIR FORCE Magazine / March 1988



BRU-46/A 14 Inch F-15 E

F-15E

## **Major Benefits**

- Reliable operations
- Life: 1,800 shots to overhaul
- In production now for F-15E aircraft
- Reduces aircraft maintenance turn times
- Inclusion and an inclusion and a same little
- Improves overall aircraft combat capability
- Configured to MIL-STD-2088 and MIL-A-8591

Contact Marketing Department, EDO Corporation, Government Systems Division, College Point, NY 11356-1434, USA • Phone (718) 445-6000 Telex 127431

CORPORATION DIVISION
Where Technological Innovation Becomes Reality

low for more flexible assignment of crew members.

In mid-December, Lockheed Aeronautical Systems Co.-Georgia delivered the **twentieth C-5B to the Air Force.** The aircraft is assigned to the 436th Military Airlift Wing at Dover AFB, Del. Since delivery of the first C-5B in early 1986, the fleet has accumulated more than 15,000 hours of flight time. Other C-5B units include the 60th MAW at Travis AFB, Calif., and the 443d MAW at Altus AFB, Okla. The last of the fifty C-5Bs on order will be delivered next year.

*(ERNMENT* 

On April 22, new regulations will go into effect completely **prohibiting smoking on all US passenger airline flights of two hours or less.** The ban applies to all interstate, intrastate, or overseas flights. The antismoking language was contained in the transportation appropriations continuing resolution approved by Congress and

#### Aerospace World

signed by President Reagan. Smoking has also been prohibited on all small military aircraft with fewer than thirty seats. Smoking is allowed on larger aircraft, provided there is adequate ventilation. Smoking is prohibited on all SAC aircraft and in military buses and vans.

For the second consecutive year, the American people have rated the US military as the institution in which they have the most confidence. Unlike last year's poll, though, the military tied for the top spot with organized religion, the perennial public confidence king. Sixty-one percent of those polled by the Gallup organization said they had a "great deal" or "quite a lot" of confidence in both the military and organized religion. Public confidence in the military has grown steadily from a fifty-four percent mark in 1979. Confidence in newspapers, however, has fallen from fifty-one percent in 1979 to a low of thirty-one percent this year.

★ DIED—Maj. Gen. Earl O. Anderson, former Air Force Reserve vice commander and the first Deputy to the Chief of the Air Force Reserve at the Pentagon, on January 8 in Marietta, Ga. He was sixty-three.

He entered the military at age eighteen, and by the next year he became one of the youngest B-24 flight leaders in World War II. He flew forty-nine combat missions in the Southwest Pacific theater with the 307th Bomb Group. General Anderson joined the Reserve in 1955 and was one of the first members of the Air Reserve Technician program. In 1960, as commander of the 452d Military Airlift Wing, his groups at March AFB, Calif., became the first Air Force Reserve units to participate in the Reserve Associate Program.

General Anderson retired in 1976. He had served as the national president of the Reserve Officers Association.

George Wunder, who wrote and drew the comic strip Terry and the Pirates from 1947 to 1973, died at the New Milford, Conn., Hospital on December 13 after suffering a heart attack. He was seventy-five.

Mr. Wunder took over Terry and the Pirates, which had been created by Milton Caniff, after Mr. Caniff started Steve Canyon. Mr. Wunder began his career with the Associated Press. While at AP, he prepared the photos and artwork of the crash of the German dirigible *Hindenburg* for wire transmission in 1937. After a stint in the Army Air Forces during World War II, he returned to AP briefly before being selected to draw *Terry and the Pirates.* He was selected after a nationwide search for a new artist by the Chicago *Tribune* and New York *Tribune* syndicate.

He was consistently called on by the Air Force for assistance in calling public attention to the necessity of military pay increases and the overall need for a strong aerospace defense posture. And he consistently responded, in spades.

Terry and the Pirates went out of syndication in 1973 after Mr. Wunder suffered a ruptured spleen, and because of contract disputes, no replacement artist could be found. Upon retirement, Mr. Wunder published an illustrated history of the American Revolution, Amateurs at Arms.

Retired Marine Col. Gregory "Pappy" Boyington, the fifth-ranked American ace of World War II, died of cancer in a hospice in Fresno, Calif., on January 11. He was seventy-five.

Most noted for how he molded VMF-214 (The Black Sheep) into a first-rate fighter unit in the Solomon Islands during the war, Colonel Boyington is credited with shooting down twenty-eight Japanese aircraft. He and his men were also noted for their disregard of service regulations and their casual attitude toward everything except combat. Colonel Boyington, an Idaho native, was awarded both the Navy Cross and the Congressional Medal of Honor for his actions while leading the squadron.

Colonel Boyington began World War II as a pilot with the American Volunteer Group in China, and he spent the last twenty months of the war as a prisoner of the Japanese. After the war, he penned his autobiography, Baa Baa Black Sheep, and worked at a variety of jobs before serving as technical advisor to the TV series "Baa Baa Black Sheep," which aired on NBC from 1976–78.

### Index to Advertisers

American Cyanamid Co.	
AT&T Technologies, Inc.	15
Aviation Illustrators	
Bell Helicopter Inc./Boeing Helicopter Co.	Cover III
Boomerang Publishers	117
Data General Corp	
EDO Corp., Government Systems Div	
Fusion Plus	113
GE Astro-Space Div.	11
General Dynamics Corp	
Greater Omaha Convention and Visitors Bureau	114
Grumman Data Systems Corp	
Harris Corp., Government Support Systems Div.	
Harris RF Communications	
Hughes Aircraft Co	
Interstate Electronics Corp	
Israel Aircraft Industries Ltd.	19
Litton Industries, Guidance and Control Systems Div	
LORAL Defense Systems-Akron	
LTV Missiles and Electronics Group, Missiles Div	12
Lucas Aerospace Ltd.	
Martin Marietta Corp	2 and 3
McDonnell Douglas Corp	. 106 and Cover IV
Military Data Corp.	114
Northrop Corp.	
Pilatus Aircraft Ltd.	20
Rafael Armament Development Authority	14
Raytheon Co.	38 and 39
Rockwell International, Collins Government Avionics Div	
Rolls-Royce plc	33
Tracor Aerospace, Inc.	16
Wang Laboratories, Inc.	23
• 	
AFA Insurance	118 and 119
AFA Member Supplies	

AFA/PES Automobile Lease-Purchase Program ..... 115

## The Heart of Mission Success

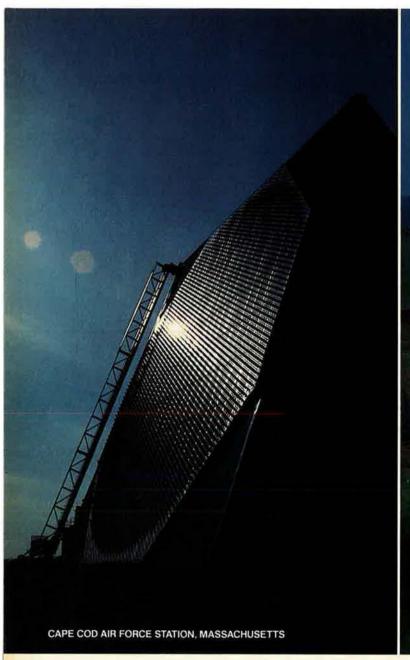
# Military Leaders Know They Need Precise Navigation.

After five complete generations of navigation advancements and more than 25,000 systems delivered, *pilots and engineers, mission analysts and avionics specialists* have learned to rely on the world leader, Litton, for innovative, superior inertial navigation technology. Litton's systems are currently on all U.S. Air Force, U.S. Navy and U.S. Army high-performance aircraft, in addition to many international aircraft.

For information write Guidance and Control Systems, 5500 Canoga Avenue, Woodland Hills, 91365 CA.

#### Litton

Guidance & Control Systems



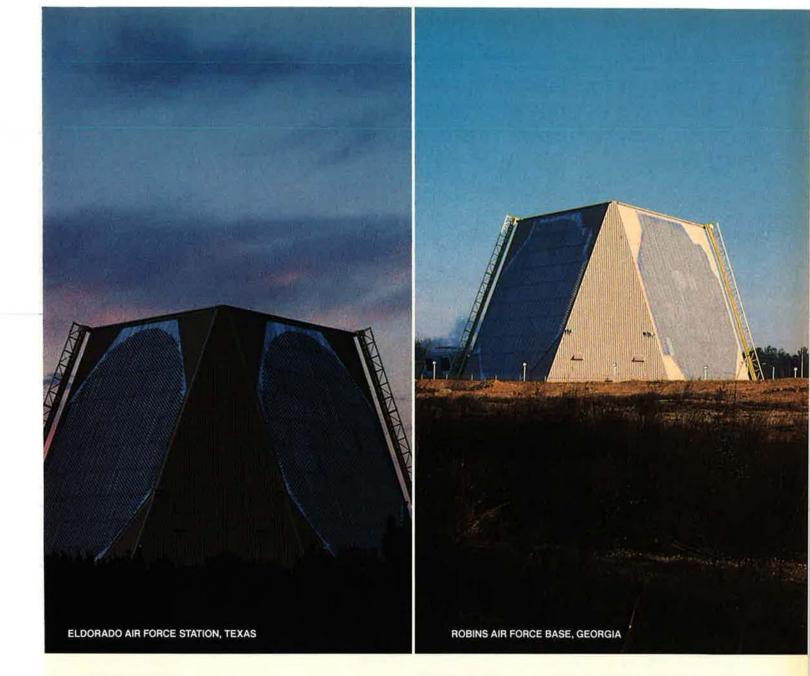
BEALE AIR FORCE BASE, CALIFORNIA

#### All-around see power.

Hostile submarines can no longer count on surprise if they attempt a missile attack on the United States. With the completion of the Air Force's network of Pave Paws radars, submarine-launched ballistic missiles can now be detected up to 3,000 miles from each of these strategically located phased array installations.

Designed and built by Raytheon, these 10-story-high electronic eyes are so precise that they can spot, identify, and track multiple targets as small as basketballs 1,200 miles away. Their beams reach out over vast areas of the Atlantic, Pacific, Arctic, Caribbean, and Gulf of Mexico to scan millions of square miles in seconds.

Pave Paws systems are among the most advanced and reliable phased array radars in existence. And Raytheon's long experience in defense electronics helped achieve time and cost efficiencies from the very beginning of these projects. All four, including the newest one at Eldorado Air Force Station in Texas, were completed on or ahead



of schedule and under budget.

The capabilities and outstanding reliability of this radar network are direct results of our strict adherence to the proven fundamentals of antenna design, systems management, and phased array technology—plus our ability to apply those fundamentals at the job site. Each of these four radars is tangible proof that, at Raytheon, quality starts with fundamentals.

Raytheon Company, Government Marketing, 141 Spring Street, Lexington, MA 02173.



Where quality starts with fundamentals

Russia's defense leaders are willing to take short-term risks in the hope that Gorbachev's economic reforms will sustain Soviet military power over the long term.

THE Soviet economy, exploited with ruthless efficiency by Russia's military men for a quarter of a century, is turning on its masters.

Today, the USSR's defense establishment is feeling the brunt of a domestic economic crisis. Though the military still gets new arms in abundance, it is being called on to make three sacrifices.

The armed forces are being tapped to contribute not only money but managers and manufacturing assets to advance Mikhail S. Gorbachev's "perestroika" campaign to rescue the economy from disaster.

This contrasts sharply with the situation since 1964, when Leonid Brezhnev gave the Soviet military carte blanche for a massive buildup.

The upshot of the new Kremlin leader's actions, in the view of a new congressional study, is that Soviet "military priorities no longer have overriding primacy" over efforts to rectify vast economic woes.

The scope and magnitude of the backwardness attributed to the Russian economy are underscored by a sampling of problems documented in the 1,132-page report, "Gorbachev's Economic Plans," prepared for Congress's Joint Economic Committee (JEC):

• Unfamiliarity with modern technology causes Soviet engineers to take more time to copy the design of an IBM computer than it takes IBM to develop it from scratch.

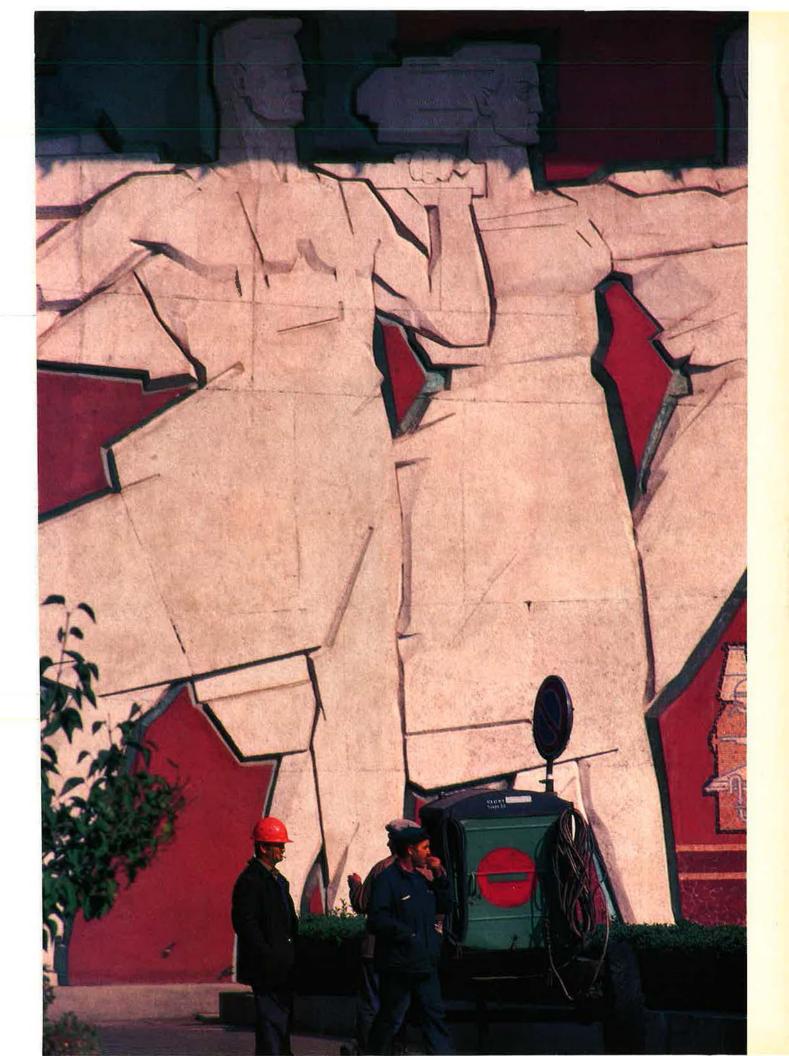
• Inadequate production and distribution of hospital supplies compel medical personnel to reuse old bandages and needles.

• Distrust of modern fastening machines leads workers to use welds in aircraft assembly rather than to use stronger, more reliable rivets.

• Neglect of transport and storage facilities results in loss of twenty to thirty percent of the annual wheat crop before it gets to the mill.

# GORBACHEV'S ECONOMY

BY ROBERT S. DUDNEY SENIOR EDITOR In today's Soviet Union, the image of a heroic, dynamlc labor force and economy is only a facade. These workers at a hydroelectric station in Volgograd are part of a dwindling national supply of workers. Also fettering the Sovlet economy are problems of raw materials, capital, and political meddling.



• Bureaucratic bungling has left only twenty-three percent of Soviet trucks and one percent of buses equipped with fuel-saving diesel engines.

• Out-of-date machining processes waste 638 pounds out of every ton of steel used in production of locomotives.

• Poor planning causes the fattening of Soviet livestock to take twice as long and to require twice as much feed as in the US.

A maximum estimate of the size of the Soviet economy, despite Russia's larger population, is put at but fifty-five percent of that of the United States—a figure even Russian authorities do not dispute.

Soviet economic performance by most estimates, poor since 1975—has been getting worse. Between 1969 and 1975, growth of Russian GNP averaged four percent, but fell to only two percent between 1975 and 1985.

Now, long-standing strains stemming from bureaucratic blockages, and vast military demands—as much as seventeen percent of GNP—are compounded by dramatic structural change: An unprecedented decline in growth of the supplies of labor, raw materials, and capital.

#### **Major Political Challenge**

The combined impact of these problems is viewed as presenting a new and major political challenge to Soviet military men.

For one thing, according to CIA analyses included in the JEC study, Russia's economic slowdown has caused a leveling off-though at high levels-of new weapons procurement across the board. Second, experts see increasing "conscription of the defense industry" to aid civilian industrial production in areas ranging from industrial robotics to tractors. Finally, top defense industry executives, the "best and the brightest" of the Soviet economic system, are being transferred to critical civilian posts-especially in aviation.

Does all of this mean that Moscow, seventy years after the Revolution, is on the verge of renouncing military power in world affairs?

On the contrary, experts say. The principal motivation for Gor-

bachev's reforms, in fact, may be the desire to sustain Soviet power over the long term.

A main conclusion of the JEC report is that Russia's defense leaders are going along with Gorbachev out of fear that worse times lie ahead if the military remains tied to a hideously deformed economy.

The analysts note that current economic growth is inadequate to provide investment resources for the military as well as for civilians.

More threatening for Moscow's superpower status is the USSR's relative backwardness in such high technologies as lasers, computers, telecommunications, and robotics—the stuff of tomorrow's weapons.

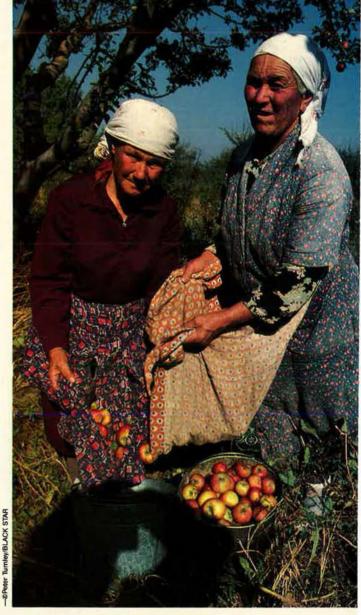
All spring from dramatic changes

occurring in Western economies that have bypassed Russia. The situation is summarized by Sovietologist Abraham Becker of the Rand Corp:

"In effect, the Soviet Union finds itself racing in an outer lane of a circular track while its adversary has the advantage of an inner lane. The price of [such] technical backwardness is the necessity to run harder. To escape the trap, the USSR must attempt to get closer to the hinge of the swing, to change lanes."

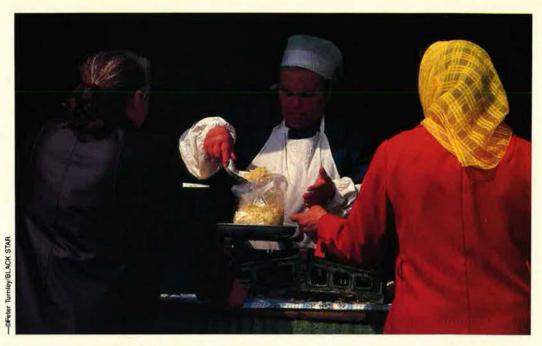
Thus, say the study's editors: "The military appears to have bought into Gorbachev's program to modernize the civilian economy, out of the belief that defense will be a major long-term beneficiary."

Soviet farm workers—such as these on a Soviet collective outside Tbilisi in the Georgian Republic are among the least productive in the world. Poor infrastructure, lack of equipment and supplies, a dilapidated transport system, and bureaucratic bungling are the main causes.



AIR FORCE Magazine / March 1988

Shopping for food at an open-air market in Moscow, center of the "worker's paradise." Long lines for groceries and other consumer goods, plus a thriving black market, are viewed as sure signs that there is a huge, pentup demand for a higher-quality diet. Meat, especially, is in chronic short supply.



How far Washington can and should go to exploit Moscow's economic crunch is a matter of intense debate.

Still, no matter how the United States responds, many analysts believe that the Kremlin has little time to show results before the military reasserts itself. The report warns that a showdown over resources may occur as early as 1990.

By that time, it asserts, "The civilian and military sectors could be on a collision course with respect to resource requirements." The military currently is quiescent. But "the situation could change if decisions are made to undertake major new military initiatives. Unless the industrial base is enlarged and modernized by the early 1990s, difficult choices will have to be made."

It is a tall order. The immense difficulties that the Soviet Union faces in this effort are pointed up in virtually every analysis of specific sectors of the Soviet economy that is contained in the congressional report.

#### The Rickety Industrial Base

These forbidding challenges are nowhere more apparent than in Gorbachev's avowed effort to spruce up and modernize Russia's rickety industrial base—the factories, plants, and assembly lines that form the bedrock of a modern economy and its military power.

Presently, Soviet industry consists of a collection of antiquated facilities plagued by low productivity, frequent mechanical breakdowns, and shoddy product quality.

Gorbachev's ambition: Raise the technological level and efficiency of Soviet industry to that of Western Europe and the US by the 1990s.

The stakes are high. "Industrial modernization is the key to Gorbachev's ultimate success or failure," contends CIA analyst Douglas Kreshover. "If his modernization program does not result in the development, production, and assimilation of substantial quantities of high-quality, sophisticated equipment, the gap between Soviet and Western technology is likely to widen during the 1990s."

Largely due to one-shot gains, say the analysts, growth in Russia's industrial output has turned upward somewhat from the depressed rates of the early 1980s. Even so, future prospects appear grim, even in industries ticketed for special attention.

A prime case in point is the Soviet machine-building industry, which is due to get an eighty percent boost in investment through 1990. Its output is to be raised by forty percent—a goal that must be viewed skeptically on the basis of the obstacles that are only too apparent.

One of these barriers is the sheer scale of the undertaking. The beginning of the 1980s saw an unprecedented falloff in production of machinery, such as turbines, locomotives, gas and oil drilling equipment, diesel and electric motors, metal-cutting machines, and transport and construction equipment.

Moreover, much of the machinetool manufacturing base, such as it is, has become obsolete and stands in dire need of replacement.

An illuminating example can be seen in a portrait of a typical hydromechanical equipment factory's machine capacity. About twelve percent of the plant capacity is under five years old, two percent is between six and ten years old, twenty percent is eleven to fifteen years old, and more than sixty-six percent is at least sixteen years old. Some is thirty to forty years old.

The problem is widespread. One Soviet official cited in the JEC study estimates that thirty to forty percent of machine-tool equipment in Russia has been in use for at least fifteen years.

The industry is victimized by a perverse Soviet incentive system that causes plant managers to resist shutting down production lines for modernization rather than risk not meeting output targets.

Thus, say analysts, Soviet managers delay replacing equipment until it is worn out, rather than when it goes obsolete. They stockpile replacement equipment to use at a later time. Even when new equipment is installed, they distrust it and keep the older machines as backups.

The costs of capital repairs, not surprisingly, are a drain of astronomical proportion on resources. A CIA estimate finds that outlays for repair of Soviet machines and equipment amounts to fifteen percent of all industrial investment five times the percentage in the West.

Ten to twelve percent of industrial workers and twenty-seven percent of metal-cutting machine tools are engaged in repairs.

#### **Bleak Outlook**

Apart from these woes, analysts are virtually unanimous in their prediction that the plans for the machine-tool industry will be blocked by bottlenecks in supply of iron and steel.

For Gorbachev's plan to work, the Soviet metallurgy industry will have to produce high-quality precision steel and specialty plates in place of the crude, mass-production heavy steels it favors. But poor production of metal products is almost certain to be the rule.

What stands in the way of more efficient use of metal? In the analysis of experts Boris Rumer and Yuri Vatkin, it is excessive use of crude casting techniques in lieu of precision metal-forming.

They report that extraordinarily high utilization of iron and steel casting characterizes Soviet machine building. In the 1980s, iron and steel casting constituted almost half of the metal used to produce machinery—2.5 times more than in Western industrial nations.

The resulting waste, and hence inefficiency, is enormous. Because of poor tolerances from castings and the need for labor-intensive machining of coarse surfaces, 6,000,000 tons of cast iron and 3,000,000 tons of steel end up on scrap heaps each year.

For example, in the production of heavy diesel engines, about 1,200 pounds out of every ton of steel goes down the drain.

This bleak outlook is repeated across the range of Soviet industrial enterprises. Two particularly noteworthy examples are the construction and heavy-steel sectors.

The Gorbachev initiatives are expected to create an enormous demand for quality construction and renovation. Modern, technologically advanced equipment requires facilities that have a broad assortment of heating and ventilation features not found in current structures.

Even so, the inefficient and trouble-plagued construction industry is not likely to rise to the task—at least not anytime soon. Soviet officials themselves report that an incredible twenty-five percent of all ongoing construction projects have been under way for ten to twenty years. The upshot, reports Robert E. Leggett of the CIA: "Construction time is so long that plants are often obsolete before they are brought on line."

Also hampering construction, in the CIA's view, is slack production of gypsum, concrete, and other basic materials. Chemical additives—essential for building materials exposed to extreme cold—as well as steel-reinforcing material and crushed stone are in short supply.

Industrial modernization depends on the ability of the steel industry to improve sharply the quality and expand the variety of steel products provided to key sectors of the economy—from drill pipe for oil rigs to high-performance electrical sheet for transformers. But in the considered opinion of intelligence analyst Cheryl A. Harris, because of outmoded facilities and little incentive to seek quality over quantity, "the steel industry is ill-prepared to meet the challenge."

#### Stagnant Energy Industry

In another critical economic sector—energy production—the outlook for Gorbachev's program is deemed to be little better, despite Russia's vast endowment of natural resources.

The need for expanded production is made urgent, in part, by wasteful energy use—consumption of two to three times more for each unit of economic output than in any other industrial nation.

The situation reaches absurd proportions in the Soviet trucking industry. According to Albina Tretyakova, an analyst with the US Census Bureau, only twenty-three percent of the 9,000,000-vehicle Soviet truck fleet runs on diesel engines, though these motors are thirty percent more efficient than gasoline-fueled engines.

The Soviet oil industry, the world's largest, was once able to feed such energy appetites with ease. No more. The Soviet Union is grappling with stagnant rates of oil output in virtually every producing area.

The downturn looks permanent to experts. "The Soviet petroleum base . . . should now be viewed as probably a physically constrained energy resource opportunity," reports industry analyst John J. Schanz, Jr. "After a century of exploitation, it can no longer be relied on to expand very much in the intermediate term, even though it can be pushed modestly upward by heroic efforts in the short term."

#### **Damaging Overproduction**

The experts cite mismanagement as a factor in the decline. They point to damaging overproduction in the giant Samotlor oil field as one example of bureaucratically induced problems. Samotlor production is now expected to decline by a quarter by 1990, far more than would have been the case with more professional exploitation.

The slack will probably be taken up by expanded production of natural gas. With forty percent of the world's proven reserves, analysts believe this sector has "an outstanding future."

Even so, the challenge of producing gas from Siberian fields is viewed as immense. The Yamburg field, the main gas field for the late 1980s, lies north of the Arctic Circle and presents more severe terrain problems than today's fields.

In its search for ways to ease the burdens on oil development, the Soviet Union will now seek to develop its eastern coal basins.

Coal production at most major underground mines is now stagnant. From 1980 to 1986, total annual output from underground coal mines fell by 17,000,000 tons. Production in the Donets basin—the USSR's largest producer of coal—is exhausted. The average mine depth is 605 meters—eight times the depth of the average US mine. Seams are thin.

The eastern coal is a resource of vast potential. But its worth is undermined by problems in technology and cost, low-grade energy content, inferior quality, lack of ready accessibility to miners, expense to transport, and problems in use.

Apart from the challenges posed by the industrial and energy sectors



of the economy, Russia's creaky agricultural system is in great need of repair. Gorbachev is out to do it, seeking significantly expanded output by 1990.

The verdict of the study's authors: Gorbachev will be lucky to maintain the current agricultural output, much less expand it.

Few enterprises in the world, it appears, operate with as much inefficiency as the farm economy in Mother Russia. Experts note that Russian agriculture lays claim to massive amounts of national resources—one-third of annual capital investment, thirty percent of the labor force, and yast tracts of land.

All told, agricultural subsidies account for fifteen percent of the state budget.

Yet the agricultural output per hectare is only half that in the US, whose farmers use far less land, manpower, and money for the job.

The impact is all too visible. Once a significant exporter of grain and other food products, the Soviet Union in the last few decades has become one of the world's largest importers of agricultural commodities.

"This reversal was not only an embarrassment for the Soviet government," asserts an intelligence expert. "It is mute testimony that its economic system was inadequate even to feed its own citizens."

A thriving black market and long lines at food markets are described as sure signs of enormous, pent-up **Renovating the Soviet** Union's rickety, antiquated industrial plant-typifled by this aging factory in Moscow, aboveposes an awesome challenge for the Gorbachev regime. Plans call not only for raising the technological level of Soviet heavy industry but for expanding and modernizing consumer-oriented "light" industry, such as this dressmaking facility in Moscow, at right. Industrial rejuvenation lies at the heart of "perestroika."

Peter Tumley/BLACK STAR

demand for a higher-quality diet especially meat. Nearly half the calories in the Soviet food supply are provided by grain products and potatoes, compared to only one-fourth in the US.

The problems continue despite agricultural performance in 1986 that was, by Soviet standards, impressive. The Soviet measure of gross agricultural output grew by 5.1 percent over 1985, vs. an average annual growth of 1.2 percent in the preceding five years. The year 1986 was also a record for the nation's livestock production.

The reasons for persistent problems in Soviet agriculture have nothing to do with climate, soil fertility, or other growing conditions. They are man-made.



One is negligence. The CIA's Barbara Severin, for example, points out that Russian meat production suffers from the failure of livestock growers to balance the kinds of feeds consumed by cattle and hogs.

Another torment is the Soviet agricultural bureaucracy. Farm managers are hamstrung by the state's constant meddling in their management decisions. Politics wins out over economics. Example: Scarce fertilizer often finds its way to the politically muscular Russian region when it would actually do more good if it were sent to the blackearth zone of the Ukraine.

Moreover, deficient performance in the industrial sectors that support the agricultural sector exacerbates the problem. Soviet agriculture suffers from scarcities in just about every item—balanced fertilizer, good seed, liming, specialized implements, and lightweight tractors.

In the 1980s, only fifty-three of the 144 necessary pesticide preparations were ever actually produced.

Perhaps the greatest problem, however, is the lack of Soviet agricultural infrastructure. Roads, storage facilities, and transport vehicles are dilapidated or nonexistent. Rural housing and civil amenities are scandalously decrepit.

It is the Soviet rural roadway system that confronts Russia with a crisis of truly awesome proportions. Agency intelligence analysts Penelope Doolittle and Margaret Hughes spell out the details.

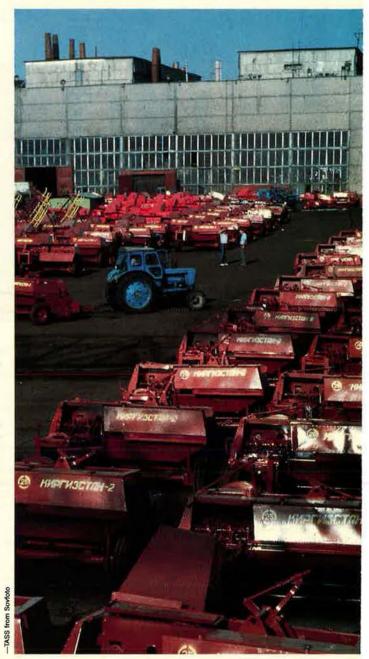
• Only twenty percent of the roads used to move farm workers to jobs, feed to livestock, and machinery to fields are paved.

• Some eleven percent of regional centers and eighteen percent of collective and state farms still have no reliable link to the main road system. By contrast, in the US, nearly all farms are linked to paved roads.

• In the Russian Republic, the most advanced farm area, only oneeighth of rural roads have hard surfaces.

Result: While there is a grain shortage, waste in transporting grain amounts to twenty percent. Waste and spoilage of fruits and vegetables are in excess of sixty percent. There are big shortages of paper, though forest resources are the richest in the world.

The top priority of "perestroika" is to produce more and better machine tools, matching the West's standard of quality and technology by the early 1990s. Such plants as the Frunze Agricultural Machinery Works in Kirghiz SSR, right, will get the lion's share of new investment in Gorbachev's big campaign to get Russia moving again.



Far and away the greatest challenge to Soviet military power in years ahead is Russia's technological backwardness. A major element of Gorbachev's economic reform program is to promote the modernization of Soviet industry by speedy technological change.

#### The Technology Gap

The Soviet leadership's sense of urgency about that nation's technological performance is perhaps best illustrated by its efforts to stimulate Soviet development of information technologies. These are microelectronics-based technologies for processing and transmitting information and include computers, semiconductors, and telecommunications equipment.

It is estimated that the US holds leads of from seven to twelve years in such advanced manufacturing categories as computer-operated machine tools, minicomputers, mainframes, supercomputers, software, and flexible manufacturing systems.

"The real revolution in Western manufacturing technology—the marriage of precision machine tools and microelectronics—has not fully reached the Soviet civilian or defense industries," observes Shelley Deutch of the CIA.

The Soviets have manufactured their own computers in quantity only since the 1960s, and the nation's computer hardware and especially software remain of exceptionally poor quality. The evidence is in the amount of computer personnel required to operate Soviet systems.

"Counter to the intent and the whole idea of computerized data processing," notes author F. I. Kushnirsky, "expanded use of computers led to a higher, not lower, demand for data-processing personnel."

Most contributors to the congressional report see a fundamental conflict between the rigid Soviet economic system and the imperatives—agility and flexibility—of the new information technologies.

"The Americans are innovators and standard-setters in information," concludes one. "The Soviets are adopters and adapters across the entire spectrum of this technology and its applications."

Even if the Soviets could unravel the computer's mysteries, there will be no early counterpart to the "networked America" of today, with various users linked together. The shortcomings of the Soviet telephone network will see to that.

In the view of Hudson Institute's Hans Heyman, Soviet telecommunications are nothing less than "archaic" in the extreme. "By any standard," he maintains, "the Soviet telecom sector is backward and inadequate—not only in comparison with its Western counterparts but also in relation to the needs of its own society."

A few comparisons with the US illustrate the point.

• While the US has 180,000,000 phones connected to a public network, the USSR has only 29,000,-000.

• Each year, US callers generate some 45,000,000,000 city-to-city calls; in the USSR, the yearly total is 1,700,000,000.

• US callers generate 311,000,-000 international calls annually; in the USSR, only 2,100,000 such calls are made.

Digital electronic switching is a standard in the West and is even being developed in such Third World nations as India, Brazil, and Taiwan. But the Soviet R&D establishment has not been able to master this technology. It has had to make do with a quasi-electronic switching technology not seen in the US since the 1960s.

#### **Disaster in Consumer Sector**

Over recent decades, Soviet authorities have achieved goals for investment in the military and other areas largely by squeezing the Russian consumer. The result is now plain to see—widespread shortages, poor quality, and unrealistic prices on goods and services ranging from housing to health care, from clothing to infant food.

Example: Gorbachev admits that in 1985 millions of meters of fabrics, pairs of shoes, and other consumer goods were returned to the producer because of shoddy workmanship. Waste attributable to lost material and inefficient labor by hundreds of thousands of people was enormous.

The crisis in Russia's consumer sector takes perhaps its most obvious form in the national healthcare system, a nightmare even by Soviet standards.

A paper by demographer Murray Feshbach reads like a case study of the consequences of underinvestment in health care. He argues that the pattern of increased illness for the population as a whole has spread to the military.

He reports that in the Soviet military:

• Bandages are reused after laundering.

• Vaccines are of poor quality and frequently ineffective.

• Old syringes are reused because of shortages.

• Nonsterile materials are frequently substituted for expensive sterile ones.

• Adhesives are applied instead of bandages.

According to Feshbach, half of the conscripts in some military districts experience intestinal problems during their tours of duty. The same proportion suffer from dysentery at least once in two years, and one-third get it twice. Poor sanitation is a leading cause.

The "childhood" diseases—especially diptheria, mumps, and measles—have increased among adults. Between 1966 and 1980, the incidence of mumps in the USSR increased by about fifty percent per capita. The prevalence of mumps in the military is now so great that it is openly referred to as "the soldiers' disease."

The incidence of hepatitis is high, and the disease has spread through the armed forces. Meningococcal infections have increased and are frequently aggravated by misdiagnosis. The number of deaths from pulmonary diseases quintupled between 1960 and 1980.

Medical problems among Soviet troops exist everywhere. Conscripts from Uzbekistan, the Baykal and Ural regions, as well as Siberia are cited for their particularly bad conditions.

"These recruits," says Feshbach, "undoubtedly reflect the general health status and illness pattern of young people throughout the country, if not the entire population."

#### **The Housing Calamity**

Provision of residential housing, which Gorbachev himself calls "an acute problem," is called one of the oldest and most persistent consumer calamities in the Soviet Union.

Scarcity is one problem. So tight is the supply of housing that only eighty-five percent of urban families have private dwellings. The rest live in multifamily communal apartments.

Even when housing is available, construction is shoddy. Reports from US analysts note that defects in new housing include missing wood floors, missing plaster on walls, crooked window frames and doors, leaking pipes, and lack of plumbing fixtures. New residents have to finish the work at their own expense.

Housing authorities rarely provide more than the barest amenities. In Leningrad, for example, all housing goes without hot water for two weeks each summer to permit maintenance of plumbing systems. Even in state-owned urban housing, only about thirty percent of dwellings have running water, sewer services, and central heating. The situation is far worse in the countryside.

Given these circumstances, Gorbachev might count himself lucky if he merely prevents the Soviet economic system from suffering a breakdown in years ahead—much less revitalizes it. The demands will be large, not least on the Soviet defense establishment. Gorbachev's definition of "reasonable sufficiency" does not differ that much from the goals stated by Brezhnev and Andropov.

# ANOTHER LOOK AT THE USSR'S

THERE are great hopes in the West that fundamental changes are taking place in the Soviet Union. Only two years ago, Mikhail Gorbachev, General Secretary of the Communist Party of the USSR, declared that "in the military sphere, we intend to act in such a way as to give nobody grounds for fears, even imagined ones, about their security."

Many Soviet leaders in the past have expressed similar sentiments, which at the time were taken at their face value. Invariably, some Soviet action—Hungary in 1956, Berlin in 1961, Cuba in 1962, Czechoslovakia in 1968, Afghanistan in 1979 shocked Western publics back to reality.

Now the "new political thinking" in Moscow is said to have brought about the following:

• Soviet military doctrine now has a purely "defensive" character.

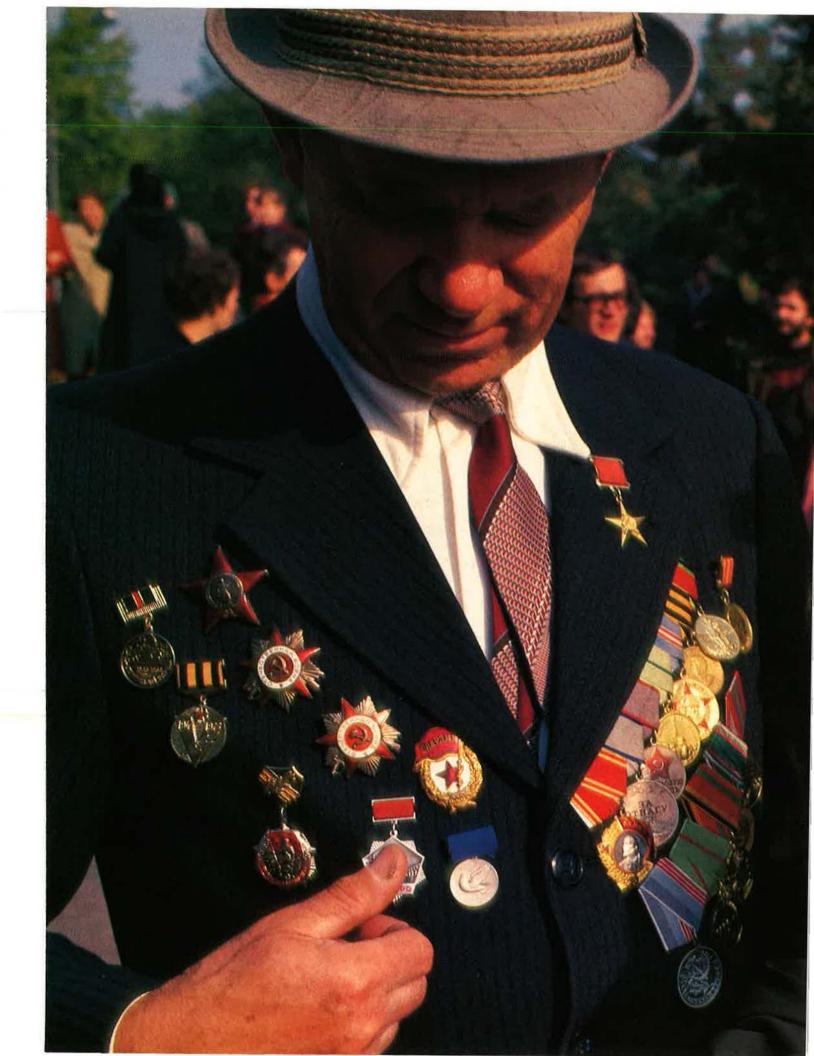
• The Kremlin's military forces are to be maintained at a level of "reasonable sufficiency."

• Society, industry, and the Soviet armed forces are being "restructured."

Assertions of changes under way in the USSR currently appear in the Soviet press, are broadcast by Soviet shortwave to the West, and are topics of conversation when NATO political leaders and scholars are invited to Moscow to meet with selected members of the Soviet Gen**"DEFENSIVE"** DOCTRINE

#### **BY WILLIAM F. SCOTT**

A Soviet war veteran proudly displays his military decorations. According to the teachings of Marxism-Leninism, the Soviet Union, by definition, can only wage wars that are "defensive" in character.



eral Staff and research institutes.

Suggestions that Kremlin leaders are placing increased emphasis on raising the living standard of the Soviet people rather than on a continued military buildup are having considerable impact on NATO defense planners. Some believe that deep cuts in both Soviet and NATO military forces can soon be accomplished.

In May 1987, a resolution of the Warsaw Pact Political Consultative Committee proposed that "authoritative" spokesmen from the Warsaw Pact and NATO get together to discuss their respective military doctrines. This sparked further optimism as to what might be achieved with respect to arms control and force reductions.

But if changes concerning Soviet military posture are really in the making, then significant modifications to Soviet military doctrine should ensue as well. Before defense planners act on the assumption that a new era has begun with regard to the Kremlin's military policies, they should reexamine basic Soviet military concepts and the current Soviet force structure.

#### **Soviet Military Doctrine**

By Soviet definition, military doctrine is the military policy of the Communist Party. It has two sides, political and military-technical. The political side is dominant and is formulated by the Party. The militarytechnical side is based on the findings of military science. Although the armed forces have primary responsibility for the military-technical side, final decisions are made by the Party leadership, not by the military.

Military doctrine is concerned with the essence, aims, and character of a potential future war, the preparation of the country and its armed forces for it, and the methods by which it will be fought. Provisions of doctrine have the force of law. Doctrine is not the same as military strategy, which executes the dictates of doctrine and is subordinate to it.

While Soviet leaders now assert that their military doctrine has a "purely defensive" character, a review of Soviet publications suggests otherwise.

Throughout the 1960s and 1970s,

statements found in Soviet military textbooks propounded the "offensive" nature of their military doctrine. For example, the Soviet Officer's Handbook stated in 1971 that "Soviet military doctrine is offensive in character." Another book issued by the Soviet Academy of Sciences stated that "our military doctrine carries an offensive [nastupatel'nyy] character." There was no pretense that Soviet military doctrine was otherwise.

This was to change not after Gorbachev rose to power but in 1981, following the 26th Party Congress. A second edition of the work published by the Academy of Sciences appeared. The earlier statement was altered to read: "Our military doctrine, as already pointed out, carries a defensive [oboronitel' nyy] character, with the aim of guarding the gains of socialism." Emphasis on the "defensive" character of Soviet doctrine has continued since.

#### **Resolving Contradictions**

For a time, it appeared that there was a contradiction between strategy and doctrine. A 1986 textbook explained that military strategy stresses strategic offensive operations. But how could this be if doctrine is defensive?

A 1987 book written for Soviet officers resolved this seeming contradiction. Military doctrine has two sides, the political and the military-technical—and only the political side is "defensive." This accords with declarations Kremlin leaders have made for decades. The 1939 Soviet attack on Finland, the 1968 invasion of Czechoslovakia, the 1979 invasion of Afghanistan—none had been offensive with respect to doctrine. Even the placement of nuclear-armed missiles in Cuba in 1962 was termed "defensive."

The Kremlin's military doctrine is rationalized in the "just war" tenet of Marxism-Leninism. Capitalist nations wage "unjust" and "aggressive" wars, unless they are allies of a Communist nation. World War II was an unjust war by all participants until Hitler's attack on the Soviet Union. Then it became the Great Patriotic War. In this period, the war was "just" for all nations fighting Hitler's forces. "Just" wars, the only type of wars in which the "peaceloving" Soviet Union would engage, by definition must be "defensive" wars.

Once a nation becomes involved in war, the military-technical side of doctrine requires that offensive actions be taken. Lenin's words are still quoted in Soviet texts and should be heeded by NATO planners:

"If we, in the face of such forces that are constantly actively hostile to us, would have to give a pledge, as has been proposed to us, that we would never resort to certain actions that in military-strategic relations might turn out to be offensive, then we would be not only fools but criminals... When fighting, one must not 'wear down' the enemy, but destroy him."

At the same time that Soviet military doctrine became "defensive," the leadership also became modest about Soviet development of new weapon systems. Marshal Ogarkov had this to say:

"We know, for example, that the United States built the world's first atomic bomb in 1945 and proceeded to use it to threaten the Soviet Union, which did not develop a similar weapon until four years later. What is more, the United States was the first to test an even more powerful hydrogen bomb in 1952, while the USSR followed suit in 1953. The Americans also were first to build nuclear-powered submarines armed with ballistic missiles in 1960, while the USSR followed suit in 1967. . . This list of strategic weapons could go on and on."

Such statements bring to mind George Orwell's 1984. What is presented as "truth" one day is removed from books the next, and a new "truth" is substituted. Prior to the 26th Party Congress, the Kremlin leadership had been very proud of its military research and development capability. A 1980 report contained the following:

"By 1947, the production of nuclear weapons did not represent a secret for us. In 1949, a nuclear bomb was created and tested in the Soviet Union, and, in 1953—earlier than in the United States of America—Soviet scientists created a thermonuclear bomb."

After the Party Congress in 1981, Washington was accused of developing new weapons that contributed to the arms race. There were no more statements in the Soviet press about specific weapon systems initiated by Soviet scientists.

Some in the West have suggested that the Soviets build up militarily in reaction to real or imagined Western actions. But the foregoing suggests that the action-reaction thesis simply doesn't explain the continued Soviet military buildup. As former US Secretary of Defense Harold Brown has said: "When we build, the Soviets build. When we stop building, the Soviets build."

#### "Reasonable Sufficiency"

NATO nations are now placing great hopes on Soviet statements about maintaining armed forces at the level of "reasonable sufficiency." This expression is thought to have originated at the Party Congress in February 1986 when General Secretary Mikhail S. Gorbachev stated, "Our country stands for removing weapons of mass destruction from use, for limiting the military potential to *reasonable sufficiency* [razumnoy dostatochnosti]."

Calls for "reasonable sufficiency" were gradually given increased notice in the Soviet press. In February 1987, Marshal Sokolov, then Minister of Defense, called attention to this statement by Gorbachev: "The Soviet Union is ready to renounce its status as a nuclear power and reduce all other arms to the minimum of *reasonable sufficiency*."

This concept of "reasonable sufficiency," emerging at a time when there are hopes in the West for a meaningful arms-control agreement with Moscow, is being carefully studied. But it is still not clear what Soviet spokesmen actually mean by "reasonable sufficiency."

All Soviet authors make clear that Soviet nuclear forces must be able to deliver a retaliatory strike on an opponent. In August 1987, Lev Semeyko, a retired colonel formerly on the faculty of the Frunze Military Academy, wrote that "the concept of reasonable sufficiency is oriented to the future" and implies "longterm action." It is not expected to be fully implemented until "nuclear weapons and other types of massdestruction weapons" are eliminated.

Thus, while it may appear that the Kremlin has found a new concept,

the words have a familiar ring. The United States has long sought to have an "assured second strike," meaning a strategic nuclear force that could survive a Soviet first strike and deliver a retaliatory strike on the Soviet Union. Moscow has maintained that they must possess sufficient nuclear forces "to give an aggressor a crushing rebuff."

It appears that General Secretary Gorbachev's "reasonable sufficiency" is much the same as had been stated twenty years previously. In March 1966, General Secretary Leonid I. Brezhnev told the 23d Party Congress that "the armaments of Soviet troops are maintained at the level of contemporary requirements, and their striking power and firepower are fully sufficient to crush any aggressor." In his speech at Tula in January 1977, Brezhnev stated that the allegation that the Soviet Union is "going further than is sufficient for defense . . . is absurd and totally unfounded."

During his brief tenure as the Party's General Secretary, Yuriy V. Andropov made a similar statement: "The defense capabilities of the Soviet Union and the countries of the socialist community are supported at the *necessary level*." There does not appear to be any real difference in the meaning of "fully sufficient" as stated by Brezhnev and "reasonable sufficiency" as used by Gorbachev.

#### The Revolution in Military Affairs

The Soviet concept of doctrine goes back to the early 1920s. After Joseph Stalin consolidated his hold over the Soviet military in the 1930s, however, all discussion of military doctrine ceased. Stalin alone was the military "genius," the source of all wisdom. This situation continued until his death in 1953.

While Stalin was alive, nuclear weapons were scarcely mentioned in Soviet writings, despite the fact that a massive nuclear program was under way. Within months after his death, the restricted journal of the Soviet General Staff, *Military Thought*, began a series of articles on the impact of nuclear weapons on military science.

By 1959, the Kremlin had concluded that the nuclear-missile weapon would be the decisive factor in future war. Therefore, it determined that the Soviet armed forces must achieve superiority over its probable opponents in such weapon systems. This was a doctrinal decision leading to the formation of the Strategic Rocket Forces in 1959.

The new military doctrine demanded a new strategy. This was formulated in the late 1950s and approved by the Party. Marshal V. D. Sokolovskiy, a former chief of the General Staff, headed a group of authors who presented the new strategy in an unclassified form to both the armed forces and the population as a whole in the book *Military Strategy*, first published in the summer of 1962, shortly before the Cuban missile confrontation.

Soviet strategists at that time anticipated that any future war with NATO forces would begin with a massive nuclear exchange. After all nuclear weapons were exhausted, the war would continue with whatever weapons were available until the final victory of communism was achieved. The slogan, "revolution in military affairs," was used to impress on the military, as well as the population as a whole, that the methods and consequences of war had changed.

By the latter half of the 1960s, the buildup of the strategic nuclear forces was well under way. Nuclear weapons were available in greater quantities and in different sizes.

Soviet military doctrine was then modified to include the possibility of a nonnuclear phase; that is, a war might begin with only the use of conventional weapons. It was anticipated that the conflict would escalate after several days, or perhaps weeks, to general nuclear war.

Even with this modification to doctrine, nuclear forces continued to have first priority in the Soviet military structure as "the main means of containment of the aggressive aspirations of imperialism."

The revolution in military affairs has not ended. Marshal Ogarkov in 1985 noted that it "is continuing in our day in connection with the *further development and qualitative improvement of nuclear weapons*, rapid development of electronics, and in connection with the significant qualitative improvement of conventional means and methods of armed conflict" (emphasis added).

That same year, General Colonel M. A. Gareyev wrote that the initial period of war may be decisive. "The virtually unlimited range of the nuclear weapon delivery systems, making it possible in a short period of time to defeat any grouping of enemy armed forces, has altered the notions of the nature of war." This is remarkably similar to statements made in the 1960s.

#### No Immediate Changes

Soviet leaders seek to link the defensive character of their military doctrine and the concept of reasonable sufficiency with a warning about the consequences of nuclear war. For example, at the 27th Party Congress in 1986, General Secretary Gorbachev stated that it is essential "to prevent nuclear war in order that civilization can survive."

His predecessors have made similar statements. In the 1950s and 1960s, both G. M. Malenkov and Nikita Khrushchev warned that entire continents would be devastated if a nuclear war were to occur.

But the utility of nuclear weapons was recognized. When Nikita Khrushchev in 1956 announced a major change in one of the basic tenets of communism-that war between capitalism and communism is no longer necessarily inevitable-he added that this was because the forces of communism now have "formidable means" that permit them "to give a smashing rebuff to the aggressors and frustrate their adventurist plans." The "formidable means" were the small stockpile of nuclear weapons then possessed by the Soviet Union.

Primary emphasis from the late 1950s to the present has been given to the deployment of ballistic nuclear weapons, primarily strategic. This was in accordance with the priority set forth by doctrine. In 1972, the trip to Moscow by the President of the United States was an acknowledgment that the Soviet Union was a military superpower a status gained primarily through its ground-based ICBMs. Without its military power, the USSR would be classified as an underdeveloped nation.

In 1981, Marshal Ogarkov wrote that nuclear weapons were so numerous that their military effectiveness had been negated. Were they to be introduced in a war, their destructive power would bring about an end to civilization. It was believed by many in the West that Ogarkov's writings signaled that the Soviets no longer thought that there could be any possible gain from nuclear war and were placing increased emphasis on conventional weaponry.

Yet the buildup of Soviet nuclear weapons went on. Conventional weapons are also constantly being improved and deployed. Mobile intercontinental ballistic missile systems are being deployed. Massive, deep, underground shelters have been prepared to house the leadership in event of war. Large signs in major cities provide civil defense information.

The deputy head of the Main Political Administration of the Soviet Army and Navy pointed out that "the concept of new thinking does not go against Leninist teaching on the defense of the socialist homeland." These same "Leninist teachings" were used to justify the Soviet nuclear buildup in the 1960s and 1970s.

When the "reasonable sufficiency" standard and the "defensive military doctrine" are examined in context, it does not appear that the use of these expressions indicates any immediate change in the posture of the Soviet forces, either nuclear or conventional or any combination of the two.

#### For Show?

Since the 1960s, Soviet writers have also warned that no weapon, including the nuclear weapon, should be "absolutized." Marxist-Leninist dialectics emphasize the constant "struggle" between offensive weapons and defensive weapons.

The ABM system that surrounds Moscow continues to be upgraded. During the December 1987 summit in Washington, Gorbachev acknowledged that Soviet scientists have been working on a more advanced strategic defense system. The Soviet Union is now dominant in manned space systems. New generations of Soviet weapons, superseding nuclear weapons, are currently receiving the Kremlin's attention.

Perhaps even now, Kremlin leaders have decided which of the new potential weapon systems will be decisive in a future war and are modifying their doctrine accordingly.

Since Gorbachev became the Party leader, the Soviet military press in some areas has become more restrictive than ever before. Foreign subscribers can no longer receive two major military journals, *Herald* of Air Defense and Foreign Military Observer. Fewer books on military matters are being published than previously. Travel restrictions for foreigners have not changed significantly since the late 1950s.

In 1973, the famed Soviet scientist, Andrei Sakharov, urged the West to speak out against "closed countries where everything that happens goes unseen by foreign eyes... No one should dream of having such a neighbor, especially if that neighbor is armed to the teeth." Fifty or so carefully sanitized areas for NATO arms-control verification teams do not change the cogency of Sakharov's warning.

Prudent NATO planners should note that there is nothing really new in Moscow's assertions about the "defensive character" of military doctrine or about force levels of "reasonable sufficiency." Thus far, the so-called new Kremlin policy of "glasnost" (openness) appears to be one primarily of "pokazuka" (for show). Signs of possible change in the Soviet Union do exist. While hoping that such change is in the best interest of all nations, we must not forget the lessons of Soviet history.

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 several return trips to the Soviet Union, the last being in 1987. Their next book, Soviet Military Doctrine, will appear later this year. Dr. Scott is presently a consultant to a number of research institutions and is a frequent lecturer at war colleges and universities. He is a regular contributor to the March issue of this magazine.

## NOW THERE'S A TRANSCEIVER THAT FOLLOWS THEM ANYWHERE



he global mission of the Air Force depends on fast, reliable communications, That's why for its PACER BOUNCE program the Air Force turned to one company. Harris RF Communications. The result is the multipurpose transceiver system

that has become the Air Force standard for fixed and mobile communications. Versatile enough for the full gamut of strategic and tactical communications, it's getting the message through—anywhere around the world.

gainut of strategic and factual communications, it's getting the message through—anywhere around the world. But Harris supplied far more than a great transceiver. With reliability—mean time between repairs—measured at 40,000 hours (800 percent higher than design specifications). And a program identified as one of the best managed by the Sacramento Air Logistic Center.

This demonstrated best buy has been available to every branch of the military, thanks to the convenience of the PACER BOUNCE program.

Does your program need a state-of-the-art transceiver system? Then call us today. Because when the message has to get through, you need Harris RF Communications. RF COMMUNICATIONS GROUP Long Range Radio Division 1680 University Avenue, Rochester, NY 14610 716-244-5830

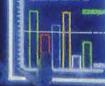












The true composition of power in the Kremlin is known only to the thirteen men who wield it.

**G**REAT efforts are being made to discern the real lineup of political power in Mikhail Gorbachev's Politburo. Before the Washington summit last December between President Reagan and the new Soviet General Secretary, US newspapers were filled with reports on the "key men in the Kremlin" and "the Gorbachev team."

The plain fact is that no one can be certain of the structure of power at the highest echelons of the Communist Party. It is only through the It has a long and checkered history, one that reaches even further back into history than the October Revolution of 1917.

On October 7, 1917, Vladimir I. Ulyanov, clean-shaven, wearing a wig for disguise, and calling himself by his pseudonym, Nikolai Lenin, was smuggled into Petrograd from exile.

Three days later, fifteen days before the Red uprising began, twelve members of the Central Committee met with Lenin in the apartment of

# **THE POLITBURO**

#### BY HARRIET FAST SCOTT

occasional volcanic eruption that flings unacceptable members out of the club that the US gains what little evidence it has about behind-thescenes affairs.

Even so, attempting to crack the Politburo is worthwhile, if only because how the West views Gorbachev's own political situation has great effect on how it deals with the Soviet Union as a whole.

What, then, are the facts about this organization, its influence, and its operations?

The Politburo (short for *Politicheskoye Buro*, or "Political Bureau") of the Central Committee of the Communist Party of the Soviet Union (CPSU) is the key policy-making body that directs the work of the Party between plenums of the Central Committee.

G. K. Sukhanov at No. 32 on the Karpovka Embankment. It was there that feverish final preparations began for the approaching uprising.

Feliks Dzerzhinskiy, founder of the Cheka (precursor of today's KGB), proposed the formation of a Politburo to be headed by Lenin. The first seven-man Politburo, including Leon Trotskiy, Joseph Stalin, Lev Kamenev, Grigoriy Zinoviev, Andrey Bubnov, and Grigoriy Sokolnikov, was organized by Lenin. This group gave political guidance to the revolution, but was disbanded not long after.

#### The Center of Power

The Politburo did not begin to function as a permanent agency until after the 8th Party Congress in



The Kremlin is a clear symbol of the Soviet Union. Much less clear is what takes place behind the walls of the old Russian citadel.

r

March 1919. Soon, however, it became the center of power, usurping the role of the Central Committee itself.

Composed of thirteen men today and never more than fifteen, the Politburo includes heads of higher Party and state agencies as well as the most influential and experienced political figures of the day.

Every five years, at the weeklong Party Congress, delegates assemble to pick, among other things, a new Central Committee of the CPSU. In 1986, 5,000 delegates, representing nearly 20,000,000 Party members, selected 307 members and 107 candidate (nonvoting) members.

Central Committees must hold at least one plenum every six months. The first of these is held before the Congress adjourns and is intended for the sole purpose of choosing a new Politburo that will carry out broad Party policy. They also select a new Secretariat that will handle the day-to-day work of the Party through departments.

Simple though it sounds, the Po-



Gorbachev

litburo selection process is a ritual fraught with intrigue and political significance of the highest order. Ultimate power rests in the hands of this small group. The most important political, social, economic, and Party questions are decided at meetings of the Politburo.

How does it operate? The Politburo runs on the basis of "democratic centralism," that is, "strict Party discipline and subordination of the minority to the majority" and "unconditional commitment to decisions of higher agencies by lower ones."

Translated, this means that once the leadership reaches a decision, no dissent is permitted or tolerated. The Party's actions are strictly subordinated to one center—the Politburo. In the current Politburo, it is Gorbachev himself, now about to embark on his fourth year in the General Secretary's post, who clearly dominates the action.

This is not to say, however, that there is a uniformity of views imposed by Gorbachev. The Politburo, in fact, is a microcosm of Soviet power and policies, reflecting the various regions, professions, and economic interests of society at large.

#### **The Current Lineup**

That much is made clear in a listing of the current lineup of members.

 Mikhail S. Gorbachev, a lawyer, is at fifty-seven the youngest of the Politburo's members. In Andrey Gromyko's 1985 speech nominating Gorbachev for General Secretary, he pointed out that Gorbachev had been a Party Secretary since 1978 and a full Politburo member since 1980. Gromyko further noted that Gorbachev had supervised the Secretariat for his predecessor, Konstantin Chernenko, and had also presided over Politburo meetings when Chernenko was not there. "A man of strong convictions" is the way that Gromyko described Gorbachev.

Gromyko warned that the "telescopes" of the world were focused on the Soviet Union. They are looking for cracks in the Soviet leadership, he said, but added, "We will not give our political enemies satisfaction on that score."

Gromyko did not fail to mention that Gorbachev had given close attention to the armed forces. In Politburo meetings, said Gromyko, the new leader had advised members of the necessity to "keep our powder dry." Gorbachev, contended Gromyko, always defended the "struggle" for peace and the need to keep Soviet defenses at the "necessary level" as "the holiest of holies" for all Soviet citizens.

• Nikolay Ryzhkov, fifty-eight, an engineer, is also a Politburo member. He was one of the first of the new Politburo appointees under Gorbachev, his elevation coming in April 1985. He became Chairman of the Council of Ministers—"Premier"—later that same year.

 Andrey Gromyko, seventyeight, an economist and diplomat, was appointed in 1973 to the Politburo. He has since July 1985 been Chairman of the Presidium of the Supreme Soviet—"President" of the nation. Until that time, the position of "President" had since 1977 been held by the General Secretary himself. Largely ceremonial, the post is seen as Gorbachev's reward to Gromyko for his support in the succession struggle. Gromyko from 1957 to 1985 served as Minister of Foreign Affairs. During World War II and after, Gromyko acted as Soviet Ambassador in Washington.

• Yegor Ligachev, sixty-seven, an aeronautical engineer, was also among the first of the Gorbachev appointments in 1985. As "second Secretary," he runs the Secretariat for Gorbachev. Western press reporting portrays Ligachev as being more "conservative" than Gorbachev, but there is little evidence one way or the other about this. He also is in charge of ideology and Party personnel, placing Gorbachev supporters in key Party slots.

 Aleksandr Yakovlev, sixty-five, a diplomat, was elevated to full



Ryzhkov

Gromyko

membership in 1987. Since 1986, he has been the Secretary in charge of ideology, propaganda, and culture. A former exchange student at Columbia University in New York, he accompanied Gorbachev to the Iceland summit in 1986 and to the Washington summit in 1987. He is a specialist on the United States and Canada, having served ten years as ambassador in Ottawa.

• Lev Zaykov, sixty-four, an engineer, was appointed to the Politburo in 1986. A Party Secretary since 1985, he is believed to be responsible for defense industry. In late 1987, Zaykov became First Secretary of the Moscow City Party Committee. The Moscow Party is second only to the Ukrainian Communist Party in size. He replaced the maverick Boris Yeltsin after the

AIR FORCE Magazine / March 1988

latter was ousted for "gross political errors." Zaykov will probably be giving up his post in the Secretariat as a result his assumption of the new duties.

• Viktor Nikonov, fifty-nine, an agricultural expert, was appointed to the Politburo in mid-1987. He graduated from the Azov-Black Sea Agricultural Institute. The first man to be added to the Secretariat under Gorbachev, Nikonov is responsible for Soviet agriculture—one of the most important jobs in the country.

• Nikolay Slyunkov, fifty-eight, an engineer, was elevated to full Politburo membership in mid-1987. On the Secretariat since January 1977, Slyunkov is currently responsible for general economics. It is possible that he will take over responsibility for defense industry from Zaykov. From 1965 to 1974, he was director of the Minsk Tractor Production Combine, part of the vast USSR military-industrial complex. Belorussian by nationality, he was First Secretary of the Belorussian Communist Party until 1987.

• Viktor Chebrikov, sixty-four, a





Ligachev

Yakovlev

metallurgist, was elevated to full membership in the Politburo in April 1985. Holder of the rank of General of the Army, Chebrikov took over as head of the KGB in 1982 when Yuriy Andropov was appointed to the Secretariat as the Party's ideologist. Chebrikov had been Andropov's deputy since 1968.

• Eduard Shevardnadze, sixty, a historian, was appointed to full Politburo membership when he became Minister of Foreign Affairs in 1985. Shevardnadze and Gorbachev both reached the Party's inner circle in 1978: Shevardnadze joined the Politburo as a candidate member, and Gorbachev became part of the Secretariat. A Georgian by nationality, he headed the MVD police there before becoming First Secretary of the Georgian Communist

AIR FORCE Magazine / March 1988

Party. He has met many times with Secretary of State George Shultz on arms-control matters and summit planning.

• Vitaliy Vorotnikov, sixty-two, an aeronautical engineer, was raised in status to full Politburo membership in June 1983. At that time, he became "Premier" of the Russian Soviet Federated Socialist Republic. He served as Soviet envoy to Fidel Castro's Cuba from 1979 to 1982.

• Mikhail Solomentsev, seventyfour, an engineer, was appointed to the Politburo in 1983 after twelve years as a candidate. As chairman of the Central Committee's Party Control Committee, he is responsible for Party discipline. From 1966 to 1971, Solomentsev was in the Secretariat, overseeing heavy industry. For twelve years, he served as "Premier" of the Russian Republic.

 Vladimir Shcherbitskiy, seventy, a chemical engineer, received full Politburo membership status in 1971. He had been a Politburo alternate from 1961 until he was ousted in 1963. Ukrainian by nationality, he has long been associated with the Dnepropetrovsk "Mafia" around Leonid Brezhnev. Brezhnev returned him to the Politburo as an alternate in 1965, after Brezhnev's rise to power. Shcherbitskiy was "Premier" of the Ukraine until 1972, when he became First Secretary of the Ukrainian Communist Party. Due to his position as Ukrainian Party chief, Shcherbitskiy was in the running to succeed his late mentor in 1982. But the stagnation and corruption of Brezhnev's last days, associated with the Dnepropetrovsk "Mafia," probably sank his chances.

#### **Three Groups**

Each of these thirteen members of the Politburo has his own power base and set of priorities. Each, however, can be placed into one of three general groupings.

At the top of the power structure, in the view of most experts, is the so-called "Party" group, which by dint of numbers and resources holds the principal levers of power.

Gorbachev, as General Secretary, heads the group. Working most closely with him are five additional men—all members of both the Politburo and the Secretariat. They are Ligachev, Nikonov, Yakovlev, Slyunkov, and Zaykov.

A subcategory of this "Party" group is formed of regional Party bosses. It includes Shcherbitskiy of the Ukraine and Zaykov, who now runs the Moscow Party Committee. These are the two largest Communist Party organizations in the Soviet Union. Solomentsev, as Party control chairman, is in another subcategory as well.

Next in line behind the "Party" group is what is known as the "government" group, which comprises individuals who are affiliated primarily with the institutions of formal administration.

First among those members whose primary functions are in the Soviet "government" is "Premier" Ryzhkov, Chairman of the Council of Ministers in Moscow. Also in this category are Chebrikov, head of the KGB; Shevardnadze, Foreign Minister; and Vorotnikov, Chairman of the Russian Republic's Council of Ministers. General of the Army Dmitriy Yazov, Minister of Defense



Zaykov

Nikonov

but only a candidate Politburo member, falls in this group.

Finally, there is the body that deals with "state" interests and that formalizes Party decisions into law. As Chairman of the Presidium of the Supreme Soviet, Gromyko functions as head of the state group in the Politburo.

So secret is another subgroup of the Politburo that its existence was not even mentioned officially until 1976. This is the Council of Defense.

Today, all that is really known for certain is that Gorbachev is the chairman of the Council of Defense. In 1977, the new Constitution of the USSR spelled out a few details of how it is formed. Brezhnev's later biographies credit him with being chairman of the Council of Defense since becoming Party leader in 1964.

Determining the membership of the Council is mostly guesswork. In addition to Gorbachev, Politburo members Ryzhkov and Gromyko, representing government and state, undoubtedly have seats in the council. Defense Minister Yazov and KGB Head Chebrikov should also be members. Moreover, Ligachev, Yakovlev, and either Zaykov or Slyunkov may take part as well because of the fact that they are also in the Secretariat.

#### **Musical Chairs**

Far more revealing of the changing balance of power in the Politburo-and of Gorbachev's possible influence-is the record of the comings and goings of Politburo members since Gorbachev became the General Secretary.

On becoming General Secretary, Gorbachev inherited a "board of directors" from Konstantin Chernenko. Politburo members do not resign when a new leader comes aboard; the new leader has to ma-



Slyunkov



neuver carefully to eliminate those who oppose him and to bring in his own supporters.

What has happened in the three years since Gorbachev and the nine other incumbent Politburo members attended Chernenko's funeral?

Five have been removed, one by one-two in 1985, one in 1986, and two more in 1987. While these five were departing, four new members were being added in 1985, one new one in 1986, and three more in 1987.

The removals and promotions came in several stages.

April 1985: At this time, the Central Committee held its first regular meeting since Gorbachev took over. Three of his supporters-Ligachev, Ryzhkov, and Chebrikov-are brought in at a single stroke. This tipped the balance in the Politburo in Gorbachev's favor, making possible the next move.

July 1985: At a critical meeting of the Central Committee, Grigoriy Romanov, Gorbachev's archrival in the succession struggle and reputed favorite of the military-industrial complex, was forced to resign "because of his health."

At the same time, Shevardnadze joined the Politburo and became Foreign Minister. Gromyko himself moved to a largely ceremonial post where he could put to use his long experience in foreign affairs to help the man he supported.

September 1985: The well-regarded Nikolay A. Tikhonov, seventy-nine at the time and chairman of the USSR's Council of Ministers, requested retirement.

February 1986: On the eve of the 27th Party Congress, a plenum stripped Viktor Grishin of his Politburo membership. As Party Secretary in Moscow, Grishin reportedly tried but failed to edge out Gorbachev for the General Secretary's post.

March 1986: The 27th Party Con-



Shevardnadze

gress added Zaykov to the Politburo.

January 1987: Dinmukhamed A. Kunayev, seventy-three, a Kazakh and Muslim and former Brezhnev crony, was censured for corruption and ousted from the Politburo.

July 1987: Slyunkov, Yakovlev, and Nikonov were added to the Politburo.

October 1987: G. A. Alivev, sixty-one, an Azerbaydzhanets, also a Muslim, and First Deputy Chairman of the USSR Council of Ministers, requested retirement for reasons of poor health and departed from the ranks of the Politburo.

As the year 1988 began, the remaining four holdovers from the pre-Gorbachev era-Shcherbitskiy, Gromyko, Solomentsey, and Vorotnikov-were still on the Politburo.

Over the past three years, political maneuvering has led to the appointment of no fewer than eight new men, all younger than the men they replaced but older than Gorbachev himself. All can be said to be supporters of Gorbachev to a greater or lesser degree.

#### A Glimpse Inside

What happened at Politburo meetings remained a mystery until Soviet newspapers, in 1982, began to publish summaries of the sessions. Accounts of recent meetings have proved at times to be illuminating.

For example, the Pravda summary of the Politburo meeting on May 30, 1987, was devoted entirely to the landing in Red Square of the West German teenager, Mathias Rust, who had piloted his private aircraft into the Soviet Union on a peace mission just a few days before.

The summary began by describing a report on the "violation" of Soviet airspace that was given by Defense Minister Sergei Sokolov. Then the Pravda account revealed that the lightplane from the Hamburg air club had been detected on radar immediately on crossing the border. Even though Soviet fighters flew over it twice, the Politburo noted that the Troops of Air Defense Command displayed "intolerable unconcern and indecisiveness" in stopping the flight.

This fact was taken as proof of "serious flaws in the organization of keeping a combat alert" in the air, "a lack of necessary vigilance and discipline," and "major omissions in leadership of troops from the Ministry of Defense."

As a result, the Politburo found it necessary to relieve Chief Marshal of Aviation A. I. Koldunov of his duties as Deputy Minister of Defense and Commander in Chief of the Troops of Air Defense because of "negligence and lack of organization in cutting short the indicated intrusion."

The Politburo, Pravda continued, also decided to "strengthen the leadership" of the Ministry of Defense. This meant that Marshal of the Soviet Union Sokolov was sacked. There was a tiny notice on page one naming General of the Army Dmitriy Yazov as new Minister of Defense.

#### **The Bloody Past**

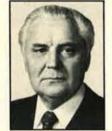
Even these strains in the transfer of power in the Politburo since 1985 pale by comparison with internal struggles of the past.

Starting even before Lenin died in January 1924, Stalin and two other founding Bolsheviks—Kamenev and Zinoviev—banded together to prevent Trotskiy from taking over the leadership in the post-Lenin period. Through his hold on the Secretariat, Stalin began replacing Trotskiy's supporters with his own.

Once he had stopped Trotskiy, however, Stalin turned on Kamenev and Zinoviev themselves, joining forces with Nikolay Bukharin, Aleksey Rykhov, and Mikhail Tomskiy to form a new majority. In turn, Kamenev, Zinoviev, and Trotskiy were all ousted from the Politburo.

Stalin was not finished. Having removed the members of the socalled "Left Opposition," Stalin moved against Bukharin, Tomskiy, and Rykhov on grounds that they were "Right Deviationists." All were threatened with expulsion





Solomentsev

Shcherbitskiy

from the Politburo if they didn't hew to Stalin's line on policy. Ultimately, they were stripped of their positions.

Another rival, Sergey Kirov, was murdered in 1934—this clearly being the work of Stalin. The putative "search" for Kirov's killer served as a convenient pretext for Stalin to unleash a ferocious purge in which hundreds of thousands of Soviet citizens perished. Included were many current and former members of the Politburo.

#### Familiar, Intricate Maneuverings

Here are the figures.

From the time of the October Revolution in 1917 until the outbreak of war in 1941, a total of twenty-three Communist Party leaders gained membership in the Politburo. Fourteen—nearly twothirds—died during this same period.

Only two—Lenin himself and a lesser figure—died in their beds. The other twelve—all of them important figures in the Revolution met grisly ends in Stalin's purges. Some, in despair, died by their own hands.

The roll of the dead:

• Sergey M. Kirov, murdered 1934.

• Lev B. Kamenev, executed 1936.

• Grigoriy Zinoviev, executed 1936.

• Mikhail P. Tomskiy, suicide 1936.

• Grigory K. Ordzhonikidze, suicide 1937.

• Nikolai N. Krestinskiy, executed 1938.

• Aleksey I. Rykhov, executed 1938.

• Nikolay I. Bukharin, executed 1938.

• Yan E. Rudzutak, executed 1938.

• Stanislav V. Kosior, executed 1938.

• Vlas Chubar, executed 1939.

• Leon D. Trotskiy, murdered 1940.

After the war, Stalin once again turned on those closest to him. According to Khrushchev, Stalin "had plans to finish off the old members of the Politburo." Andrey A. Andreyev was ousted. Klimentiy Voroshilov was accused of being a British spy and forbidden to attend Politburo meetings. Vyacheslav Molotov and Anastas Mikoyan were under suspicion. Only the death of Stalin himself, in March 1953, prevented yet another bloody purge.

In 1957, Khrushchev, too, faced major opposition from what became known as the "anti-Party group," composed of Molotov, Georgiy Malenkov, Lazar Kaganovich, and Maksim Saburov. Khrushchev, challenged in the Politburo (at that time, it was called the Presidium), turned to the Central Committee for support. Marshal Georgiy Zhukov, Defense Minister, dispatched military aircraft to bring Khrushchev supporters to Moscow for a showdown vote. When the vote was tallied at the Central Committee plenum, Khrushchev had defeated his opponents.

Khrushchev rewarded Zhukov by elevating him from candidate status to full membership in the Politburo. Ironically, Zhukov was ousted within four months for manifesting "Napoleonic tendencies." Not until 1973, sixteen years later, would any Defense Minister reach the ranks of the Politburo. This, however, did not stop Politburo members from approving a huge buildup of nuclear and conventional weapons.

In the early 1960s, Khrushchev's heir apparent, Frol Kozlov, threatened to unseat him prematurely. Khrushchev decided to stay on. Kozlov was thwarted and eventually hospitalized with a heart attack. Five months later, Khrushchev was ousted, accused by others on the Politburo of "harebrained scheming" and "willfulness." Leonid Brezhnev, Aleksey Kosygin, and Nikolay Podgornyy took over the reins of power.

If persistent rumors are to be believed, Brezhnev survived a number of attempts to remove him during his eighteen-year career as Soviet General Secretary in the Kremlin. Always successful in turning the plotters aside, Brezhnev in the end died of natural causes in his dacha.

Five of the Old Bolsheviks who had served on the Politburo in the days of Lenin and Stalin before World War II and had managed to survive Stalin's purges lived on into the 1960s, 1970s, and even the 1980s. The last of the tribe, Molotov, did not pass away until well into 1987—long enough for him to observe the familiar, intricate maneuverings between yet another Soviet General Secretary and his Politburo.

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 and traveled extensively in the USSR and maintains one of the largest private libraries in the US 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, as are three of her other books—The Armed Forces of the USSR, The Soviet Art of War, and The Soviet Control Structure, all coauthored with her husband, Dr. William F. Scott.

# **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 1942–45, on Volkhov and Leningrad Fronts. From 1956–61 and 1963–65, on the staff of the Leningrad Military District.

In Main Directorate of Cadres, army commander, and again Main Directorate of Cadres 1970–76. First Deputy Commander of Far Eastern Military District 1976–79. Commander, Central Group of Forces (Czechoslovakia) 1979–80, Central Asian Military District 1980–84, Far Eastern Military District 1984–87. Deputy Minister of Defense for Cadres January–May 1987. Member of the Central Committee since 1987 (Candidate 1981–87). Deputy of the Supreme Soviet 10th and 11th sessions. Frunze Military Academy (1956) and the Voroshilov Academy of the General Staff (1967).



Marshal of the Soviet Union Sergei Fedorovich Akhromeyev. Born 1923. Russian. First Deputy Minister of Defense and Chief of the General Staff since September 1984. Entered service in 1940. Graduated from naval school, but fought from Stalingrad to

Berlin in infantry in World War II. Deputy Chief (1975–79), then First Deputy Chief (1979–84) of the General Staff. Candidate (1981), then Member of the Central Committee since 1983. Deputy of the Supreme Soviet 11th session. Military Academy of Armored Forces (1952). Academy of the General Staff (1967). "Hero of the Soviet Union" (1982). Lenin Prize.



Marshal of the Soviet Union Viktor Georgiyevich Kulikov. Born 1921. Russian. Commander in Chief of United Armed Forces of the Warsaw Pact (since 1977). 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.



General of the Army Pëtr Georgiyevich Lushev. Born 1923. Russian. 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 of 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. Deputy of the Supreme Soviet 10th and 11th sessions. Malinovskiy Tank Academy (1954). Academy of the General Staff (1966). "Hero of the Soviet Union" (1983).



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. Graduated from Lenin Military-Political Academy (1957), Higher Academic Courses of same (1973).



General of the Army Yuri Pavlovich Maksimov. Born 1924. Russian. Commander in Chief of Strategic Rocket Forces since June 1985 and Deputy Minister of Defense. Joined the Red Army in 1942. Was 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).



General of the Army Yevgeniy Filippovich Ivanovskiy. Born 1918. Belorussian. 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 Belorussian 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).



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. Com-

mander of Belorussian 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) and 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).



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 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 Military Sciences (1968).



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 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).

-HARRIET FAST SCOTT

# 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. (See charts on the following two pages.)

The Strategic Rocket Forces, established in 1959, operate all land-based ballistic missiles with ranges greater than 1,000 km—about 1,400 ICBMs and 550 IRBMs and MRBMs. Little is known about the SRF outside the Soviet Union, but it is first among services, with its commander taking precedence over those of the other services, regardless of his actual rank.

The Ground Forces, numerically the largest of the five services, are divided into motorized rifle and tank troops, airborne troops, rocket troops and artillery, and troops of troop air defense. The 210 Ground Forces divisions, with tanks, armored personnel carriers, selfpropelled artillery, and personal equipment, are all designed for a CBR environment and are equipped and trained for combat with or without nuclear, chemical, and biological weapons. Ground Forces personnel number more than 1,990,000.

The **Troops of Air Defense** (Voyska PVO) was 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.

Significant changes in the Troops of Air Defense ap-

pear to be taking place at present, the extent of which are not known. For example, between October 1985 and September 1986, the First Deputy Commander of Troops of PVO was reassigned as Commander, Troops of Air Defense of the Ground Forces. This suggests a return to the structure that had existed in the late 1970s.

The three major components of Troops of Air Defense are approximately 2,250 fighter-interceptors, some 9,000 SAM launchers, and a huge radar network. Two other components—antirocket defense (PRO) and antispace defense (PKO)—continue to grow in importance. General Secretary Mikhail Gorbachev has acknowledged that a Soviet equivalent to the US's SDI program is in progress.

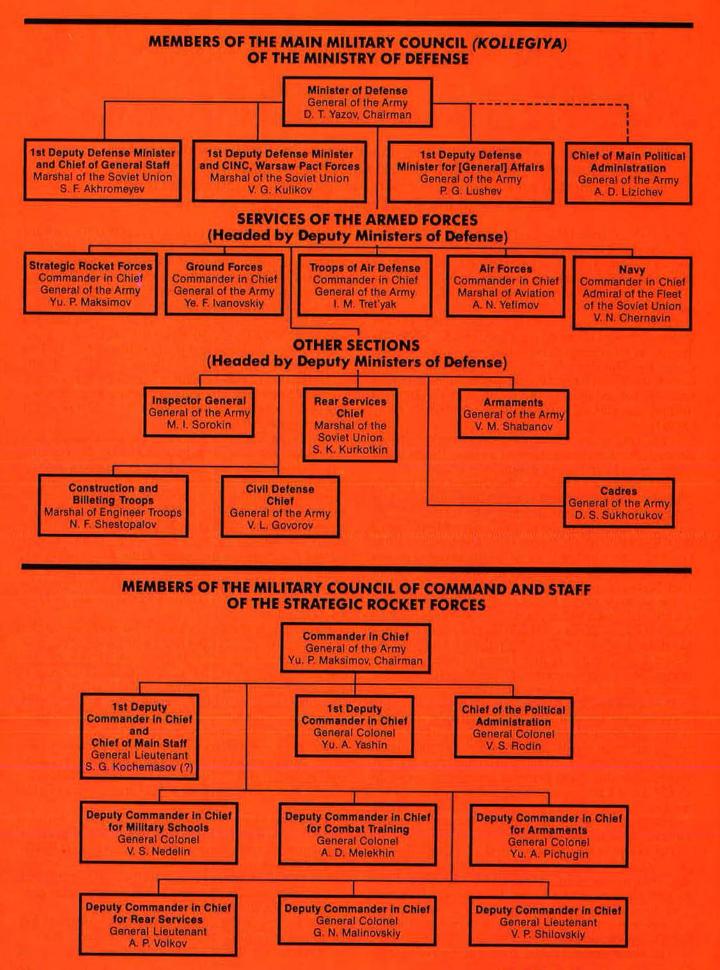
The Soviet Air Forces reorganization that started several years ago continues in 1988. In border regions, aircraft and helicopters designated as "frontal aviation" are to maintain air superiority and to strike targets in the "operational depth" of an opponent. "Army aviation" is to attack primarily mobile 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 "Army Aviation" in the United States.) Both frontal and army aviation are in the Air Forces of the Military District, which are subordinate to the commanders of the TVDs (Theaters of Military Operation).

Elsewhere in the Soviet Union, bombers and strike aircraft are combined into five air armies. Included in these air armies are about 165 Bison and Bear bombers, 565 medium-range Blinder, Badger, and Backfire bombers, 450 Fencer strike aircraft, more than 300 tanker, reconnaissance, and ECM aircraft, plus fighter escort aircraft. Combat aircraft are equipped to carry either nuclear or conventional weapons.

Transport Aviation includes some 600 fixed-wing aircraft. The transport aircraft of the Soviet airline, Aeroflot, with its 1,600 medium- and long-range transports, should also be included as a full-time reserve of this component.

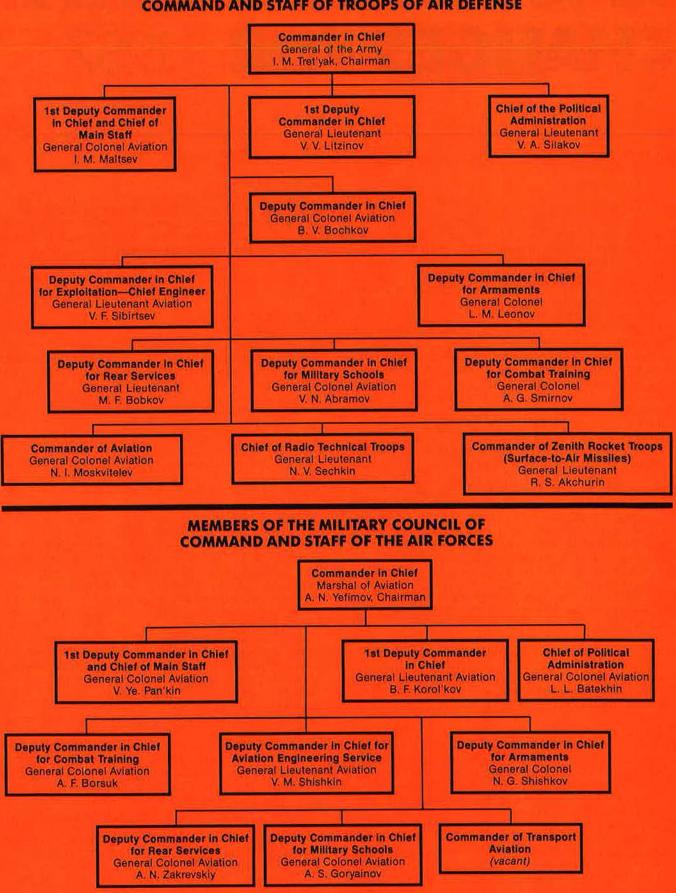
The Soviet Navy is a maritime superpower. With its aircraft carriers of the *Kiev* class, Soviet Naval Aviation has a mix of carrier-based helicopters and V/STOL aircraft. Naval Aviation also has land-based and reconnaissance fighters, a limited transport force, bombers, and surveillance aircraft. The total Naval Aviation force now exceeds 1,600 aircraft.

The accompanying charts, prepared by Harriet Fast Scott and current as of January 1, 1988, show the top members of the USSR's military organization.



and a motion that there is a many failer to be the motion of their

#### MEMBERS OF THE MILITARY COUNCIL OF COMMAND AND STAFF OF TROOPS OF AIR DEFENSE



AIR FORCE Magazine / March 1988

63

-CHARTS COMPILED BY HARRIET FAST SCOTT

## SENIOR MILITARY LEADERSHIP CHANGES FOR 1987 <del>\*</del>

#### PROMOTIONS

None reported in 1987.

#### TRANSFERS

- Bugayev, Boris Pavlovich, 64, Chief Marshal of Aviation. Removed as Minister of Civil Aviation, May 4, 1987, for laxity. In 1970, Bugayev became the first postwar head of Aeroflot not from the Soviet Air Forces. The new Minister of Civil Aviation, General Colonel of Aviation A. N. Volkov, headed Soviet Air Forces' Military Transport Aviation from 1980 to 1987.
- Koldunov, Aleksandr Ivanovich, 65, Chief Marshal of Aviation. Released as Commander in Chief of Troops of Air Defense following the invasion of Soviet airspace on May 28, 1987, by a West German sports plane piloted by teenager Mathias Rust. Koldunov, one of the top ten Soviet aces of World War II, is twice "Hero of the Soviet Union."
- Konstantinov, Anatoliy Ustinovich, 64, Marshal of Aviation. Another casualty of the Rust affair, Konstantinov was the Commander (since 1973) of the Moscow Air Defense District, which did not stop the intruder plane. Konstantinov was reprimanded and relieved of his command.
- Sokolov, Sergey Leonidovich, 76, Marshal of the Soviet Union. Minister of Defense since 1984. Abruptly removed from that post in May 1987 as the result of the Red Square plane scandal, although at the time of the incident he was sitting next to Gorbachev at a high-level Warsaw Pact meeting in East Berlin. Fifty-five years on active duty. Now a general inspector in the Ministry of Defense's Group of General Inspectors.
- Sorokin, Mikhail Ivanovich, 65, General of the Army. Appointed Inspector General and Deputy Minister of Defense in July 1987. Rumored to have been Commander of Soviet troops in Afghanistan (1981–84) and 1st Deputy Commander in Chief of the Western Theater of Operations (1984–87).
- Sukhorukov, Dmitriy Semyonovich, 65, General of the Army. Replaced Yazov as Deputy Minister of Defense for Cadres. He was Commander of Airborne Troops from 1979 to 1987.
- Tret'yak, Ivan Moiseyevich, 65, General of the Army. New Commander in Chief of Troops of Air Defense. Had been Inspector General since July 1986. Remains a Deputy Minister of Defense. Tret'yak was Commander of the Far Eastern Military District in September 1983, when a Korean Airlines 747 airliner was shot down in that area after straying into Soviet airspace.
- Yazov, Dmitriy Timofeyevich, 64, General of the Army. Appointed Minister of Defense in May 1987 after the Red Square plane affair. Apparently impressed Gorbachev when Commander of the Far Eastern Military District (1984–87). Had already moved to Moscow by early 1987 when he became Deputy Minister of Defense for Cadres. Alternate Member of the Politburo since June 1987.

#### FATAL ACCIDENTS

As the result of a helicopter accident on October 19, 1987, in Hungary, five Soviet generals were killed: General Colonel V. P. **Shutov**, 63, deputy chief of a main directorate of the General Staff; General Lieutenant Yu. I. **Ryabinin**, 53, of the General Staff; General Lieutenant K. N. **Trofimov**, 66, deputy chief of Signal Troops; General Major E. V. **Porfir'yev**, 51, chief of staff, Southern Group of Forces (Hungary); and General Major V. S. **Bardashevskiy**, 49, of the General Staff.

#### OTHER DEATHS

- Belikov, Valeriy Aleksandrovich, 62, General of the Army. Commander in Chief of Soviet Forces in Germany since 1986. Candidate member of the Central Committee CPSU. Died November 1987.
- Gareyev, Musa Gaysinovich, 65, retired Colonel, twice "Hero of the Soviet Union." *Shturmovik* (ground attack) pilot, 250 combat sorties. Died October 1987.
- Getman, Andrey Lavrent'yevich, 83, General of the Army. First Guards Tank Army commander during the war. Military district commander (1958), then Chairman of DOSAAF from 1964 to 1972. Died April 1987.
- Lelyushenko, Dmitriy Danilovich, 86, General of the Army. Fourth Guards Tank Army commander during the war. Military district commander, then Chairman of DOSAAF from 1960 to 1964. Died July 1987.
- Lovkov, Mikhail Aleksandrovich, 77, retired General Lieutenant of Aviation. From 1962 to 1966, Chief of the Main Staff of the Strategic Rocket Forces. Died April 1987.
- Peredelskiy, Georgiy Yefimovich, 74, Marshal of Artillery. Commanded Ground Forces' Rocket Troops and Artillery from 1969 to 1983. Died November 1987.
- Skripko, Nikolay Semenovich, Marshal of Aviation, on his 85th birthday. Wartime deputy commander of Long-Range Aviation (1942–44), then 18th Air Army. Postwar, first deputy commander of Long-Range Aviation until 1949, then (from 1950 to 1969) commander of air transport aviation, after 1955 called Military Transport Aviation. Died December 1987.
- Smirnov, Aleksey Semyonovich, 70, retired Colonel, twice "Hero of the Soviet Union." One of the leading wartime fighter aces: 457 sorties, 72 air battles, 34 enemy planes shot down. Died August 1987.
- Sokolovskiy, Yevgeniy Vasil'yevich, General Major, son of Marshal of the Soviet Union V. D. Sokolovskiy, who was the editor of *Military Strategy*. Died August 1987.
- Zhilin, Pavel Andreyevich, 74, General Lieutenant, Corresponding Member of the Academy of Sciences, USSR. Since 1966, head of the Institute of Military History of the Ministry of Defense, part of the Academy of Sciences, USSR. For many years Vice President of the International Commission of Military Historians. Died February 1987.

-HARRIET FAST SCOTT



Information for this Almanac was compiled by the staff of AIR FORCE Magazine from a variety of open sources. Since 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 their 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).
- 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
- 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 to 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).

#### Soviet Aeronautical Milestones

- 1884—First "hop" by a steam-enginepowered monoplane designed by Alexander Fedorovich Mozhaiski. Short distance and incline-assisted takeoff prevent it from being considered true powered flight.
  1904—Nikolai Zhukovsky, "Father of So-
- 1904—Nikolai Zhukovsky, "Father of Soviet Aviation," founds Europe's first institute of aerodynamics.
- 1910—Russian Imperial War Ministry establishes flying school at Gatchina.
- 1913—(May 13) First flight of the world's first four-engine airplane—*The Russian Knight*, affectionately called *Le Grand*. Designed by Igor Sikorsky.
   1913—(August 20) Staff Capt. Peter
- 1913—(August 20) Staff Capt. Peter Nesterov performs history's first inside loop in a Nieuport IV.
- 1914—(August 26) First air battle of World War I on the Eastern Front. Staff Capt. Peter Nesterov records first aerial ramming in combat.
- 1921—The ANT-1 flies, the first of a record number of more than 100 aircraft designed by Andrei N. Tupolev.
- 1922—The Germans begin construction of a modern aircraft plant at Fili (near Moscow) under the provisions of the Treaty of Rapallo.
- 1930-The I-5 flies, the first Soviet-designed and -built fighter.
- 1934—(May 19) First flight of the ANT-20 Maxim Gorki, at the time the world's largest aircraft. Designed by Andrei Tupolev.
- 1937—The Soviets set several record endurance flights, including the first polar flight between Europe and North America.
- 1946—(April 24) First flight of Soviet-designed and -built jet fighter prototypes—the Yak-15 and the MiG-9.
- 1947—(December 30) First flight of the MiG-15.
- 1956—The Tu-104 makes its debut as the world's first commercial jetliner.
- 1968—(December 31) First flight of the Tu-144, the world's first supersonic transport.

#### Top Soviet Aces of World War II

Men	<b>Solo Victories</b>
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] exserviceman 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 March 8

May 9 October 7 November 7 & 8

May 1 & 2

New Year's Day International Women's Day International Worker's Solidarity Days Victory Day Constitution Day of the USSR 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 April 12

Second Sunday of April May 28 First Sunday after July 22 Third Sunday of August Second Sunday of September November 10 November 19 Soviet Army and Navy Day World Aviation and Cosmonautics Day Troops of Air Defense Day Border Troops Day Navy Day USSR Air Force Day (Aviation Day) Tank Forces Day Soviet Militia Day 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
	0610-0630 0630-0650 0650-0720 0725-0755 0800-1400 1400-1440 1440-1510 1510-1530 1530-1830 1830-1940 1940-2010 2010-2040 2040-2155

## **Comparative Grades and Insignia**

(Bold face indicates equivalent USAF rank.)



Glavnyi Marshal Aviatsii General of the Air Force



General-Mayor Aviatsii Brigadier General



Kapitan Captain



Marshal Aviatsii General



Polkovnik Colonel



Starshiy Leytenant 1st Lieutenant



General-Polkovnik Aviatsii Lieutenant General



Podpolkovnik Lieutenant Colonel



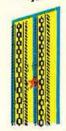
Leytenant 2d Lieutenant



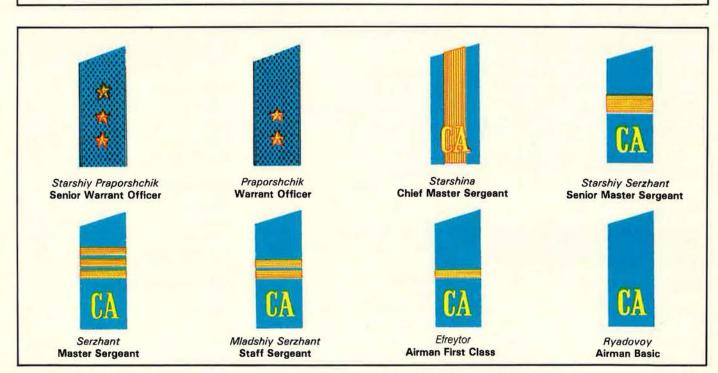
General-Leytenant Aviatsii Major General



Mayor Major



Mladshiy Leytenant 2d Lieutenant



## Soviet Theater Estimates

COMBAT ORGANIZATION (As of October 1, 1987)

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.

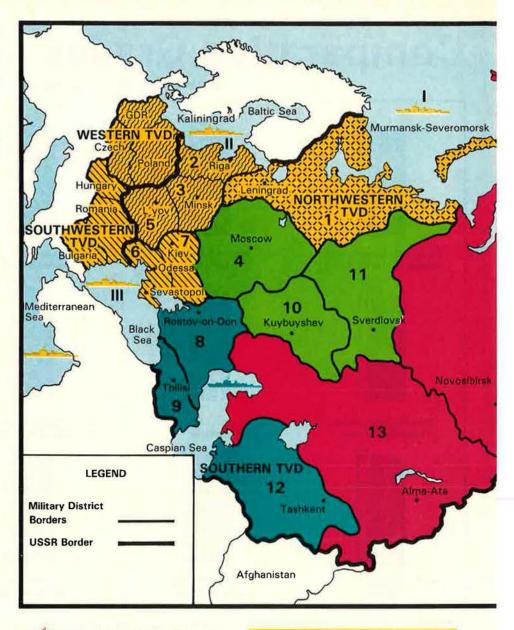
Commanders of TVDs and TVs are combined-arms commanders, directing all operations in their areas during conflict and reporting directly to the Soviet Supreme High Command. The Soviets consider the Western TV the most important, and its commander holds a position of special responsibility—perhaps extending to control of all Warsaw Pact forces in wartime.

The Soviets have never published specific information on TVs or TVDs.

#### FAR EAST THEATER

#### Far East TVD

Divisions	57
Tanks <sup>4</sup>	14,700
Artillery <sup>2</sup>	13,420
Tactical Aircraft	1,330



Pacific Ocean TVD

#### Pacific Ocean Fleet

Aircraft Carriers	2
Principal Surface Combatants	76
Other Combatant Craft	395
Auxiliaries	240
Submarines <sup>3</sup>	90
Naval Aviation	515
Naval Infantry Division	1

Indian Ocean Squadron

(most units drawn from Pacific C Fleet)	cean
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

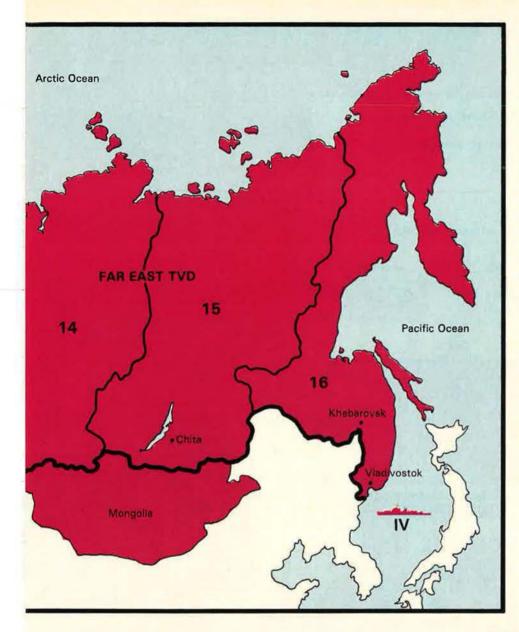
#### WESTERN THEATER

#### Northwestern TVD Divisions 12 Tanks<sup>4</sup> 1,320 Artillery<sup>2</sup> 2.000 Tactical Aircraft 130 Southwestern TVD Divisions 29 Tanks<sup>4</sup> 7,200 Artillery? 5,900 Tactical Aircraft 820

#### Western TVD

63
19,120
16,000
2,030

AIR FORCE Magazine / March 1988



#### Atlantic TVD

#### **Baltic Fleet**

Principal Surface Combatants	50
Other Combatant Craft	320
Auxiliaries	155
Submarines	48
Naval Aviation	275
Naval Infantry Brigade	1

#### **Black Sea Fleet**

Aircraft Carriers	1
Principal Surface Combatants	69
Other Combatant Craft	221
Auxiliaries	155
Submarines	32
Naval Aviation	450
Naval Infantry Brigade	1

#### Mediterranean Squadron

(most units drawn from Black Sea and Northern Fleets) 36-49 Ships, average

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	74
Other Combatant Craft	137
Auxiliaries	205
Submarines <sup>3</sup>	135
Naval Aviation	408
Naval Infantry Brigade	1

#### **MILITARY DISTRICTS**

- 1. Leningrad
- 2. Baltic
- 3. Belorussia
- 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).
- <sup>2</sup> This category includes all field artillery, mortars, and multiple rocket launchers 100 mm in size or
- greater. <sup>3</sup> Not including SSBNs.
- 4 Medium tanks only.

#### SOUTHERN THEATER

#### Southern TVD

Divisions	30
Tanks <sup>4</sup>	5,300
Artillery <sup>2</sup>	5,600
Tactical Aircraft	700

#### **Caspian Flotilla**

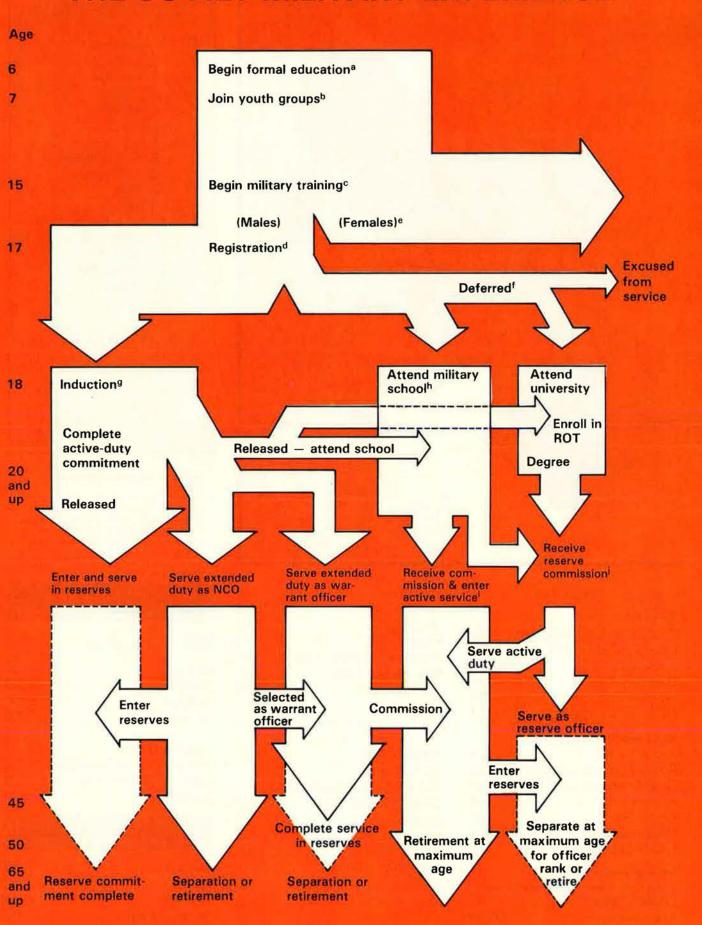
Principal Surface Combatants	5
Other Combatant Craft	79
Auxiliaries	20

#### STRATEGIC RESERVES

Divisions	20
Tanks <sup>4</sup>	4,700
Artillery <sup>2</sup>	4,000
Tactical Aircraft	135

AIR FORCE Magazine / March 1988

## THE SOVIET MILITARY EXPERIENCE



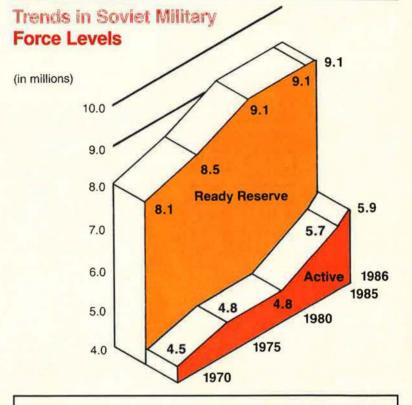
# Footnotes

- <sup>a</sup> Formal education begins at age 6: eleven years of schooling required.
- <sup>b</sup>Youth groups include Little Octobrists (ages 7-9), Young Pioneers (10-14/15), and Komsomol, the All-Union Communist Union of Youth (14-28).
- <sup>c</sup> At age 15, Soviet teenagers begin military training and receive a minimum of 140 hours before induction. Boys get thirty additional hours during summer camp. First aid is emphasized for girls.
- <sup>d</sup> By age 17, all males must register for military service. They may be assigned to specific training prior to induction.
- e Soviet law provides for conscription of women, but in practice this is not done. However, women may volunteer. A very few women are commissioned officers.
- f Few deferments from military service are granted; the majority of these allows selected students to attend approved schools to learn skills critically needed by the state or military. Males enroll concurrently in Reserve Officer Training (ROT). In rare instances, males may be deferred for health or family reasons and excused from their active commitment upon reaching age 27
- <sup>9</sup> Most Soviet males are inducted for enlisted service at the age of 18. Call-ups are held annually in the spring and fall. Conscripts rarely have a choice of service or branch. The usual term of service is two years for the Army and Navy ashore and three years for the Navy afloat.
- h Males who qualify by competitive examination and political recommendation may attend one of about 140 higher military schools. These schools are the primary sources of active-duty officers.
- The Soviet military does not have an "up-or-out" policy for officers, but does impose maximum ages on active service according to rank. An officer who reaches his maximum age but is not eligible for retirement will be transferred to the reserves
- The Soviet armed services require a large number of reserve officers. Citizens receiving reserve commissions may spend their entire careers as part-time reservists, or they may be called to a period of active duty, particularly if they possess critical skills.

## Soviet Active Military Population

(As of October 1, 1987)

Ground Forces	2,000,000
Air Forces	528,000
Navy	470,000
Strategic Defense Forces	520,000
Strategic Attack (includes Strategic Rocket	410,500
Forces and strategic elements of the Air Forces and Navy)	
Command/General Support	1,475,000
Security Forces (KGB/MVD)	570,000
Total	5,973,500



## Significant Military Deployments **Outside the Soviet Union** (As of October 1, 1987)

**AFRICA<sup>3</sup>** 

Ethiopia4

EUROPE Warsaw Pact Countries 635 000

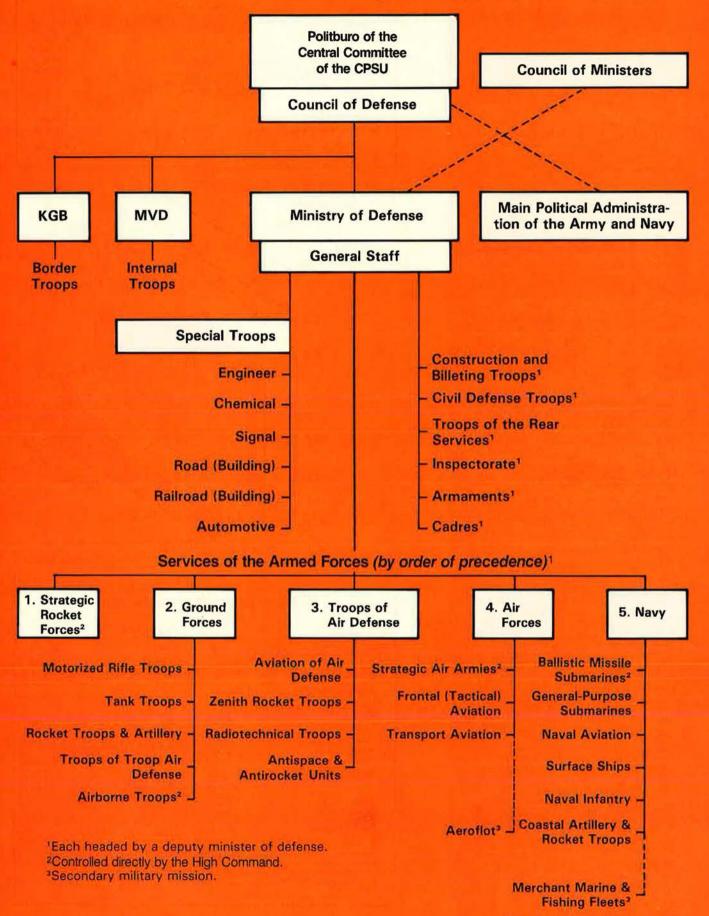
warsaw Pact Countr	les 635,000	Ethiopia	1,500
		Libya <sup>4</sup>	1,400
ASIA		Angola <sup>4</sup>	1,200
Afghanistan <sup>1,4</sup>	116,000	Mozambique <sup>4</sup>	800
Mongolia	61,000	Algeria	700
Vietnam <sup>2</sup>	2,500	Congo <sup>4</sup>	100
Laos	500	Mali	50
India	300		
Kampuchea	200	LATIN AMERICA	*
MIDEAST		Cuba <sup>5</sup> Peru	7,700 125
Syria	4,000	Nicaragua <sup>4</sup>	75
South Yemen <sup>4</sup>	1,000		
Iraq4	800		
North Yemen	500		

Total includes an estimated 10,000 MVD and KGB forces.

2Estimate does not include transient Soviet naval presence. 3About 900 additional Soviet military advisors are deployed in smaller numbers to many other African nations. 4Significant Cuban military forces are also deployed to this country. Sincludes an estimated 2,800 Soviet advisors and technicians, 2,800 in the Soviet brigade, and 2,100 in the SIGINT facility

1 500

# **The Soviet Military Establishment**



#### Lineup of Soviet Military Power (As of October 1, 1987)

### **Strategic Nuclear Missiles**

- 1,400 (approx.)-Intercontinental ballistic missiles (ICBM). SS-11: 420. SS-13: 60. SS-17: 145 (with 580 warheads). SS-18: 308 (with 3,080 warheads). SS-19: 350 (with 2,100 warheads). SS-25: 100. (The total ICBM figure does not include ICBMs held in reserve for flight testing.
- 987-Submarine-launched ballistic missiles (SLBM). SS-N-5: 39. SS-N-6: 272. SS-N-8: 292. SS-N-17: 12. SS-N-18: 224. SS-N-20: 100. SS-N-23: 48.
- 545—Intermediate/medium-range ballistic missiles (IRBM/MRBM). SS-4: 104 (all based west of the Urals). SS-20: 441. (Approximately one-third of the SS-20 launchers are deployed in the Far East.)

#### **Air Defense**

- 2,250-Interceptors. Includes MiG-23 Floggers, MiG-25 Foxbats, Su-15 Flagons, Su-27 Flankers, Tu-28/-128 Fiddlers, Yak-28 Firebars, and MiG-31 Foxhounds.
- 8,560-Strategic surface-to-air missile (SAM) launchers. SA-1: 1,860. SA-2: 2,550. SA-3: 1,100. SA-5: 1,950. SA-10: 1,100.
- 4,490-Tactical SAM launchers. SA-4: 1,350. SA-6: 840. SA-8: 800. SA-9: 460. SA-11: 200. SA-12A: 20. SA-13: 820.
- 12--Airborne warning and control aircraft. Tu-126 Moss: 7. II-76 Mainstay: 5
- 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**

- 175-Long-range strategic bombers. Tu-95 Bear: 160. Mya-4 Bison: 15. Blackjack is still under development.
- 545-Medium-range bombers. Tu-22M Backfire: 175 (excludes Backfires with Soviet Naval Aviation). Tu-16 Badger: 250. Tu-22 Blinder: 120.
- 1,700-Tactical counterair interceptors. Includes MiG-21 Fishbeds, MiG-23 Floggers, MiG-25 Foxbats, Su-15 Flagons, Tu-128 Fiddlers, Yak-28 Firebars, MiG-29 Fulcrums, MiG-31 Foxhounds, and Su-27 Flankers
- 2,800-Ground attack aircraft. Includes MiG-21 Fishbeds, MiG-27 Floggers, Su-7/-17 Fitters, Su-24 Fencers, and Su-25 Frogfoots. -Tanker aircraft. Mya-4 Bison: 30. Tu-16 Badger: 20.
- 650-Tactical reconnaissance and electronic countermeasures aircraft. MiG-21 Fishbed: 65. MiG-25 Foxbat: 195. Su-17 Fitter: 150. Su-24 Fencer: 65. Yak-28 Brewer: 175.
- 129-Strategic reconnaissance and ECM aircraft. Tu-16 Badger: 40. Tu-22 Blinder: 15. Tu-95 Bear: 4. MiG-25 Foxbat: 20. Su-24 Fencer: 50.
- 1,200-Attack assault helicopters. Includes Mi-8 Hip and Mi-24 Hind aircraft.
- 1,500—Training aircraft. Includes 800 fixed-wing, of which perhaps 600 are combat capable, and 700 rotary-wing aircraft.
- 575—Military air transports assigned to Transport Aviation (VTA). An-22 Cock: 55. An-12 Cub: 160. II-76 Candid: 355. An-124 Condor: 5.

- 1,450-Transports in other elements of the armed forces. An-12 Cub: 300. Others: 1,150.
- 1,665-Civil aviation aircraft (Aeroflot). An-12 Cub: 160. II-76 Candid: 55. Other medium- and long-range transports: 1,450.

#### **Ground Forces**

- 52,500-Main battle tanks. T-54/-55: 19,200. T-62: 12,600. T-64: 9,800. T-72: 8,900. T-80: 2,000.
- 1,532-Surface-to-surface missiles. FROG-3/-5/-7: 660. SS-21 Scarab: 130. SS-1 Scud B: 620. SS-23 Spider: 12. SS-12 Scaleboard: 110 (includes more accurate version deployed in 1984).
- 47,360-Artillery pieces, mortars, and multiple rocket launchers. Artillery pieces: 29,600. Mortars: 10,660. MRLs: 7,100. (Total does not include more than 4,000 antitank artillery pieces.)

## 70,000-Infantry fighting vehicles and armored personnel carriers.

4,410-Combat and support helicopters. Mi-2 Hoplite: 675. Mi-4 Hound: 20. Mi-6 Hook: 435. Mi-8 Hip: 1,920. Mi-24 Hind: 1,300. Mi-26 Halo: 45. Mi-10 Harke: 15. Mi-28 Havoc and Hokum are still in development. (Total includes 1,200 Hip E and Hind D and E gunship helicopters.)

#### **Naval Forces**

- 76-Ballistic missile submarines. Delta: 40. Hotel: 1. Yankee: 17. Typhoon: 5. Golf: 13.
- 142-Nuclear-powered general-purpose submarines. Cruise missile attack: 50. Attack: 78. Other: 14.
- 140-Diesel- and electric-powered general-purpose submarines. Cruise missile attack: 16. Attack: 120. Training: 4.
- -Auxiliary submarines. Includes both nuclear-powered and nonnuclear-powered boats.
- Guided missile V/STOL aircraft carriers (Kiev class).
- Guided missile aviation cruisers (Moskva class).
- -Cruisers. Kirov-class nuclear-powered guided missile: 2. Sverdlovclass light: 8. Guided missile: 27.
- -Destroyers. Includes 43 guided missile destroyers.
- 179-Frigates and corvettes. Includes 32 Krivak-class guided missile frigates.
- 965—Small surface-ship combatants. Patrol: 190. Coastal patrol and river/roadstead: 395. Mine warfare: 380.
- 184-Amphiblous warfare ships and craft.
- 780-Auxiliary shlps. Material support: 75. Underway replenishment: 80. Fleet support: 145. Other: 480.

#### **Naval Aviation**

- 350-Strike and bomber aircraft. Tu-22M Backfire: 130. Tu-16 Badger: 190. Tu-22 Blinder: 30.
- 135-Fighter and fighter-bomber aircraft, Su-17 Fitter: 70. Yak-38 Forger A: 65.
- 60-Tankers (Tu-16 Badger).
- -Reconnaissance and electronic warfare aircraft. Includes Tu-16 Badgers, Tu-95 Bear Ds, Tu-22 Blinders, An-12 Cubs, and others.
- -Antisubmarine aircraft. Tu-142 Bear F: 60. Mi-14 Haze A: 100. Ka-27 Helix: 60. Ka-25 Hormone A: 115. Be-12 Mail: 95. II-38 May: 45.
- 425-Transport and training aircraft.

-Totals for air defense interceptors, strategic bombers, and tactical aircraft include aircraft in operational units only. All data predates INF Treaty.

## 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 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, even numerals to bombers and transports.

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 or 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

(1957-1987)

Photo Reconnaissance	743
Communications	282
Electronic Intelligence (ELINT)	170
Related to Manned Spaceflight (Manned: 62; Unmanned: 98)	160
Minor Military (Radar calibration, etc.)	147
Navigation/Geodetic	140
Scientific/Developmental (including rocket tests)	110
Weather/Natural Resources	77
Early Warning	56
Venus or Mars Missions	40
ASAT-Related	38
Lunar Missions	30
Fractional Orbital Bombardment System (FOBS)	18
Unknown	6
Total	2,017
-Courtesy Teledyne Brown Engineering	

**Soviet Space** Launches to **Orbit or Beyond** 

(As of	December	31,	1987)	
--------	----------	-----	-------	--

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

# 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 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 link-up 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 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

# GALLERY OF SOVIET **AEROSPACE WEAPONS**

## BY JOHN W. R. TAYLOR EDITOR IN CHIEF, JANE'S ALL THE WORLD'S AIRCRAFT

# **Bombers and Maritime**

Beriev M-12 (NATO 'Mail') The 1987 edition of DoD's Soviet Military Power publication refers to the eight active aircraft design bureaus of the Soviet Ministry of Avlation Industry. This implies that the Berlev seaplane design team no longer exists, but it would be surprising if there were no plans to replace the M-12 with another amphibian after it has given more than twenty years of useful service. About 100 M-12s were built, of which as many as 95 continue to perform overwater surveillance and antisubmarine duties within a 230-mlle 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 lvchenko AI-20D turboprops; each 4,190 ehp. Internal fuel capacity approx 2,905 gallons. Dimensions: span 97 ft 534 in, length 99 ft 0 in, height 22

ft 111/2 in, wing area 1,130 sq ft. Weight: gross 68,345 lb.

- Performance: max speed 378 mph, service ceiling 37,000 ft, max range 4,660 miles. Accommodation: crew of five.
- Armament and Operational Equipment: torpedoes, depth charges, mines, and other stores for maritime search and attack carried in internal bay aft of step in bottom of hull and on four pylons under outer wings. Radar in nose 'thimble'; MAD (magnetic anomaly detection) tail-sting.

Ilyushin II-38 (NATO 'May') The alrframe of this intermediate-range shore-based antisubmarine/maritime patrol aircraft was developed from that of the II-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; stan-dard 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 had to be moved forward. II-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 coun-try. Periodically, deployments are made to Libya and Syria. About 59 II-38s are In service with Soviet naval units, plus three that were passed on to No. 315 Squad-ron of the Indian Navy, based at Dabolim, Goa.

Power Plant: four lvchenko Al-20M turboprops; each 4,250 ehp. Fuel capacity 7,925 gallons. Dimensions: span 122 ft 914 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.

#### Myasishchev M-4 (NATO 'Bison')

About 15 of these four-turbojet aircraft remain available to the Moscow air army for long-range maritime and Eurasian missions, plus another 30 equipped as probe-and-drogue aerial refueling tankers for the 'Backfire/ Bear/Bison/Blinder' attack force. Pending replacement, respectively, by 'Blackjacks' and II-76 'Midas' tankers, 'Bisons' are being phased out of service and placed in storage. (Data for 'Bison-A' strategic bomber follow.)



Berlev M-12 (NATO 'Mail') (Swedish Alr Force)



Ilyushin II-38 (NATO 'May') (Royal Norwegian Air Force)

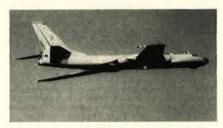
Power Plant: four Mikulin AM-3D turbojets; each 19,180 lb st.

- Dimensions: span 165 ft 71/2 in, length 154 ft 10 in. Weight: gross 350,000 lb.
- Performance: max speed 620 mph at 36,000 ft, service ceiling 45,000 ft, range 4,970 miles at 520 mph with more than 12,000 lb of bombs, max unrefueled combat radius 3.480 miles.
- Armament: 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. Three weapon bays in center-fuselage, for free-fall weapons only.

Tupolev Tu-16 (NATO 'Badger') The prototype Tu-16 flew for the first time in the winter of 1952. 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 260 are estimated to remain operational in the five Soviet air armies, supported by 20 Tu-16 aerial refueling tankers and about 115 of various ver-sions equipped for ECM duties and for strategic reconnaissance. Soviet Naval Aviation is thought to have about 190 Tu-16 attack models, plus 70 tankers and up to 80 reconnaissance and ECM variants. The attack alrcraft carry antiship crulse missiles with standoff ranges vary-Ing 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, Vletnam, with a potential combat



Tupolev Tu-16 (NATO 'Badger-D') (Royal Navy)



Tupolev Tu-16 (NATO 'Badger') in-flight refueling tanker (Swedish Air Force)

radius encompassing Thailand, the Philippines, Guam, most of Indonesia, and southern China. Known 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-B. Generally similar to 'Badger-A', but equipped originally to carry two turbojet-powered aero-plane-type antishipping missiles (NATO 'Kennel') under-wing. Superseded by 'Badger-G'.

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 glaz-ing 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 ver-

sion. Nose like that of 'Badger-C', Larger undernose radome. Three radomes in tandem under bomb bays. Badger-E. Photographic and electronic reconnais-sance 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' with underwing pylons for two rocket-powered air-to-surface missiles (NATO 'Kelt') that can be carried to a range greater than 2,000 miles. Free-fall bombing capability retained. Majority serve with antishipping squadrons of the Soviet Naval Air Force. A few have been passed on to Iraq.

One Soviet Navy Tu-16, probably a 'Badger-G' shown in an accompanying illustration 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 cance 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 air-craft have large flat-plate antennae at wingtips.



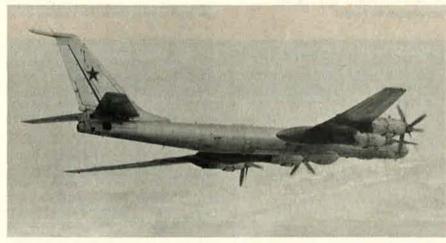
Tupolev Tu-16 (NATO 'Badger-G') of Soviet Naval Air Force



Tupolev Tu-22 (NATO 'Blinder') (Swedish Air Force)



Tupolev Tu-26 (NATO 'Backfire-C')



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.

gainors. 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-142 (NATO 'Bear-F') (UK **Ministry of Defence)**

Tupolev Tu-22 (NATO 'Blinder') Tu-22s were the first Soviet operational bombers capable of supersonic performance for short periods. About 120 remain operational with medium-range units of the air armies, mostly in such support roles as ECM jamming, plus 15 equipped for reconnaissance. The Soviet Navy has about 30 bombers and 20 equipped for mari-time reconnaissance and ECM duties, based mainly in the Southern Ukraine and Estonia to protect the 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 for-ward for takeoff, creating annular slot through which additional air is ingested. Dimensions: span 78 ft 0 in, length 132 ft 111/2 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')

Unlike their Western counterparts, Soviet leaders r er believed that the availability of ICBMs and SLBMs made unnecessary the development of new generations of manned strategic bombers. 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 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 awaiting ratification and possible ICBM force reductions to follow, the significance of the 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. No ICBM can make such a visible deterrent gesture. For Western Europe and Japan, relief at the planned removal of Soviet SS-20 missiles is tempered by requent sightings of missile-armed 'Backlires', 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 inflight refueling so that it can be used against the continental US if sufficient tankers are available. However, the total of about 320 '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 plate

Backfire-C. Advanced production version with wedgetype air intakes. Upturned nosecone with small pod at tip. No visible flight refueling probe. Single twin-barrel gun in tail mounting.

During the SALT if treaty talks, Soviet delegates re-ferred 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 penetra-tion 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 'Backlire-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 su-personic transport. Can be refueled in flight.

Dimensions: span 112 ft 61/2 in spread, 76 ft 91/4 in swept; length 129 ft 11 in; height 35 ft 51/4 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-tosurface missiles, carried under the fixed center-sec-tion panel of each wing, or a single 'Kitchen' semirecessed 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 twin-barrel 23 mm guns in radar-directed tail mounting.

# Tupolev Tu-95 and Tu-142 (NATO 'Bear') Although the first prototype of Andrei Tupolev's huge

four-turboprop 'Bear' was flown in the summer of 1954, most of the 150 'Bears' now flying with the Soviet air armies are of the newly upgraded 'Bear-G' or new-production 'Bear-H' missile-carrying versions. In Soviet Mili-tary Power, DoD warns that 'Bear-H' and the new 'Black-

jack' will 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 designa-tion was changed from Tu-95 to Tu-142. This year, it is possible to list yet another variant, 'Bear-J', which reminds us that high performance is not the only factor that has kept this remarkable aircraft in continuous production for 34 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 un-classified NATO reporting names are: Bear-A. Basic Tu-95 long-range strategic bomber.

Chin radome. Internal stowage for two nuclear or a vari-ety 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 blis-

ter 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. Dif-fers 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 reconnais sance version of the Tu-95 is equipped with I band sur-face 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' photographed in the second half of 1978 had in place of the normal tail turret and associated radome a faired tail housing special equipment. 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 se-

ries 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. Reen-tered production in the mid-1980s. Originally, 'Bear-F' had enlarged and lengthened fairings aft of its inboard engine nacelles and undernose radar. The main under fuselage 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 turnet 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 lip. 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 'Bear-Fs' in service are now to Mod 3 or Mod 4

standard

Bear-G. Tu-95, generally similar to 'Bear-B/C', but re-configured 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, con-taining special equipment, similar in shape to that on some 'Bear-Ds'.

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-1987 had only an internal (rotary?) launcher for eight of these ALCMs, but pylon mountings for four more can probably be attached under each wingroot. 'Bear-H' achieved initial operational ca-

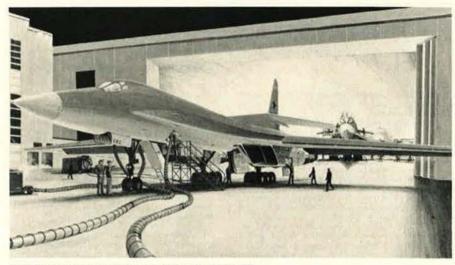


Tupolev Tu-95 (NATO 'Bear-G') (UK **Ministry of Defence)** 

New Tupolev Bomber (NATO 'Blackjack')

DoD artist's impressions published in Soviet Military Power continue to be the only reliable guide to the general appearance of the Tupolev strategic bomber known as 'Blackjack', However, flight testing of at least eight pro-totype and preproduction aircraft had reached such an advanced stage by 1987 that operational deployment could begin this year, initially to replace the M-4 'Bison' and Tu-95 'Bear-A'. This helps to explain the US view that "strategic aviation is making a strong comeback in the Soviet Union"

'Blackjack' is about 20 percent larger than USAF's B-1B and 10 percent longer than even a B-52, with a higher supersonic speed than the B-1B and a similar combat radius. It is in no way a simple scale-up of Tupolev's earlier 'Backfire'. Common features include low-mounted variable-geometry wings and large vertical tail surfaces with a massive dorsal fin, but 'Blackjack's'



Artist's impression of Tupolev 'Blackjack' (DoD)

pability in 1984, and at least 50 were deployed by spring 1987. 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 main-tain an on-station/all-ocean link between national command authorities and nuclear missile armed submarines under most operating conditions. Operational in comparatively small numbers, 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 frequently off the US east coast during transits between Murmansk and Cuba and during elint missions from Cuba. 'Bear-Hs' also carry out simulated attack and training missions against the USA. The Indian Navy is reported to have ordered two 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



MiG-21 (NATO 'Fishbed-J') of Polish Air Force (Lech Zielaskowskiv)

horizontal tail surfaces are mounted higher, at the intersection of the dorsal fin and main fin. The fixed root panel of each wing seems to be long and very sharply swept, and the engine installation resembles that of the now-retired Tu-144 supersonic airliner rather than 'Backfire'

The Soviet Union is expected to build a production series of at least 100 'Blackjacks' at a new complex added to the huge Kazan airframe plant. 'Blackjack's' primary weapons will be the AS-15 'Kent' air-launched cruise missile and supersonic BL-10 missile, each with a range of 1,850 miles, but it will have provision for carrying

Power Plant: possibly four uprated versions of the 44,090 lb st Kuznetsov NK-144 afterburning turbofan.

Provision for in-flight refueling assumed. Dimensions: span 182 ft 9 in spread, 110 ft swept; length 177 ft; height 42 ft.

Weight: gross 551,150 lb. Performance: max speed Mach 2.0 at high altitude, max

unrefueled combat radius 4,535 miles

Armament: up to 36,000 lb of free-fall bombs, shortrange missiles, or ALCMs.



#### MiG-21 (NATO 'Fishbed')

As deployment of new MiG-29s and Su-27s gains mo-mentum, the number of MiG-21s in first-line units of the Soviet tactical air forces has fallen below 500, of which about 65 are reconnaissance models known to NATO as 'Fishbed-H'. 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. Deep-ened 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 'Advanced Atoll' missiles to supplement infrared 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

MiG-21bis ('Fishbed-L'). Third-generation multirole air combat fighter/ground attack version, with Tumansky R-25 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-21bis ('Fishbed-N'). Advanced version of 'Fish-bed-L' with further improved avionics. Rate of climb at To weight of 15,000 lb, with 50 percent fuel and two Atoll' missiles, is 58,000 ft/min. Armament uprated to two radar-homing 'Atolls' and two 'Aphids'. (Data for MIG-21MF follow.)

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

pacity of 471 gallons and for two JATO rockets. Dimensions: span 23 ft 51/2 in, length 51 ft 81/2 in, height 14 ft 9 in, wing area 247 sq ft. Weight: gross 20,725 lb.

Performance: max speed Mach 2.1 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 K-13A (Atoll') and two 'Advanced Atoll' 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/interdic-tor. 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, lighterweight radar, and, on some aircraft, an undernose sensor pod of new design.

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

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



'Foxbat-F' defense suppression version of MiG-25 (Krasnaya Zvesda)

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 flight or on the ground, to 16°, 45°, or 72°. Full-span single-slotted trailing-edge flaps are each in three sec-tions, 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 420 'Flogger-B/G/K' interceptors serve with the Soviet strategic air defense force and a further 1,570 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 11/4 in; height 15 ft 9 in; wing
- area 293.8 sq ft spread. Weights: empty 22,050 lb, max external weapons 6,615
- lb, gross 35,495-41,670 lb. Performance: max speed Mach 2.025 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 B-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 300 MiG-25s continue to equip the Soviet strategic inter-ceptor force; a further 105 interceptors and 195 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. Nose radar (NATO 'Fox Fire') of MiG-25 examined in Japan in 1976, after the defection of its pilot, was the most powerful fitted to any interceptor of that period, but embodied vacuum tubes rather than modern circuitry, with emphasis on antijam-ming capability rather than range. 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 lookdown/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 cur-rent absolute height record of 123,523 ft.

MiG-25 ('Foxbat-F'). New version illustrated in Soviet press in 1986. Airframe generally similar to 'Foxbat' inter-ceptors, but with dielectric panel aft of radome on port side (possibly both sides) of front fuselage. Probably an electronic reconnaissance or 'Wild Weasel' type of com-bat aircraft carrying such missiles as the antiradiation AS-11 (NATO 'Kilter'). (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 intake

Dimensions: span 45 ft 9 in, length 78 ft 134 in, height 20 ft 014 in, wing area 611.7 sq ft.

- Weights: basic operating 44,100 lb, gross 82,500 lb. Performance: never-exceed combat speed, with mis-siles, 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, the MiG-29 is a twin-engine combat aircraft comparable in size to the Navy's F/A-18 Hornet. A large pulse-Doppler look-down/shootdown radar gives it day and night all-weather operating capability against low-flying targets as well as freedom from the ground controlled interception techniques that formerly restricted Soviet air defense effectiveness. It has an infrared search/track sensor in front of the windscreen. 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 is likely to have a full dual-role air combat/attack capability, and a combat-capable two-seater is also in production and service. The only NATO reporting name that may yet be mentioned is 'Fulcrum-A' for the basic operational single-seat version, but five variants of the MiG-29 may be identified as follows: • 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 detach-

ment 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 overwing fences

· Differs from second variant in having extendedchord rudders.

· As preceding variant, but with more deeply curved fuselage aft of the cockpit, almost certainly providing additional fuel tankage.

· Combat trainer with second seat in front of the normal cockpit, under a continuous framed canopy. Nose radar replaced by radar rangefinder. Periscope above canopy. Underwing stores pylons retained.

Comparison of the general configurations of the MiG-29 and Su-27 prompts the thought that some authority, perhaps the TsAGI Central Aerodynamics and Hydrodynamics Institute, may be exerting a greater influ-ence on design than was the case in the era of the late Artem Mikoyan and Pavel Sukhoi. The Sukhoi fighter maintains the tradition of being larger than the MiG, but 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.

More than 300 MiG-29s are already operational with Soviet units stationed in East Germany, Hungary, in the USSR west of the Urals, and in the far eastern USSR. They are replacing MiG-21s, Su-15s, and some MiG-23s. Export deliveries have been made to India, Iraq, and Syria, 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 noncon-formal auxiliary fuel tank under fuselage.

Dimensions: span 37 ft 834 in, length 56 ft 5 in, height

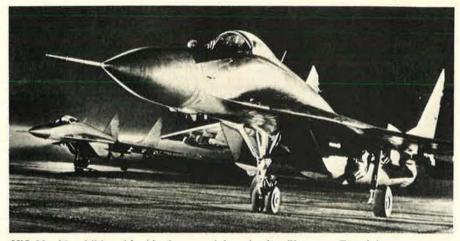
14 ft 51/4 in, wing area 378.9 sq ft. Welghts: empty 18,025 lb, gross 36,375 lb. Performance: max speed at height Mach 2.2, at S/L Mach 1.06, service ceiling 65,600 ft, combat radius 715 miles

Accommodation: pilot only (two seats in tandem in combat trainer).

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. Expected to carry bombs, rocket pods, 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



MiG-29 with additional fuel in deepened dorsal spine (Krasnaya Zvesda)



#### MiG-31 (NATO 'Foxhound') (Royal Norwegian Air Force)

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 150 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 Gorkiv 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 111/4 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 number of AA-9s to eight.

#### Sukhoi Su-15 (NATO 'Flagon')

Although some US sources claim that the late-model 'Flagons' still in first-line service are designated Su-21, DoD continues to refer to them by the original designa tion of Su-15. The number remaining in home defense



Sukhoi Su-15 (NATO 'Flagon-F') (Tass)

units is believed to be around 240, with another 260 in tactical units, in three versions, as follows:

Flagon-E. Single-seat interceptor. Longer-span wings than those of original 'Flagon-A', 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. (Data for 'Flagon-F' follow.) Power Plant: two afterburning turbojets, reported to be

Tumansky R-13F2-300s; each 15,875 lb st. Dimensions: span 34 ft 6 in, length 68 ft 0 in.

Weight: gross 35,275 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 un-derwing pylons; AA-8 infrared homing close-range missile ('Aphid') on each inboard pylon. GSh-23L 23 mm gun pods or fuel tanks on two underbelly pylons.

#### Sukhoi Su-27 (NATO 'Flanker')

Responsibility for the larger of the Soviet air forces' two new-generation single-seat fighters, equivalent to USAF's F-15 Eagle, was assigned to the Sukhoi design bureau. Its general configuration is similar to that of the smaller MiG-29, suggesting that the two aircraft evolved from a common research program by a central authority, such as the famous TsAGI Central Aerodynamics and Hydrodynamics Institute. Two versions have been identi-fied to date by NATO reporting names, as follows: Flanker-A. Prototypes, which began flight tests in

1977, as illustrated in the 1987 Soviet Gallery. 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. Like the MiG-29, the Su-27 is described by DoD as a

supersonic all-weather counterair fighter, with lookdown/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 said to be improved in comparison with earlier Soviet fighters. Its large pulse-Doppler radar and heavy armament should give it formidable potential against low-flying aircraft and cruise missiles, particularly when it is deployed in partnership with the new Soviet AEW&C aircraft based on the II-76 transport and known to NATO as 'Mainstay'. DoD esti-mates suggest a combat radius as great as that of the Tupolev Tu-28P 'Fiddler', which is overdue for replace-ment, making the Su-27 capable of escorting missile-armed bombers and deep-penetration ground attack aircraft on sorties against the UK and western Europe.

Series production is centered in a plant at Kom-somolsk, Khabarovsk Territory. With the MiG-31, the Su-27 is expected to replace many of the MiG-21, MiG-23/27, Su-15, and MiG-25 aircraft in the 17 tactical air forces assigned to Soviet military districts and groups of forces. It may also equip, in a navalized form, the large Soviet aircraft carrier now fitting out at Nikolayev. At least 50 had been deployed operationally by the autumn of

1987, when those based in the Kola Peninsula were particularly active in simulated interceptions of NATO aircraft over the Barents Sea. 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 234 in, length excl nose probe

70 ft 101/2 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.



Yakovlev Yak-28P (NATO 'Firebar') (Tass)



Sukhoi Su-27 (NATO 'Flanker-B') (Royal Norwegian Air Force)

#### 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 unlikely to be of consequence for much longer; fewer than 80 production 'Fiddler-Bs' remain operational with the Voyska PVO home defense fighter force, plus 20 with tactical air forces.

Power Plant: two unidentified afterburning turbojets; each estimated at 27,000 lb st.

Dimensions: span 59 ft 41/2 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 65 Yak-28P all-weather interceptors are thought to remain operational in the Voyska PVO fighter force, plus 20 with the tactical air forces. The longer dielectric

nosecone fitted retrospectively to some aircraft does not indicate any increase in radar capability or aircraft performance, but simply a change of material and shape. Power Plant: two turbojets, related to the Tumansky R-11 fitted in some MiG-21s: each 13,120 lb st with after-

burning. Dimensions: span 42 ft 6 in, length 75 ft 51/2 in, height 12 ft 111/2 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 semiactive 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



Yakovlev Yak-38s (NATO 'Forger-A')

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 probably totals about 75 aircraft.

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 turboiet, 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 lift-iets in tandem aft of cockpit, inclined forward at a slight angle; each 7,875

lb st. Dimensions: span 24 ft 0 in, length 50 ft 101/4 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.

# 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 inter-ceptor 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 inter-ceptor. 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 guid-ance. 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 anten-nae 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, 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' Iollow.)

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 almost 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') The original prototype of this family of aircraft, known to NATO as 'Fitter-B', was simply an Su-7 with 13 ft 9 in of each wing pivoted outboard of a very large fence. By the time the Sukhoi Bureau had also introduced a more powerful engine and improved avionics, the variable geometry 'Fitter' was in a completely different class from 'Fitter-A'. A doubled external load could be lifted from strips little more than half as long as those needed by the original fixed-wing aircraft; it could then be carried about 30 percent farther and delivered with greater accuracy. As a result, the fighter was put into series produc-tion, and about 1,060 of the 2,350 ground attack aircraft in service with Soviet tactical air forces are now Su-17s. Soviet Naval Aviation has about 75 assigned to 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. Opera-tional since 1971 in relatively small numbers. Serves also

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 Sovi-

et air forces. Generally similar to 'Fitter-D', without elec-tronics pod, but entire fuselage forward of wing drooped slightly to improve pilot's view. Deepened dorsal spine fairing, almost certainly providing additional fuel tank-age. 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 (Filter-H). Improved single-seater for Soviet air forces. Basically as 'Filter-D', but with wide and deep dorsal fairing aft of canopy, like 'Filter E/G'. Doppler navigation radar filted internally in deepened undersur-face of nose. Taller fin like 'Filter-G'. Removable ventral fin. Retains both wingroot guns. About 165 'Fitter-H/K' equipped for tactical reconnaissance duties, carrying a centerline sensor pod.

Su-17 ('Fitter-K'). Latest single-seat version for Soviet air forces, identified in 1984. Dorsal fin embodies small cooling air intake at front. Also in service with Polish Air Force.

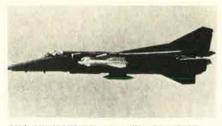
It was deduced for some years that certain export versions of the variable-geometry 'Fitter' series had different engines from the Su-17 variants listed above. 'Fitter-C/D/E/G/H/K' operated by the Soviet air forces and some other air forces have a rear fuselage of basically constant dlameter and are powered by a Lyulka turbolet. Versions exported to Angola, Libya, Peru, Syria, Viet-nam, 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, Czechoslo-vakia, 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, in increased-diameter rear fuselage. 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.

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



MiG-27 (NATO 'Flogger-J') with AS-14 ('Kedge') missile



Sukhoi Su-17 ('Fitter-K') of the Polish Air Force



Sukhoi Su-24 (NATO 'Fencer-C') (Swedish Air Force)

with Tumansky engine. Internal fuel capacity 1,656 gal-lons. More angular dorsal fin, 'Atoll' air-to-air missiles.

- Supplied to Libya. (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 61/4 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')

Recognized since the mid-1970s as the best deepinterdiction 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 new long-range navigation system and electro-optic weapons delivery systems enable the Su-24 to penetrate hos-tile airspace at night or during poor weather with great



Sukhoi Su-25 (NATO 'Frogfoot')

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 Decomber 1974 as a replacement for the Yak-28 (NATO 'Brewer'). More than 800 are now operational, including 450 assigned to strategic missions and at least one squadron with the Baltic Fleet air force for maritime reconnaissance. Five versions can be identified by NATO reporting names:

Fencer-A. Identifiable by rectangular rear fuselage box enclosing jet nozzles. Fencer-B. Rear fuselage box around jet nozzles has

deeply dished bottom skin between nozzles. Larger brake parachute housing. Fencer-C. Introduced in 1981. Important equipment

changes. Multiple fitting on nose instead of former simple probe. Triangular fairing forward of each fixed wing-root, on side of air intake (presumably housing RWR equipment of the kind seen on the fuselage sides, for-ward 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-tosurface missiles retained. About 65 in service.

An electronic warfare version, to replace the 'Brewer-E' model of the Yak-28, has been reported. (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
- 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 814 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) 905 miles 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, includ-Ing 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 pio-neered with the llyushin II-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. Since 1982, in Afghanistan, the Soviet tactical air forces have been testing 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. Well over 200 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 634 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-toground weapons, including 57 mm and 80 mm rock-ets, and 1,100 lb incendiary, antipersonnel, and chem-ical cluster bombs. Two small outboard pylons for AA-2 (NATO 'Atoll') or AA-8 ('Aphid') air-to-air self-defense missiles



Antonov An-74 AEW&C Variant (NATO 'Madcap') at Antonov OKB

# **Reconnaissance**, ECM, and Early **Warning Aircraft**

#### **New Reconnalssance Aircraft**

Among Soviet military aircraft said to have been ob-served at Ramenskove flight test center in 1982 is a highaltitude 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 some-where between the MiG-29 (Ram-L) and the Tupolev bomber known to NATO as "Blackjack" (Ram-P). No de-tails 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 dutles. Four variants may be identified by NATO reporting names

Cub-A. Electronic intelligence (elint) version. Gener-ally similar to basic 'Cub' transport, but with blade antennae on front fuselage, aft of flight deck, and other chang

Cub-B. Conversion of 'Cub' transport for elint misslons. 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 pro-duced 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 oglval 'solid' fuselage tailcone, housing electronic equipment, is fit-ted 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 concelvable ECM task. Equipment differs from that of 'Cub-C' to perform different active countermeasures duties. Up to 25 '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, slightly 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 Sentinel, with similar potential for export to selected customers. Production is likely to be at an early stage, with a few aircraft completed.

#### Ilyushin II-20 (NATO 'Coot-A')

This electronic intelligence (elint)/reconnaissance aircraft appears to be a conversion of the standard II-18



Ilyushin II-20 (NATO 'Coot-A') (Swedish Air Force)

four-turboprop transport. An under-fuselage container, about 33 ft 71/2 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 centerand rear-fuselage, plus two large plates projecting above the forward-fuselage.

# Ilyushin II-76 AEW&C Variant

(NATO 'Mainstay') Development of this AEW&C version of the II-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 conven-tionally 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 combat command and control. It provides the Soviet forces with the capability to detect and track aircraft and crulse 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. The first examples are operational, and a production rate of at least five alrcraft a year is expected. They are intended to operate primarily with the Soviet air forces' new-generation MIG-29, MIG-31, and Sukhol Su-27 counterair fighters.



Ilyushin II-76 AEW&C Varlant (NATO 'Mainstay') (Royal Norwegian Air Force)

#### 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 alreraft:

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 cen-terline pyton. 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

#### MiG-25 (NATO 'Foxbat-B and D')

Although generally similar to the basic MIG-25 inter-ceptor, 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 alroorne radar (SLAR). No arma-ment. Slightly reduced span. Wing leading-edge sweep constant from root to tip. Total of about 195 'Foxbat-Bs and. Ds' estimated in service with Soviet tactical air forces. 'Foxbat-B' also operational in Algeria, Libya, Syr-

la, 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.

#### MII MI-8 (NATO 'Hip-D, G, J, and K')

Versions of this medium-size helicopter adapted for various electronic duties have been allocated the follow ing NATO reporting names:

HID-D. For airborne communications role. Generally similar to 'Hip-C' transport, but with canisters of rectangular section on outer stores racks, and added anten-

HIp-G. Airborne communications version. Rear inclined antennae projecting from rear of cabin and from undersurface of tallboom, aft of box for Doppler radar. Hip-J. Additional small boxes on sides of fuselage

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.

#### Sukhol 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 cen-ter-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 electron-ic reconnaissance versions of the Tu-16, and ECM chaffdispensing 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')

The Tu-126 was the Soviet Union's first counterpart to USAF's Boeing E-3 AWACS (Alrborne Warning and Control System). About seven are still operational, with airframe and power plant based on those of the now-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. Replace-

Power Plant: four Kuznetsov NK-12MV turboprops; each 14,795 ehp. Internal fuel capacity 20,075 gallons. In-

Fight 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.

## Yakoviev 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 ra-

dome under fuselage forward of wings. Brewer-E. Deployed in 1970 as the first Soviet operational ECM escort aircraft, with an active ECM pack built into its bomb-bay, from which the pack projects in cylindrical form. No radome under front fuselage, but many additional antennae and fairings. A rocket pod, chaff dispenser, or antiradiation missile can be carried under each outer wing, between the external fuel tank and balancer wheel housing. Approximately 195 'Brewer-Ds and Es' remain in service for tactical reconnaissance and ECM and 102 for strategic reconnaissance and ECM.

Dimensions, weight, and performance should be in the same order as those of the Yak-28P ('Firebar') interceptor (which see).

# Transports

Antonov An-12BP (NATO 'Cub') Nearly thirty years have passed since the An-12BP began to enter service as the standard paratroop and freight transport of the Soviet Military Transport Aviation freight transport of the Soviet Military Transport Aviation force (VTA). II-76s have been replacing them at the rate of 30 a year since the 1970s, but some 200 An-12BPs con-tinue to equip 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 assets of VTA can also be boosted at any time by drawing on the 1,600 medium-and long-range transports belonging nominally to the national airtine Aeroflot, which includes more than 200 An-12s and II-76s.

The usefulness of the An-12BP 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 nine other air forces and are in pro-duction 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 lychenko Al-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 71/4 in,

height 34 ft 61/2 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 han-

dling 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 sys-tems. The prototype flew for the first time on February 27, 1965. Production was terminated sconer 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 11/2 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.

Hungarian Air Force (Press Office Sturzenegger)



Antonov An-74 (NATO 'Coaler-B') (Brian M. Service)

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, many Aeroflot An-26s are available to the Soviet Military Transport force; others are flown by about 27 forcign air forces. Some operated by Angola and Mozambique have a rack on each side of the fuselage below the wing for bombing missions.

Power Plant: two lvchenko Al-24VT turboprops; each 2,820 ehp. One 1,765 lb st RU 19A-300 auxillary turbo-jet in starboard nacelle for turboprop starting and to provide additional power for takeoff, climb, and cruising flight, as required.

Dimensions: span 95 ft 91/2 in, length 78 ft 1 in, height 28 ft 11/2 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, ser-

vice celling 24,600 ft, range 683 miles with max payload

Accommodation: crew of five, plus station for load supervisor or dispatcher. Electrically-powered mobile hoist, capacity 4,409 lb, and conveyor to facilitate loading and airdropping. Provision for carrying 40 paratroops or 24 litters. Improved An-26B version has rollgangs and mechanical handling system, enabling two men to load and unload three 8 ft long standard freight pallets in 30 minutes.

Armament: none on Soviet air forces An-26s.

Antonov An-32 (NATO 'Cline') No photographs have yet identified this specialized 'hot and high' short/medium-range transport in Soviet air forces service. However, India ordered 118, Peru has 15, and at least three other customers have been reported. The basic airframe is similar to that of the An-26,



Antonov An-124 (NATO 'Condor') (Brian M. Service)

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 lvchenko Al-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 in the autumn of 1985.

The An-32 can be fitted with 4,195 ehp Al-20M engines for operation in moderate climatic conditions. (Data for version with Al-20DM engines.)

Dimensions: span 95 ft 91/2 in, length 78 ft 01/4 in, height 28 ft 81/2 in.

- Weights: empty, equipped 38,158 lb, gross 59,525 lb. Performance: max cruising speed 329 mph, service
- celling 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. Two production versions have since appeared, with extended wing span, lengthened fuselage, and other refinements, as follows:

Coaler-B. Specialized version for operation in the Arctic and Antarctic, with flight crew of four, advanced navigation aids including inertial navigation system, and provision for wheel/ski landing gear. Distinguishable from 'Coaler-C' by larger radome that does not follow curve of fuselage undersurface. Scheduled for certifica-

tion during current year. Known as An-74. Coaler-C. Light STOL transport for military or civil operation. Airframe identical to that of 'Coaler-B'. Crew of two on flight deck. Less extensive navigation equip-

ment. Conventional landing gear. Known as An-72. Examples of 'Coaler' have been seen in military cam-ouflage. In addition, an AEW&C variant is flying and has received the NATO reporting name 'Madcap' (see Recon-naissance, 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 71/2 in, length 92 ft 11/4 in, height 28 ft 81/2 in.

- 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, range 715 miles with max payload or 2,610 miles with 3.307 lb payload.
- Accommodation: crew of two (An-72) or four (An-74); main cabin designed primarily for freight, but An-72 has folding seats for 32 passengers along side walls, and provision for 24 casualties and attendant. In combi role, An-74 carries eight mission staff, plus 3,307 lb of freight in rear compartment.

#### Armament: none

#### Antonov An-124 (NATO 'Condor')

The An-124 is one of the few Soviet aircraft to have received a thoroughly appropriate reporting name. Nature's condor is the world's largest flying bird. Antonov's 'Condor' is the largest aircraft currently flying, in terms of wingspan, with the heaviest max takeoff weight of any aeroplane yet built. The prototype flew for the first time on December 26, 1982. By mid-1987, a second pro-totype and eight production aircraft had followed. Planned production rate is eight to ten aircraft a year, and deliveries to VTA, the Soviet Military Transport Avia-tion force, were scheduled to begin during 1987, to replace the turboprop An-22. Proving flights, carrying heavy commercial loads, had been under way since January 1986.

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 its US counterpart, the Lockheed C-5 Galaxy. 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 per-cent fly-by-wire control system, titanium floor through-



out the main hold, and 12,125 lb of composites, making up 16,150 sq ft of its surface area and giving a weight saving of more than 4,410 lb. The 24-wheel landing gear enables the An-124 to operate from unprepared fields, hard packed snow, and ice-covered swampland. Pay-loads will range from the largest Soviet battle tanks to 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 poten-tial, on May 6-7, 1987, an An-124 set a closed circuit distance record by flying 12,521.2 miles nonstop around the periphery of the Soviet Union. Power Plant: four Lotarev D-18T turbofans; each 51,590

Ib st. Fuel capacity quoted as 507,063 lb. Dimensions: span 240 ft 534 in, length 226 ft 81/2 in, height 68 ft 21/4 in, wing area 6,760 sq ft. Weights: nominal max payload 330,693 lb, gross 892,872

Ih

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 re-serve 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

#### Ilyushin II-76 (NATO 'Candid-B')

This Sovlet counterpart to USAF's C-141 StarLifter now equips 60 percent of the 600-strong Soviet VTA transport force and will continue replacing An-12BPs at the rate of about 30 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, II-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 II-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 Ttail, full-span leading-edge slats and triple-slotted flaps for good field performance, a navigator's station in the alazed nose, with ground-mapping radar in a large un-dernose 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 II-76/76T/76TD versions are known to

NATO as 'Candid-A'. Deliveries to a development squadron of military II-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 II-76Ts and Ms of Aeroflot as necessary. A developed version of the II-76 is in service with the Soviet air forces in an AEW&C role (see entry on 'Mainstay') and is being joined by II-76 in-flight refueling tankers (see entry on Midas')

The following data refer to the basic military II-76M. Also in service is an improved version, designated II-76MD, with an Increased gross weight of 418,875 lb,

Ilyushin II-76M (NATO 'Candid-B') of Iragi Airways (Anton Wettstein)

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

Dimensiona: span 165 ft 8 in, length 152 ft 101/4 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 han-diers; up to 140 passengers.

Armament: two 23 mm NR-23 guns in tail turret.

#### Ilyushin II-76 Tanker Variant (NATO 'Midas')

A version of the II-76 has been under development since the mid-1970s as a probe-and-drogue in-flight re-fueling tanker to replace the modified Myasishchev M-4 ('Bison') aircraft, which have served previously in this role. It was expected to achieve initial operational capability during the past year, in support of both tactical and strategic combat aircraft.

# 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.



Aero L-39 ZA



Sukhoi Su-7U (NATO 'Moujik') of the **Czechoslovak Air Force** 

Power Plant: one M701c500 turbojet; 1,960 lb st. Dimensions: span 33 ft 9 in, length 35 ft 51/2 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

- celling 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 nods 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 supple-ment and eventually replace the L-29 as the standard trainer of the Soviet and other air forces. More than 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, Czecho-slovakla, 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 sta-tions. Strengthened wings and landing gear. Operational

with air forces of Czechoslovakia and Romania. Production continues L-39MS. New version with Improved airframe and up-

graded avionics and equipment, including electronic displays. Prototype flew initially with standard engine. New power plant (approx 5,300 lb st) will enhance performance, notably rate of climb.

- Power Plant (current production versions): one lvchen-ko Al-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 01/2 in, length 39 ft 91/2 in, height 15 ft 734 ln, wing area 202.36 sq ft. Weights (L-39ZA): empty 8,060 lb, gross (clean) 10,029
- lb, max 12,346 lb. Performance (L-39ZA): max speed 469 mph at 16,400 ft,
- service ceiling 36,100 ft, range 621 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 air-brake, 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 flapblowing 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 78.

#### MIG-25U (NATO 'Foxbat-C') (See page 78.)

MiG-29 combat trainer (NATO 'Fulcrum') (See page 79.)

# Mil (WSK-PZL Swidnlk) Mi-2

(NATO 'Hoplite') Among the many military duties for which the Soviet Union utilizes MI-2 light helicopters (see page 86) is primary training of helicopter pilots.

# Mil Mi-24 (NATO 'Hind-C') (See page 87.)

#### Sukhol Su-7U (NATO 'Moujik')

The Soviet and several other air forces use this tandem two-seat adaptation of the Su-7B as an operational train-er 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 torward 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, corre

sponding 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 91/4 in, length 58 ft 81/2 in, height 15 ft 9 in, wing area 297 sq ft.

Sukhoi Su-15 trainer (NATO 'Flagon-G') (Soo page 79

Sukhoi Su-17 trainer (NATO 'Fitter-E and G') (See page 81.)

Tupolev Tu-22U (NATO 'Blinder-D') (See page 76.)

#### 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 80.)

#### 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 DOS-AAF centers, since the mid-1940s. Large-scale production was entrusted to the Intreprinderea de Avioane Bacau works in Romania, which delivered the 500th Yak-52 in 1983, with production continuing.

Externally, this trainer resembles closely the final Yak-18 designs, but has a more powerful engine, re-duced span with no wing center-section, a semi-monocoque rear fuselage instead of the Yak-18's fabric-covered steel-tube structure, and a tricyle 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 61/4 in, length 25 ft 5 in, height 8 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 semiretractable 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 21/4 in, height 9 ft

81/4 in, wing area 161.5 sq ft.

Weights: empty 1,985 lb, gross 2,337 lb. Performance: max speed 186 mph, cruising speed 143 moh. max endurance 50 min.

# Helicopters

#### **Tilt-rotor aircraft**

According to the 1987 edition of Soviet Military Power, 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 enthusiasm for 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 replace-ments for such helicopters as the Mi-8/17 (NATO 'Hip') and Mi-24 ('Hind') in the 1990s.

#### 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



Sukhoi Su-15 (NATO 'Flagon-G')



Yakovlev Yak-52 (Brian M. Service)

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 equip-ment 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 car-riers Moskva and Leningrad, and carrier/cruisers of the Kiev class

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 ra-dome with more spherical undersurface. Cylindrical radome under rear of cabin. Data link equipment. Hormone-C. Utility and search and rescue model, gen-

erally similar to 'Hormone-A', but with inessential opera-



Kamov Ka-25 (NATO 'Hormone-B') with landing gear retracted



Kamov 'Hokum' (DoD)

tional 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 734 in, length of fuselage 32 ft 0 in, height 17 ft 71/2 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 inhellete

## 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 transi-tion 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 re-placement of 'Hormone-As' with 'Helix-As' has con-

tinued. Four variants may now be identified, as follows: Hellx-A. Basic ASW version, with probable crew of three, Equipment includes undernose radar, a ventral veapons 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 60 operational. Eight ordered for Indian Navy.

Hellx-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 Helix-C. Civil versions, designated Ka-32.

Hellx-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. 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 81/2 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 accu-rate in all general detail. 'Hokum' can be seen to have coaxial contrarctating 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 airto-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 ar-

In 1987, 'Hokum' was still at the development stage,

with only a few prototypes involved in flight and structural testing. If it enters production, DoD expects that "Hokum will give the Soviets a significant rotary-wing air superlority capability. The system has no current Western counterpart'

Dimensions: rotor diameter 45 ft 10 in, length excl nose probe and gun 44 ft 31/2 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 turbo-

shafts; each 400 shp.

Dimensions: rotor diameter 47 ft 634 in, length of fuselage 37 ft 43/4 in, height 12 ft 31/2 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 pro-duction 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 101/2 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 Ib 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 1,950 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 weap-ODS

Hlp-D. For airborne communications role; see page 82, 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 170 in service with Soviet ground forces.

HIp-F. Export counterpart of 'Hip-E'. Missile armament changed to six 'Saggers'.

Hlp-G. For airborne communications duties; see

Hip-H. See entry on Mi-17. Hip-H. See entry on Mi-17. Hip-J and K. ECM versions; see page 82. Power Plant: two Isotov TV2-117A turboshafts; each 1.700 shp. Standard fuel capacity 494 gallons, max ferry capacity 977 gallons.



Mil (WSK-PZL Swidnik) Mi-2 (NATO 'Hoplite') (Robert Senkowski)



Mil Mi-8 (NATO 'Hip-C') (Robert Senkowski)



Mil Mi-14 (NATO 'Haze-C') of the Polish Air Force

Dimensions: rotor diameter 69 ft 101/4 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 com-bat equipped troops on tip-up seats along cabin side walls; 8,820 lb of freight internally, 6,614 lb externally; or 12 litters and attendant.

Armament: see individual model descriptions.

Mil Mi-14 (V-14) (NATO 'Haze') The Mi-14 shore-based amphibious helicopter flew for the first time in 1973. Overall dimensions, power plant, and dynamic components are generally similar to those of the Mi-17, reflecting parallel development from the Mi-8 airframe. New features to suit the Mi-14 for its primary role as an antisubmarine aircraft include a boat hull of the kind used on the Sikorsky Sea King and a sponson on each side at the rear to confer a degree of amphibious capability. The landing gear is fully retract-able. 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.



Mil Mi-17 (NATO 'Hip-H') used to patrol border between East and West Germany

Three versions of the Mi-14 are identified by NATO reporting names

Haze-A. Basic ASW version, with crew of four or five, as described above. About 100 operational in Soviet

Haze-B. 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 10 in service with Soviet Navy; others with the East German and Polish services.

Haze-C. 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, and eight to East Germany. Production continues. **Power Plant:** two Isotov TV3-117 turboshafts; each 2,200

shp.

Dimensions: rotor diameter 69 ft 101/4 in, length overall incl rotors 83 ft 0 in, height 22 ft 734 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')

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 deliv-eries include 16 to Cuba in 1983 and others subse-quently 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 101/4 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 was designed originally to deliver a squad of eight assault troops into a battlefield. Its weapons were intended then to clear a path past any tanks, antiaircraft guns, or other obstructions to its progress, but it was not long before training exercises caused a major change in tactics. Today, the Mi-24, redesigned in gunship form, is regarded as not only an antitank weapon but capable itself of functioning as a high-speed, nap-of-the-earth 'tank', and of destroying enemy helicopters in air-to-air combat. Other duties include escort of troop-carrying Mi-8/17s and ground attack. To reduce vulnerability to ground fire, steel and titanium were substituted for aluminum in critical components, and glassfiber-skinned rotor blades replaced the original metal blade-pocket design. As a result of combat experience in Afghanistan, infrared jammers, suppressors, and decoy dispensers have been added, and armor has been increased. Vari-ants identified to date are as follows:

HInd-A. Initial series production version. Armed assault transport, with large enclosed 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, 20round packs of 80 mm rockets, UPK-23 pods each containing twin 23 mm guns, up to 3,300 lb of chemical or conventional bombs, or other stores; four AT-2 (NATO Swatter') antitank missiles on wingtip launchers. Provisions for firing AK-47 guns from cabin windows. Anti-torque 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 ca-pability 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 tur-ret, 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.

Hind-E. As 'Hind-D', for Soviet armed forces, 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. 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 acci-dent at a nuclear power station, this version lacks the usual undernose electro-optical and RF guidance packs for antitank missiles. Instead of wingtip weapon attach-ments, 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 continuing at the 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, Mo-zambique, Nicaragua, North Korea, Poland, Vietnam, and South Yemen. Some export models, including those for India, are designated MI-25, suggesting different equipment standards.

#### 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 celling 14,750 ft, combat radius with max military load

99 miles, range with max fuel 466 miles. Accommodation ('Hind-D/E'): crew of two; 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 adjust-able individually in length to facilitate loading and to ermit 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 fuse-

lage 110 ft 8 in, height to top of main rotor head 26 ft 83/4 in.

Weights: empty 62,170 lb, gross 123,450 lb, max pay-

load, Internal or external, 44,090 lb. Performance: max speed 183 mph, service ceiling 15,100 ft, range 497 miles.

Accommodation: crew of five; about 40 tip-up seats

Mil Mi-24 (NATO 'Hind-D') of the Polish Air Force (Robert Senkowski)

along side walls of hold; max seating for about 85 combat-equipped troops. Other loads include two air-borne 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 weapon 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 will have two Isotov TV3-117 turboshaft engines of the kind fitted to the Mi-24 and Ka-27, but its rotor system is believed to be 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 yet 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 (NATO 'Sandal')

The Soviet Union's remaining 112 SS-4s are scheduled for elimination under the terms of the INF treaty signed at the Washington summit meeting on December 8, 1987. Remembered as the missile that precipitated the Cuba crisis in 1962, the SS-4 was based on German wartime V-2 technology. About 12 tractors with special trailers, and 20 men, are needed to transport, erect, and fire each missile. The entire force is located in the western USSR, opposite European NATO.

ower Plant: one four-chamber RD-214 liquid-propellant (nitric acid/kerosene) sustainer; 163,142 lb thrust in vacuo.

Guldance: inertial, offering CEP of 2.4 km (1.5 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')

Three versions of this 1966–70 vintage '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 and 20 SS-11 Mod 1s remained in early 1987. Differences are as follows:

SS-11 Mod 1. Single reentry vehicle (950 kiloton), with CEP of 1.4 km (0.87 miles).

SS-11 Mod 2. Single reentry vehicle (1 megaton), with

added penetration aids. SS-11 Mod 3. First operational Soviet missile with MRVs (three 100-300 kiloton). CEP 1.1 km (0.7 miles). Power Plant: two-stage storable liquid-propellant. Guidance: inertial.

Warhead: single nuclear (Mod 1 and 2); three MRVs (Mod 3).

Dimension: length 66 ft 0 in. Performance: max range Mod 1 6,835 miles, Mod 2 8,075 miles, Mod 3 6,585 miles.

SS-13 (NATO 'Savage') In the Minuteman category; only 60 SS-13 ICBMs are deployed, in Mod 2 configuration.

Power Plant: three-stage solid-propellant. Guldance: inertial, offering CEP of 1,8 km (1.1 miles). Warhead: single RV; nuclear (750 kilotons). Dimensions: length 66 ft 0 in, max diameter 6 ft 6 in (first-stage skirt).

Performance: range 5,840 miles.

#### SS-16 (Soviet designation RS-14; NATO 'Sinner')

This three-stage solid-propellant ICBM is basically an SS-20 IRBM with an added stage. Testing of the SS-16, which can be silo or vehicle based, took place in 1972-76, but further production, test, or deployment were to be banned under the nonratified SALT II agree-ment. DoD's official view is that available information does not allow a conclusive judgment on whether or not the Soviets deployed the SS-16. Power Plant: three-stage solid-propellant.

Guldance: inertial. Warhead: single RV, nuclear. Dimension: length 59 ft 0 in. Performance: range 5,600 miles.



Mil Mi-26 (NATO 'Halo')

#### 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 150 SS-11 silos have been modified to accept SS-17 missiles, all upgraded to Mod 3 standard with four MIRVs and suitable for use against targets in Eurasia as well as in the US. 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.

Warhead: four MIRVs (each 750 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, All have been upgraded to Mod 4 standard, with at least 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, using two nuclear warheads against each silo. After doing so, more than 1,000 SS-18 warheads would still be available for further attacks on US targets. A CEP of under 1,000 ft has been quoted. Power Plant: two-stage liquid-propellant.

#### Guldance: 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') The Soviet Union's 360 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-propeliant.

Guidance: inertial.

Warhead: six MIRVs (each 500 kilotons) Dimensions: length 75 ft 0 in, max diameter 9 ft 0 in. Performance: max range 6,200 miles.

#### SS-20 (Soviet name Pioneer; NATO 'Saber')

If and when ratification of the INF treaty initiates elimination of the SS-20 force, this will remove the most formidable Soviet threat to NATO nations in western Europe. Of 441 launchers currently deployed, 270 are opposite NATO, with the others targeted on China and Japan, SS-20s could attack the Aleutian Islands and western Alaska from deployment areas in the eastern USSR, but could not reach the contiguous 48 states. The SS-20, currently in Mod 2 form, is a mobile solid-propellant missile, carried on a wheeled launcher that is capable of both on- and off-road operation, rendering detection and targeting difficult. Furthermore, the launcher has the capability of being reloaded, and refire rounds are known to be stockpiled. A CEP of about 1,300 It is estimated when the SS-20 is fired from a presurveyed site. An improved version, with even greater accuracy, is being flight-tested.

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')

Construction of an extensive network of rail support facilities for the rail-mobile version of the SS-24 was so advanced a year ago that deployment was regarded as imminent. 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.

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 1987, the Soviet Union was estimated to have deployed about 100 launchers for this Minute-man-size ICBM at several operational bases. Each base



Artist's impression of SS-20 (NATO 'Saber') (DoD)



Artist's impression of SS-25 (NATO 'Sickle') (DoD)

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 twice the throw-weight and five 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. 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. A replacement for the SS-18 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 more than 25 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 ver-sion 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 liquidpropellant rocket motor, with inertial midcourse guidance and active radar terminal homing, giving excep-tional accuracy. The warhead can be either nuclear (200 kiloton) or 2,200 lb high explosive. Dimensions: span 8 ft 21/2 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, in-cluding launches from 'Backfire' bombers, the Soviet Union began deployment of its new-generation 'Kent' long-range air-launched cruise missiles on 'Bear-H' strategic bombers in 1984. 'Kent' will also arm 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 USAF's much smaller General Dynamics ground-launched 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 150 ft, and a nuclear warhead. Dimensions: span 10 ft 8 in, length 23 ft 0 in.

Performance: speed subsonic, range 1,850 miles.

#### **BL-10**

This supersonic cruise missile, with a reported range of 2,000 miles, is being developed as an alternative weap-on 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 guldance is believed to comprise preprogrammed flight under autopilot control, with optional command override, and active radar terminal homing. A 2,200 lb high-explosive warhead is fitted. Dimensions: span 16 ft 0 in, length 32 ft 10 in. Weight: 9,260 lb.

Performance: max speed Mach 1.2, range 132 miles.

#### AS-5 (NATO 'Kelt')

The transonic AS-5 has a similar aeroplane-type con-figuration 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 permit-ted the use of a larger radar inside the hemispherical nose fairing. Guidance is said to be by autopilot on a preprogrammed flight path, with radar terminal homing that can be switched from active to passive as required. A

2,200 lb high-explosive warhead is standard. Well over 1,000 AS-5s had been delivered by the spring Well over 1,000 AS-55 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 14 ft 11/4 in, length 28 ft 2 in. Weight: 7.715 lb.

Performance: max speed Mach 0.9 at low altitude, Mach 1.2 at 30,000 ft, range 100 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 tactical air-to-surface missile is said to have a singlestage solid-propellant rocket motor, radio command guidance system, and 220 lb high-explosive warhead. Dimension: length 11 ft 6 in. Weight: under 880 lb.

Performance: max speed transonic, max range 7 miles.

#### AS-9 (NATO 'Kyle')

This is a reported antiradiation missile, with a range of 55 miles at supersonic speed, carrying a 330–440 lb warhead for defense suppression. It is said to arm Su-24, Tu-16, and Tu-26 aircraft. Dimension: length 19 ft 91/2 in.

#### AS-10 (NATO 'Karen')

The laser homing 'Karen' is a solid-propellant rocketpowered 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

milae

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 suppres-sion version of the MiG-25. DoD has listed it among weapons carried by the Su-24 'Fencer'

#### AS-12 (NATO 'Kegler')

'Kegler' is described as an advanced version of the AS-9, with a different seeker and improved performance. It, too, is carried by the Su-24.

#### AS-13 (NATO 'Kingbolt')

Nothing is known about this new 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 25 miles.

#### AT-2 (NATO 'Swatter-C')

This standard Soviet antitank weapon formed the original 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' employs semiautomatic command to line-of-sight (SACLOS) guidance via elevons on the trailing-edges of its rear-mounted cruciform wings and two small movable canard surfaces at the nose.

Dimensions: span 2 ft 2 in, length 3 ft 934 in. Weight: 65 lb.

Performance: cruising speed 335 mph, range 800-13.125 ft.

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 1,650-9,850 ft.

#### AT-6 (NATO 'Spiral')

Unlike previous Soviet helicopter-launched antitank missiles, 'Spiral' does not appear to have a surface-launched application. Few details are available, except that it is tube-launched and radio command guided. It equips the 'Hind-E and F' versions of the Mi-24 and is said to have a range of up to 5 miles.

#### AA-2 (NATO 'Atoll')

Designated K-13A in the USSR, '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 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 13 lb fragmentation warhead are fitted. Dimensions: length 9 ft 2 in, body diameter 4.72 in, fin

span 1 ft 83/4 in.

Weight: 154 lb.

Performance: cruising speed Mach 2.5, range 3 to 4 miles.

#### AA-2-2 (NATO 'Advanced Atoll')

he 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 a standard infrared homing 'Atoll' on the inboard pylon. The radar version is known as 'Advanced Atoll'. Length is increased to at least 9 ft 10 in.

#### 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

Dimensions: length 13 ft 5 in (IR) or 13 ft 1 in (SAR), body diameter 11 in, wing span 4 ft 3 in. Performance: range over 10 miles.

#### AA-5 (NATO 'Ash')

Several thousand of these large air-to-air missiles were produced as armament for the Tu-28P interceptors of



#### AA-10 (NATO 'Alamo') missiles on Su-27 ('Flanker-B') (Royal Norwegian Air Force)

Voyska PVO. 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 4½ in (IR) or 17 ft 0 in (SAR), body diameter 12 in, wing span 4 ft 3 in. Performance: range 18.5 miles.

#### 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 220 lb warhead. Photographs suggest that the version of 'Acrid' with an infrared hom-ing 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 71/2 in (radar version), 19 ft 0 in (IR version)

Weight: 1.650 lb

Performance: cruising speed Mach 2.2, range at least 23 miles

#### AA-7 (NATO 'Apex')

This long-range 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 is deployed in both infrared and semiactive radar homing versions (Soviet designations R-23T and R-23R respectively). Warhead weight is 88 lb. Dimensions: length 15 ft 11/4 in, body diameter 8.75 in,

wing span 3 ft 51/2 in. Weight: 705 lb.

Performance: range 20 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 7 ft 21/2 in, body diameter 4.75 in, wing span 1 ft 33/4 in, Weight: 121 lb.

Performance: range under 1,650 ft min, 3-4.3 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 an alternative weapon for the MiG-29. Performance: range 25-28 miles at height, 12.5 miles at S/I

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 ver-sion, 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-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 helicop-

ters 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 silobased launchers for long-range modified ABM-1 'Ga-losh' 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 nu-clear 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 mis-sile will be deployed in 32 of the modernized ABM-1 silos, at four complexes around Moscow, as the second laver 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 is deployed by the Soviet Union at more than 300 sites and by about 26 of its allies and friends as a mobile lowaltitude 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. Guldance: 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 airtransportable 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 1990s, 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 26 ft 101/2 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 longrange 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.

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 unexpect-edly 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, heatseeking 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 infan-try, 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 antihelicopter combat use.

Power Plant: solid-propellant booster/sustainer. Guidance: infrared homing with filter to screen out de-

coy 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 shortrange, 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 horning.

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, ef-fective ceiling 20,000 ft.

#### SA-9 (NATO '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 sur-face-to-air missile systems. These include multitarget tracking and engagement, a capability against low-al-titude 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 this version was operational at more than 80 sites by 1987, with work in progress on a further 20 sites. Nearly half the force is stationed near Moscow, suggesting a priority on termi-nal 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.

Guldance: 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. It can be de-ployed alongside SA-6s, using common radars, 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. 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. Guldance: semiactive radar command.

Warhead: high-explosive, weight 330 lb. Dimensions: length 23 ft 8 in, body diameter 1 ft 8 in.

aunching 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') The USSR had under flight test in early 1987 this longer-range, higher-altitude version of the SA-12 that 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 transportererector-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.

Guldance: 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 is replacing the latter In Soviet service. It can engage aircraft pulling up to 8g and has an all-aspect capability enabling it to engage targets head-on at ranges up to 13,000 ft.

#### SA-X-15

Known to NATO as the SA-X-15, a new mobile, low- to medium-altitude, surface-to-air missile system is under development to replace the SA-8 'Gecko'. No details are available.

#### **SA-16**

DoD's Soviet Military Power publication refers to "new, highly accurate SA-16 handheld SAMs replacing the SA-7 in tactical units". No details are available.

#### 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 carrler/ 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 effec-tive 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

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. No authentic information on the SA-N-6 missile is available, although some relationship to the landbased SA-10 seems likely. Best estimates suggest a length of about 23 ft, effective ceiling of at least 100,000 ft, and range of 37 miles at Mach 6, carrying a 200 lb warhead. Likely features include multiple target detection and tracking and high resistance to ECM and jamming.

#### SA-N-7

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 thought to be 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 hellcopter pad, and two rectangular groups of four launchers on the forecas-tle. The same missile is carried by *Udaloy* class antisubmarine ships and the carrier/cruisers Novorossiysk and Baku. No details are available.

# A C T U A T I O N • P O W E R S Y S T E M S • F A B R I C A T I O N S E L E C T R O N I C S Y S T E M S • E N G I N E S Y S T E M S

# WE HAVE THE MEANS TO PERFECT YOUR ENDS.

Lucas provides the main engine controls and thrust reverser actuation for the Tornado. Which is hardly surprising, as virtually all the world's most advanced aircraft and missiles depend on Lucas technology. Contact Lucas Aerospace Ltd, Brueton House, New Road, Solihull, West Midlands, B91 3TX, England. Tel: 021-704 5171. Telex: 335334. Lucas Aerospace Inc., 11150 Sunrise Valley Drive, Reston, VA, 22091-4399, U.S.A. Tel: (703) 264 1704. Telex: 197930. Lucas Aerospace France, 11 Rue Lord Byron, Paris 75008, France. Telephone: (1) 45 61 95 25. Telex: 290080.



TECHNOLOGY YOU CAN TRUST

The Air Force's new acquisition official says that in today's environment, good systems that run into trouble may be killed before it's possible to work out the bugs in them.

# Backlash from the R&D SuperStandard

NAVIGATION and targeting system sorely needed by Air Force ground-attack fighters had rocky going in development. It is in production today, only because the Air Force had enough money and could buy enough time to stay with it through its technological troubles. Now, with much less money to go around, taking such pains with highly prized systems having big problems may be a thing of the past.

This point is made by John J. Welch, Jr., Assistant Secretary of the Air Force for Acquisition. His example is LANTIRN, the Low-Altitude Navigation and Targeting Infrared for Night system. It is designed to enable attack aircraft to find and hit ground targets at night and despite low cloud cover, a capability that they have never had and that may make all the difference in combat to come.

"I wonder if LANTIRN could have survived to be successful in today's environment," muses Mr. Welch in his measured way. "It was developed during a period of growing budgets. The Air Force could afford to have the patience to let it come together and show that it could be made to do what was expected of it.

"Today, the fact of life is that if we have a high-priority system in difficulty—financial, schedule, or performance—we are forced to judge it against others that we know we can afford, that are on schedule, and that are performing. It's hard now to make a judgment to save a program on the basis of its priority—the need for it—alone."

Mr. Welch also wonders "whether AMRAAM would have lived" through a time of tight budgets. Right from the start, the Air Force tagged the Advanced Medium-Range Air-to-Air Missile as a musthave weapon, one that would give fighters launch-and-leave capability for reversing the odds when outnumbered and for keeping safe disBY JAMES W. CANAN SENIOR EDITOR tance from foes. But it was touch and go for AMRAAM through several years of turbulent development and testing, and the weapon may very well owe its survival to the beefier defense budgets of the recent past.

The leaner budgets now on and in store for the Pentagon simply mean, says Mr. Welch, that the Air Force "will have to buy less and accept the risk" in matching its force structure, came USAF's top boss of acquisition last November, succeeding Thomas E. Cooper and reporting to Secretary of the Air Force Edward C. Aldridge, Jr. His civilian post had gained ascendancy over the uniformed side of the Air Force acquisition hierarchy as a result of last year's reorganization of the command structure.

There is no longer a general-officer Deputy Chief of Staff for Rejunior engineer in 1951, back when the firm was called Chance Vought. Through the years, he worked on a wide range of weapons programs, from aircraft to antisubmarine warfare. Missiles and space systems were his specialties at the point of his promotion in 1975 to corporate business-development leadership.

Mr. Welch's background goes well beyond the corporate world, however. He served as Chief Scien-



Assistant Air Force Secretary for Acquisition John J. Welch, Jr., points out that ample funding enabled USAF to ride out troubles with LANTIRN, represented (at right) by a head-up display in a fighter. Such patience is no longer possible in today's budget climate.

weapons, and technologies with its strategy and missions for meeting present and future threats.

### On an Even Keel?

All is not lost, though. On the plus side, he says, are signs that the executive and legislative branches of government may be coming to terms on the need to put defense spending on an even keel, which would be salutary in itself.

"The ingredients that are missing from what is otherwise a well-understood and well-structured acquisition process are financial stability and program stability," Mr. Welch declares. If defense spending is raised modestly but consistently each year, the Air Force, he says, "will have the opportunity to make sure that we really are procuring those things that are going to satisfy our needs to meet the threats in the time periods when the user commands will have those needs."

Mr. Welch, who is fifty-seven, be-

search, Development, and Acquisition directly accountable to the Chief of Staff. That slot was shifted to civilian control and was renamed Principal Deputy for Acquisition. It is now manned by Lt. Gen. George L. Monahan.

The big budget crunch of late last year caught Mr. Welch coming in the door, but did not detract from his outlook. "For anyone with my background and experience, this has to be a great job," he says. "We have a good acquisition system, a new approach to acquisition as a matter of policy and law, lots of good things we're procuring to meet the Air Force's well-established needs, and good people who want to get it done."

His career has been in aerospace all the way. He was Senior Vice President of LTV Aerospace when he accepted the Air Force post. He left the corporation that he had joined, fresh out of the Massachusetts Institute of Technology, as a tist of the Air Force in 1969–70 and has been a consultant to the Air Force Scientific Advisory Board, Air Force Systems Command, the Defense Science Board, the Army Science Board, and, on naval affairs, the National Academy of Sciences.

He has also been a member of the Defense Systems Management College Board of Visitors, the MIT Educational Council, and the Center tractors, such as their teaming on major programs, are different today. Their return on investment is trending heavily in the negative direction, so the money that they have available to invest as a result of profits is being pressed."

The Air Force's Advanced Tactical Fighter program has brought the issue of contractor cost-sharing to the forefront of procurement concerns. The ATF program has a linehigh-priority, long-term effort. The potential market [750 fighters] for industry was obviously a big one. But the Air Force knew that it would not have enough money to pursue the development program at the rate that it wanted to.

"So the Air Force sat down with the companies and put all those things on the table. It told them that it really wanted to go after the ATF, but would need their help. They said



The Advanced Medium-Range Air-to-Air Missiles (AMRAAM) shown at right on an Air Force F-16 Fighting Falcon, Secretary Welch stresses, are must-have weapons for USAF. AMRAAM encountered big problems in development and testing. Secretary Welch theorizes that the beefier defense budgets of the recent past allowed enough breathing room for the AMRAAM program to work through those difficulties.

for Strategic and International Studies, having specialized there on issues of technology transfer and emerging military technologies.

## **Discouraging Innovation?**

Making sure that those technologies keep on coming from a healthy, competitive defense industry is one of Mr. Welch's major goals. He is in harmony with Secretary Aldridge, who has warned that "we're on the road to destroying our industrial base" because of policies that require contractors to invest too heavily in too many development programs and that tend to discourage risky innovations that are "necessary to move our technology forward."

Says Mr. Welch: "The military marketplace has many of the features of the commercial marketplace, but it is different, because there are big winners and big losers. The relationships among the con-

up of US aerospace all-stars. Lockheed, Boeing, and General Dynamics are teamed against Northrop and McDonnell Douglas in competition to build the fighter. General Electric and Pratt & Whitney are competing to build the ATF engines. Westinghouse and Texas Instruments are teamed on the ATF radar. All are investing heavily in the winnerstake-all program, and many have complained that their expenditures are eating them alive, will neutralize their ATF profits for years ahead if they come out winners, and will haunt them forever-perhaps destroy them-if they come out losers.

The Air Force is sympathetic, but also points out that the companies knew what they were getting into from the start.

"At the time that the ATF program started," says Mr. Welch, "it had the ingredients, and it has them today, of good competition in a very they would help and that they recognized the need for their investment.

"Now, after all is said and done, everyone is asking how it is all running out. If it doesn't run out well, if we drive people out of business and shrink our industrial base, we will not have the industrial competitiveness that we will need for the kinds of technology and systems that we'll have to have in the long run. So we shouldn't pursue a negative [acquisition] strategy."

The upshot of all this is another look, in an Air Force-industry study ordered up by Mr. Welch, at the ATF acquisition program.

"The ATF program happens to be the one we're focusing on," he says, "but the study is broader than the ATF. It is addressing what our acquisition strategy should be in order to ensure that we'll have a robust industrial base in the future. It signals that we understand both sides of the equation—investment and return on investment—in doing business with industry.

"Industry is, by definition, in free enterprise. It has certain requirements—and one is that a company has to have a return on investment if it's going to stay alive or is going to fulfill its obligations to stockholders."

Mr. Welch cautions against interpreting the current reexamination of Air Force acquisition as caving in to contractor complaints: "We're reminding them [the companies] that we were up front with what we had and what we wanted, that we have honored our commitments as to the size and the priority of the ATF program, and that they're in it."

Mr. Welch did not address the possibilities for reformation of procurement policy and practices that the study may explore. There are indications, though, that it will consider development contracts that guarantee contractors certain levels of return on investment if they in turn are willing to take commensurate risks and control costs.

#### **Changes Are Afoot**

Whatever comes to pass in the study, it is clear that changes in ways of doing business with industry are afoot not only in the Air Force but in the Department of Defense at large.

Dr. Robert B. Costello, who recently succeeded Richard Godwin as Under Secretary of Defense for Acquisition, has said that DoD must improve its relations with industry and must, by the same token, revitalize the defense industrial base. Dr. Costello is said to be attracted to incentive-type contracts that make it more worthwhile for contractors to restrain program costs.

Keeping costs under control is imperative in the ATF program. The Air Force's goal is to come up with an ATF no heavier than 50,000 pounds and costing no more than \$35 million each—as measured by the value of the dollar in Fiscal Year 1985 and assuming the production of 750 aircraft at the rate of seventytwo per year, beginning in the mid-1990s.

Those weight and cost ceilings were set by Mr. Welch's predecessor, Dr. Cooper. It is no secret that the fighter community and the fighter R&D community regarded them as overly ambitious, but agreed to abide by them for the sake of getting the program under way. More and more, however, those ceilings are being called into question as the Air Force and its ATF contractors continue to chip away at the fighter's performance characteristics in order to contain the aircraft's cost and retain its planned production quantity.

On this issue, Mr. Welch declares that the Air Force "cannot and will not sacrifice" its requirement that the ATF be built as "a revolutionary air-superiority fighter that can do its job over the aggressor's territory. That is the user's requirement, and that's what's driving the program.

"But we're also realists. We know that if an airplane gets too big and heavy, it's going to cost too much money, and we won't be able to get sufficient numbers. We've got to have force structure as well as performance. Quantity of aircraft is an asset that can't be dismissed. We can trade off quantity and quality, but we must trade them off within the boundaries of force-structure requirements and performance requirements. Those requirements are well understood, and we will meet them."

Will the Air Force have to relent sooner or later and raise its weightand-cost ceiling for the ATF? "That's a little hard to answer," replies Mr. Welch. "It was properly set as the kind of weight and the kind of dollars that would permit us to get the kind of force structure that was thought to be required. It's very real. Pounds are dollars, and flyaway dollars are the great denominator in determining force structure. The important thing is to achieve the characteristics for air superiority at a cost we can afford."

On the issue of contractor investment, the National Aerospace Plane program is another striking case in point where USAF is concerned.

General Dynamics, McDonnell Douglas, and Rockwell International were chosen last October as the finalists in competition to continue developing technologies for the hypersonic X-30 experimental aircraft that is scheduled to begin flying in the early to mid-1990s. Rockwell's Rocketdyne Division and Pratt & Whitney are competing in development of the highly advanced engines that will be required for the plane's hypersonic flight in air and space.

NASP program officials expect that by the time the X-30 takes to the air, the companies involved in the program will have spent up to half as much money on it as the government will have paid them to proceed.

In terms of contractor investment, "the NASP program is the opposite of the ATF program," Mr. Welch says. "The Air Force has not told the NASP contractors that it's a number-one operational priority program or that we know when NASP will go operational or how many we plan to build."

What it comes down to, he says, is that contractors should see for themselves that the NASP program is a good buy for their investment dollars even without any immediate promise of a big market: "If I were in industry and looking at that program, I would conclude that it must help my technology base and will help me be competitive in the future, or I wouldn't invest in it."

Nevertheless, the Air Force will do all it can to facilitate industry's investment in NASP technologies. The reason, says Mr. Welch, is that "we know that the Air Force must be out in front in getting an industrial base for hypersonic technologies so that we can be confident of being able to operate in the hypervelocity regime. That regime is certainly more interesting to the Air Force than it is to anyone else. We should be the leader in it, and the NASP program offers us the opportunity in the near term."

#### Managing the Risks

The NASP program is an extreme example of the technological riskiness of virtually all Air Force development programs—and on this score, Mr. Welch has words for critics of Air Force R&D and procurement management.

"Defense procurement requirements are different from others," he says. "We are asking for systems and applying technology to keep reaching out against very challenging threats. So we know up front that we have to take risks. Our job is to manage the risks, not to avoid them. Most times when we are criticized, it's because the critics don't recognize that we're not in a riskfree business. If you want us to be free of risk, you will not have programs that will keep us the most admired and respected defense capability in the free world. People who are quick to jump on us should recognize that they were told of the risks, just as we were, at the outset.

"There is plenty of room for us to improve, and we are improving. But have we managed our risks well? tary of Defense Frank C. Carlucci.

Mr. Welch cautions against "addressing the subject of radar warning receivers without recognizing that thousands of aircraft exist today—some bigger than others, some with newer systems, some with older systems, some required to perform in a high-threat environment, some in a low-threat environment, and some that will be with us for a longer time than others. to a slew of joint-service EW programs under OSD management.

Mr. Welch indicates reservations about this, saying: "Where there are mutual needs across the services, you can end up with joint programs. But jointness is a result, not a goal, and it should not be predefined. To presume that it's a virtue unto itself is to cause anomalous decisions."

He leaves no doubt of his philosophical and practical opposition to



"Our job," says Secretary Welch, "is to manage the risks." One high-risk program currently on the burner is the National Aerospace Plane (NASP) project. An artist's concept of how such an advanced hypersonic vehicle might look is shown at left.

The answer is, 'Hell, yes, we have.'"

Over the past few years, the Pentagon has taken increasing heat from Congress over its management of electronic warfare systems acquisition, with special emphasis on the alleged jumble of programs for aircraft radar warning receivers (RWRs).

Last August, the General Accounting Office reported that the Air Force and the Navy were acquiring nine different RWRs for their tactical aircraft at a combined cost of more than \$6.6 billion, that "none are common to both Air Force and Navy aircraft," and that "the services have not capitalized on several opportunities to develop common RWRs."

GAO's charges prompted the Office of the Secretary of Defense to launch a special program review (SPR) of the RWR situation last October that seems, at this writing, to be picking up steam under Secre"To reject these facts of life in planning RWR procurements to meet all the needs would be to hold the real world hostage to the unachievable world—and maybe that's the way we're being asked to live."

In the EW context, the question of the adequacy of the defensive avionics on the B-1B bomber invariably comes up.

Says Mr. Welch: "We did a good job on the individual systems on the bomber, but we ran into difficulties when we wanted them all to work together. Today, the defensive system in the airplane can go to war no question in our minds. Over time, we will get to the full capability that we want. The [defensive avionics] contractor was given a job to do, and he didn't do it. Now he is doing it."

Congress is putting heavy pressure on the Pentagon to devise a master plan for development and procurement of electronic warfare systems that would inevitably lead centralizing the execution of the services' acquisition programs in the Office of the Secretary of Defense, a move that many in Congress favor and that seemed to be afoot in OSD for a time last year under Richard C. Godwin, then the Under Secretary of Defense for Acquisition.

The drift toward centralized acquisition created a rift between Mr. Godwin and the service Secretaries, who, with Secretary Aldridge in the forefront, managed to stem it. Mr. Godwin subsequently resigned, because he lacked the authority that he thought was due him in the congressionally mandated revamping of the Pentagon's procurement power structure.

Dr. Costello, who served under Mr. Godwin and then succeeded him, is believed to be less sensitive to the issue, but much remains to be seen.

Of centralized acquisition, Mr. Welch asserts: "I've seen it tried elsewhere, and it hasn't worked."

# Viewpoint

# **Cautious Indecision**

By Gen. T. R. Milton, USAF (Ret.), CONTRIBUTING EDITOR

The Bay of Pigs—our first experiment in "measured response"—has become the model for our timid and ineffective approach to national defense and to strategy in Central America.



It may be only a side effect of the catastrophic weather, but 1988 does seem to be unraveling a bit early. Perhaps the sight of a Soviet General Secretary venturing where

Presidents fear to tread—namely, into the midst of an American crowd—has lowered interest in defense at both ends of Pennsylvania Avenue. The danger of war has somehow gone the way of the Pershing IIs and GLCMs.

In all fairness, the danger of a third world war is remote just now, but so it has been for a long time. A principal reason for this comfortable assertion has been our readiness to fight World War III, if it came to that.

As Armageddon recedes from view, however, other unpleasantries come to the fore, ones that will become more unpleasant, even unmanageable, if we fail to deal with them. Anyone listening with half an ear to the current Presidential campaign is entitled to feel discouraged over our future willingness, or capability, to act in our national interest. In fact, some of the aspirants to the role of Commander in Chief sound as though the armed forces are essentially irrelevant.

The Caribbean Basin Initiative, for instance, begun so auspiciously a few years ago, is foundering on the question of the Contras. Whatever their motivation, these opponents of the Sandinistas symbolize the uncertainty of current US security objectives. No one really believes that the Contras, or freedom fighters, to use the preferred honorific, can actually overturn the Sandinista regime. For one thing, our level of support for the 12,000 or so Contras is far below that furnished Managua by the USSR. Nevertheless, the Contras are a serious impediment to the exported revolution promised by the Nicaraguan commandantes. That should be reason enough for US support—that and the fact that a revolution stopped now is infinitely preferable to a Central American war fought later on. The opposition believes otherwise.

Opposition in Congress has, of course, been a severe impediment to Central American initiatives. The Boland Amendment, such outspoken congressional Sandinista supporters as Rep. Ron Dellums (D-Calif.), and others not so outspoken but nonetheless in the Sandinista camp have been invaluable allies of the commandantes. Then there is the strange behavior of some Roman Catholic churchmen, such as Detroit's Bishop Thomas J. Gumbleton, who side openly with a regime that insulted Pope John Paul II when he visited Managua in 1983. The orchestrated crowd performance during his homily was an unprecedented display of badmannered defiance.

In some ways, the present situation is reminiscent of the state of affairs forty years ago. In 1949, the Truman Doctrine stated a firm intention to oppose the creation of totalitarian governments. While the USSR was not singled out, the meaning was clear: The United States intended to contain Communist expansion.

It is true that the Nicaraguan elections last year were judged to be honest, at least by Central American standards, so the Truman Doctrine doesn't quite fit. There were, however, circumstances accompanying those elections that detract from the Sandinista victory. Sandinista gangs broke up opposition rallies, and according to a reliable account, some opponents of the Sandinista regime were arrested or drafted. President Truman's brave words in 1949 came at a time when our armed forces were engaged in a bitter interservice quarrel and were demobilizing in a hasty and disorderly way. Aside from being the sole possessor of a few atomic bombs, the US military would have had trouble backing up President Truman's pledge.

Forty years later, the threats are still there. And while the current defense reductions are not comparable to the massive demobilization after World War II, there is a disturbing similarity. As in 1949, the commitment would appear to exceed our eroding capabilities. And it is not clear what those remaining capabilities are intended to accomplish.

If we learned anything in Vietnam, it was the futility of a timid strategy, for which the official term is "measured response." We gave signals and took casualties for nearly twenty years and came away with nothing. From all the signs, we are going the same way again. Grenada was a happy exception, and so, for that matter, was the retaliatory raid on Libya, but the general pattern is one of cautious indecision.

The Bay of Pigs fiasco, which can properly be called our first experiment in measured response, is plausibly at the root of the present Central American situation. After Fidel Castro's easy victory in that affair-made easy by President Kennedy's last-minute denial of US air cover for the landing-Castro and "Che" Guevara began to dream of a Marxist Central America. There was a period, in 1981, when the dream seemed in danger of coming true. The "final offensive" of the Sandinista-backed guerrillas in El Salvador failed, thanks mainly to intelligent US support.

The Sandinistas haven't given up. Since there has been no retraction of their original platform, we can assume they still plan to export their revolution. Just now, the need is to get the Contras off their backs, and so, sweet reasonableness is in order. With a decade of experience under their belts, Air Force program managers are looking at fiber optics for the advanced aircraft of the 1990s.

**F**IBER optic flight-control systems are finally coming to the Air Force. After more than a decade of research—while the other services forged ahead in implementing this new technology—the Air Force is now ready to take fiber optics out of the laboratory and put it into two of its top aircraft programs for the 1990s—the Advanced Tactical Fighter (ATF) and the X-30 National Aerospace Plane (NASP) being developed in cooperation with NASA.

The Air Force originally took the lead in this technology. The Flight Dynamics Laboratory at Wright-Patterson AFB, Ohio, awarded a development contract to Honeywell in 1977 for the DIGITAC (digital tactical aircraft control) program to demonstrate the use of advanced computers and data buses in operational aircraft. First flight of the A-7D test aircraft was on February 7, 1975, and on March 24, 1982, at Edwards AFB, Calif., it made the first totally fiber optic-controlled flight using a single-fiber flight-control system.

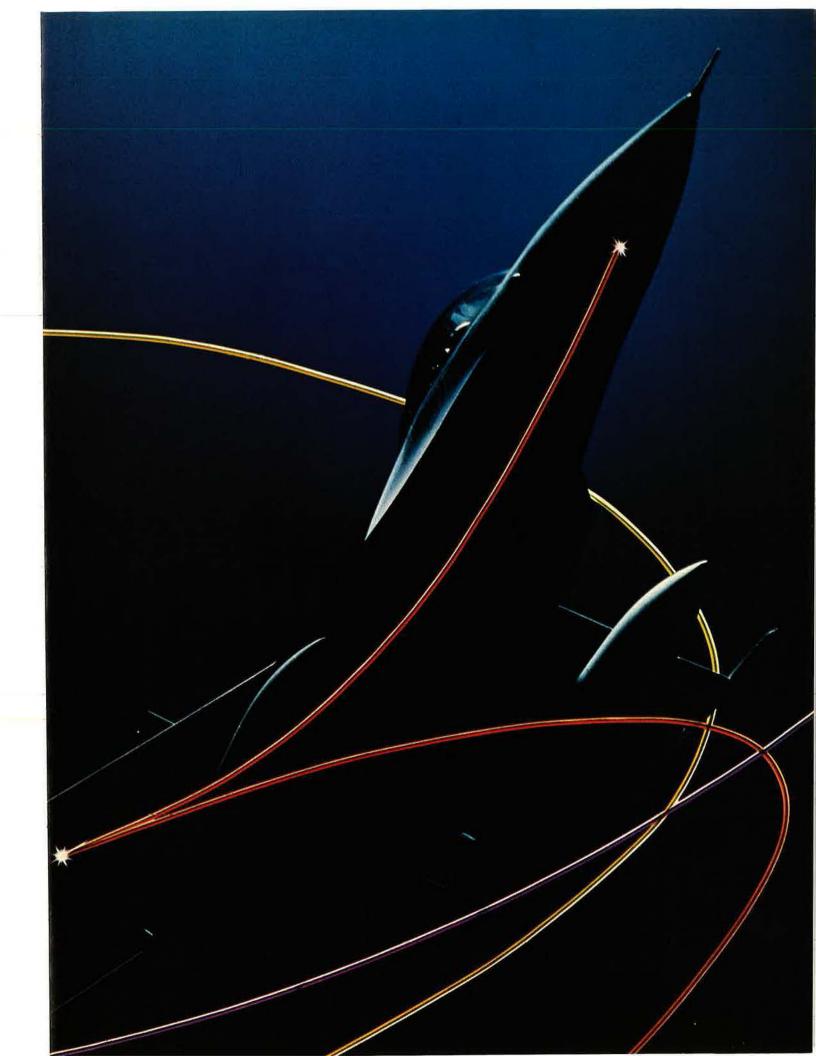
DIGITAC and the parallel research programs of the other services have demonstrated three major advantages of fiber optics for airborne applications: reduced weight, greater data-handling capability, and immunity to electromagnetic interference (EMI) and the electromagnetic pulse (EMP) caused by nuclear blasts. Conservative aircraft designers were reluctant to gamble on this new technology, however, until there was sufficient flight experience.

Now, with the DIGITAC experience behind them, the ATF and X-30 program managers at Aeronautical Systems Division (ASD) say that they are confident enough about fiber optics to specify it for their programs, although not necessarily for the flight controls.

# FLY BY LIGHT

**BY JOHN RHEA** 

The incorporation of fiber optics in advanced aircraft is depicted in this artist's concept. The Air Force is ready to put fiber optics to work in its Advanced Tactical Fighter and in the National Aerospace Plane now being designed for hypersonic filght in air and space.



"Fiber optic technology has matured to a point where use for both multiplex and point-to-point data paths is considered an acceptable risk in view of fiber's advantages over older wire circuits," Col. (Brig. Gen. selectee) James A. Fain, Jr., ATF system program director, told AIR FORCE Magazine. Dr. Robert R. Barthelemy, NASP program manager at ASD, added that the high data rates expected to be respokesman. "This is not regarded as a significant technical risk area."

## Moving Ahead on the X-30

Dr. Barthelemy said that the X-30 program office was currently concentrating on the propulsion system for the hypersonic aerospace vehicle. "We're at the stage of the program where we're just beginning to look at the controls and the communications . . . but the good news is be used as test-beds for the Strategic Defense Initiative, and that means they will have to reduce the cost of placing payloads in low earth orbit by a factor of ten, according to Dr. Barthelemy—from about \$4,000 per pound for today's Space Shuttle to \$400 for the hypersonic vehicles of the future. Weight may be an even more critical factor for this application than for tactical aircraft.

The first operational use of fiber



The Marine Corps AV-8B Harrier II was the first aircraft to embody fiber optics for data handling, not for flight control. Mc-Donnell Douglas is now considering the use of flight-control fiber optics in Its Navy F/A-18 and in a night-attack version of its AV-8B.

quired for the X-30 (more than five times greater than those for the F-15 and F-16) would require fiber optic data links and possibly also a new generation of optical computers using photons rather than electrons for data processing.

In both cases, the principal factor in favor of fiber optics is improved data handling. "The modular, integrated avionics architecture of the ATF relies on a high-speed data bus [HSDB] to interconnect avionics functions," Colonel Fain said. "Data rates up to 50,000,000 bits per second are projected. Both of the contractor teams for the current ATF demonstration/validation phase [Lockheed teamed with Boeing and General Dynamics and Northrop teamed with McDonnell Douglas] have adopted a fiber optic HSDB in their designs."

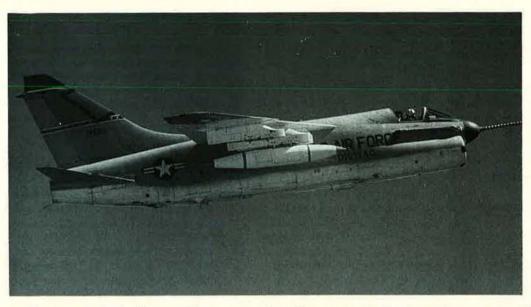
"Both the ATF contractor teams ... are investigating issues like the protocol and the use of active or passive couplers," added an ASD that the technology is moving an order of magnitude every five years," he said.

With last fall's selection of the major X-30 contractors (General Dynamics, McDonnell Douglas, and Rockwell International on the airframe and Rockwell/Rocketdyne and United Technologies/Pratt & Whitney on the propulsion system), Dr. Barthelemy expects a technology readiness review by 1990 and first flight in early 1993. That means that the technologies eventually employed will have to be in hand by 1990. That's going to be tougher for the propulsion and the airframe materials than for the avionics, according to Dr. Barthelemy, but he's not ready to call avionics "the short pole in the tent."

The other two features of fiber optics—weight savings and EMI/ EMP immunity—will also be important for the X-30, Dr. Barthelemy contends. Aerospace vehicles derived from the X-30 are expected to optics in an aircraft was achieved by the Marine Corps in its AV-8B ground support aircraft, although this was strictly for data handling and not for flight control. In-house studies by McDonnell Douglas in 1977, followed by flight tests in 1981, led in 1983 to the first production deliveries of aircraft equipped with fiber optics.

The purpose wasn't to reduce weight or save money, according to Gus Weinstock, electronics technology branch chief at McDonnell Douglas, but to prove this technology would work in aircraft. This first installation was only thirty-three feet long, connecting a digital map set used in the navigation system to a cockpit panel, and had a data rate of only 125,000 bits per second.

The most useful result of this effort, Mr. Weinstock recalls, is that it demonstrated that maintenance personnel could successfully work with the tiny fiber cables. The cables were subjected to a worst-case



Six years ago, the first flight under total control of fiber optics avionics was made by this A-7D test alrcraft at Edwards AFB, Calif. Developed by Honeywell under contract to USAF's Flight Dynamics Laboratory, the DIGITAC (Digital Tactical Aircraft Control) system in the A-7D was the start of something bla.

environment—including gasoline, oil, and other contaminants—and they still worked after they were installed.

## **Potential Pitfall**

Mr. Weinstock tells a story on himself that illustrates a potential pitfall of using fiber optics. The fiber optic cable assemblies had to be shipped to AV-8B co-prime contractor British Aerospace for installation, and Mr. Weinstock had them cut an extra foot long to be sure they would fit into the aircraft. As it turned out, that extra foot wasn't necessary and actually caused the cables to fail because the installers had to crimp the cables to jam them into the available space. All cables are now cut to the exact length.

McDonnell Douglas is considering the use of fiber optics in the F/A-18 Navy tactical aircraft and a night attack version of the AV-8B. However, the next major airborne application of fiber optics, this time in a full flight-control mode, will be in the Navy's new blimp, known as the Navy Airship Study Program (which also goes by the acronym NASP).

This program, for which a consortium of Westinghouse and the British firm Airship Industries won development contracts totaling \$169 million last summer, will produce a prototype model of a new-technology airship capable of housing a longrange over-the-horizon radar to warn ships of incoming cruise missiles. The basic idea is to find a better way to detect these missiles before it's too late, and that means

AIR FORCE Magazine / March 1988

spotting them over the horizon at the time of launch.

"These new airships represent the cutting edge in airship technology," says J. W. Phipps, President of Westinghouse-Airship Industries. "The difference between these new ships and the lumbering old blimps you are used to seeing at football games is like comparing a World War II airplane to modern jets now active with US forces."

To improve performance and reduce vulnerability, the Westinghouse-AI team chose fiber optics for both the flight controls and for the data bus to transmit data from the radar to the central processors. The purpose is to provide two critical capabilities: greater bandwidth than conventional copper cabling and virtual invisibility to enemy radars since there are no electromagnetic emissions.

NASP development is due to be completed within five years, and the first flight of the fiber optic-controlled airship is scheduled to take place before 1991. The contracts contain options for up to five additional operational development model airships.

Beyond the Navy airships, the leading candidate for the next major application of fiber optic flight controls is the Army's proposed new



Airships such as this may be the next major airborne application of fiber optics in a full flight-control mode. The Navy Airship Study Program for this is being carried out by Westinghouse and Airship Industries of Britain.

class of helicopters, the LHX (for Light Helicopter, Experimental, although the Army would like to rename it the ATH, for Advanced Tactical Helicopter, in order to give it the same status as the Air Force's ATF and the Navy's Advanced Tactical Aircraft, or ATA). Flight demonstration tests have been under way since 1985, using a modified UH-60A Black Hawk helicopter, under the Army's Advanced Digital/ Optical Control System (ADOCS) program. Boeing is the prime contractor.

ADOCS, if successfully implemented in LHX, would give a major boost to the idea of controlling an aircraft totally (that is, without a mechanical or electrical backup) by light. The problem isn't with the technology, however, but with the whopping \$66 billion price tag for the LHX program.

The Army insists it needs a new generation of helicopters to replace the more than 4,000 still in its inventory from the Vietnam era, but Congress has consistently cut off funds. LHX would advance technology across a broad front, including an automated cockpit based on artificial intelligence concepts, but its future is uncertain. The program was recently cut in half and may be deleted altogether.

### **Reducing Cost and Complexity**

Still, the Army is optimistic about fiber optic technology for future military aircraft. "I think fiber optics will give the protection we're looking for in the future," noted Joel L. Terry, Jr., team leader for flight control in the Army's Aviation Applied Technology Directorate, Fort Eustis, Va., "but first we've got to do a lot of work to get the cost and complexity of the transducers reduced.

"It's just about like working with fly-by-wire, except right now we're being careful with the fibers. They're a little more delicate," he added.

Although the Air Force did experiment with optical data links in the YC-14 prototype short takeoff and landing (STOL) transport, first flight-tested in 1976, most of the service's experience with fiber optics has been in nonflight applications. Such experience includes the installation of a 147-kilometer fiber optic cable at the Missile Test Center at Vandenberg AFB, Calif., to serve as the primary communications link for controlling ground and flight tests of the Peacekeeper, communications links for the groundlaunched cruise missile (GLCM), and the AN/GRC-206 tactical radio for forward air controllers.

In the GLCM deployment in England, each flight of missiles contains two control vans and four launchers—all interconnected via a redundant network of optical fiber cables. The launchers, located 300 meters away from the vans, receive checkout and firing commands via two six-channel fiber cables.

The GRC-206 radio uses twochannel fiber optic cables in onekilometer lengths to link jeepmounted radios to headquarters operations located behind the forward edge of the battle area (FEBA).

In a parallel development, Westinghouse-designed fiber optic cabling systems were delivered to the air forces of Australia and Egypt to disperse elements of air defense radar systems and thus reduce their vulnerability to homing antiradiation missiles.

Many of these initial applications were made possible by using the mature multimode technology of fiber optics, in which many rays of light are transmitted along the optical fiber, or waveguide. The Navy, for example, has used what is known as the large core fiber (LCF), in which a 100-micron fiber operating at the standard 850-nanometer wavelength is enclosed in a 140-micron cladding. This was the type of fiber used in the AV-8B.

This approach is particularly good for such short lengths as those needed for flight controls and other avionics applications, because the LCF is easier to connect and splice. Other military users have begun using a smaller, more efficient variety of multimode fiber with a core diameter of fifty microns and cladding of 125 microns.

But the availability of singlemode optical fibers offers even greater advantages: reduced attenuation that makes possible longer distances between repeaters; greater bandwidth, allowing further size and weight reductions and system upgradability; and improved radiation hardening.

#### Single-Mode Fibers

To understand the significance of single-mode fibers compared to the original multimode, consider the basic processes involved. Optical fibers are made of liquid silicon and germanium tetrachloride and then drawn into fine strands to achieve unprecedented levels of transparency.

A pane of ordinary window glass an inch thick permits half the light to pass through it, and high-quality optical glass, such as that used for eyeglasses and microscopes, can be ten feet thick before half the light is dispersed or absorbed. For optical fibers, the comparable figure is two and a half miles for multimode and twelve miles for single-mode.

Single-mode fibers, as the name implies, use a small optical core to carry a single ray of light, which greatly reduces signal distortion in digital and analog systems. Singlemode fibers operate in the regions of minimum signal loss, either 1,300 or 1,550 nanometers.

In addition to the lower attenuation and therefore greater distances between repeaters, single-mode fibers are also more radiation-resistant than the earlier multimode varieties. The reason is that singlemode technology requires less dopant to be added to the silica-core matrix, with the result that less color darkens the fiber. A radiation dose of 3,700 rads on a multimode fiber results in signal loss of about twelve dB some ten seconds after exposure, which effectively shuts down the system. For a single-mode fiber under the same conditions, the loss is less than three dB.

With regard to EMI, signals can be transmitted over fiber through electrically noisy areas with extremely low bit error rates and with no possibility of electronic jamming. This is particularly important for aircraft and other weapons platforms. It also has the added advantage of enabling equipment to operate during thunderstorms, around air bases, and even on the battlefield.

Optical fibers also have two big advantages in a nuclear environment. The first is their EMP immunity, which allows signals to be transmitted following a nuclear event. Destructive high-energy voltage and current pulses do not couple into the receivers and transmitters, thus preserving their functionality. The second is optical fibers' ability to recover within minutes of exposure to high-radiation weapons bursts.

Fiber optics offer yet another useful property for military applications. Because they use photons rather than electrons, they do not pose electrical shock or fire hazards. This safety factor enables Langley-sponsored study identified four: high costs, specialized training for repair and maintenance, low tensile strength of the fibers, and potential signal losses, particularly at the connectors.

As fiber optics usage grows—in both the military and commercial market sectors—costs should continue to decline along the classical curve previously demonstrated by the semiconductor and other hightemporal, and the special tools will become commonplace." Also, tensile strength is steadily rising. The theoretical tensile limit for silicaclad fiber is more than 800,000 pounds per square inch. Fiber optic companies have begun supplying long lengths of fibers at 400,000 psi values. And signal loss is being reduced by shifting transmission to the higher wavelengths and using improved connectors.



This photo shows how single-mode optical fibers can literally light up a communications or datahandling system. Lower attenuation of the signal and greater resistance to EMI and EMP are two advantages of singlemode fibers over earlier multimode varieties.

them to be used near ammunition storage areas and fuel tanks.

Summing up the advantages of fiber optic flight-control systems, H. A. Rediess and E. C. Buckley of HR Textron, Inc., Irvine, Calif., in a study conducted for NASA's Langley Research Center, concluded: "The higher data rates afforded by fiber optics will enhance the system capabilities and design options, particularly in the area of highly redundant, fault-tolerant architectures. Increased use of composite materials in airframes would also motivate use of fiber optics because of the loss of shielding now provided by the metallic skin."

## What's the Down Side?

Any technology that sounds this good must have a down side, and fiber optics is no exception. The technology industries. This will enable military program managers to use off-the-shelf commercial products without the expense and delays of custom designs—and with the assurance that alternate sources of supply will be available.

This is not happening yet—in fact, Kessler Marketing Intelligence of Newport, R. I., estimates that the military is paying a premium of fifty-six cents a meter for multimode fiber vs. an industry average of fifty-one cents—but it should happen once there is sufficient volume to force standardization and thus open the way for off-the-shelf procurement. Kessler is predicting a drop to forty-eight cents a meter this year for multimode fiber.

Regarding training, Rediess and Buckley comment, "The training required for repair and maintenance is

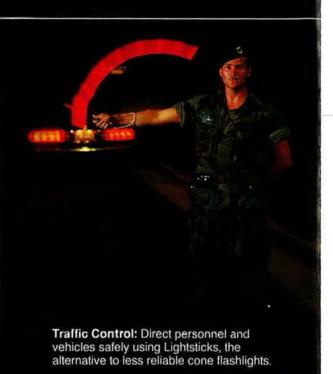
John Rhea is a free-lance writer living in Woodstock, Va. He has written about technology issues for military publications in this country and overseas and is currently the editor of Space World. His most recent article for this magazine, "Sensors Across the Spectrum," appeared in the November '87 issue.

neer in Corning Glass Works's Government and Military Advanced Fiber Products Department, warns of another potential problem: excessive heat. Fiber optics used in today's operational systems meet the +85° C. to -60° C. temperature requirement, which is adequate for tactical aircraft and blimps but may not do the job for the temperature extremes that the X-30 and its derivatives are likely to encounter. One solution, according to program manager Barthelemy, is improved cooling within the vehicle by using the slush liquid hydrogen fuel. Mr. Landin reports that fibers capable of withstanding temperatures up to 200° C. have been produced by using Teflon coatings on the fibers.

Mark Landin, senior sales engi-

But as with any new technology, time is on the side of the users. As the HR Textron analysts put it, "The disadvantages of using optics are partially temporal and will be minimized as the technology matures and experience is gained."

# **CYALUME LIGHTSTICKS...on the flight line**



Color-Coding: Increase visibility in the air and facilitate location on the ground.

Night Vision: Infrared Lightsticks mark the I Z while a blue Lightstick

provides compatible cockpit illumination.

**Operational Safety:** Marshall aircraft near flammable fuel supplies by placing sparkproof Lightsticks in directional handles.

Disaster Preparedness: Identify personnel wearing NBC suits and mark off contaminated areas.

> For a complete listing of NSNs or for more information, contact: Bob McDermott, Military Sales Manager Chemical Light Department **American Cyanamid Company** One Cyanamid Plaza Wayne, New Jersey 07470 TELEX #219136 ACYIN UR

Order today through your supply system.

reliable, compact and totally safe.

Your Key To Safety And Command Control

CYALUME Lightsticks offer the tactical flexibility to meet nighttime military objectives while maintaining operational safety for ground and flight crew.

Available in the colors, intensities, sizes and durations that have made

them a key part of flight safety kits and night operations, Lightsticks are

e 1988 American Cyanamid Company

 1988 American Cyanamid Company Cyalume is a registered trademark of American Cyanamid Company

# Airman's Bookshelf

## **NATO's Two Pillars**

The Limited Partnership: Europe, the United States, and the Burdens of Alliance, by Josef Joffe. Ballinger Publishing Co., Cambridge, Mass., 1987. 256 pages with notes and index. \$29.95.

Although it has endured some forty years, the North Atlantic Treaty Organization (NATO) stands as a classic study of the internal conflicts that beset any alliance. Josef Joffe evaluates the problems confronting NATO in his newest scholarly work, *The Limited Partnership.* 

Without succumbing to the emotionalism that tends to attach itself to any modern study of NATO, Joffe addresses the issues with facts and cogent analysis rather than with opinion and virulent invective.

The book's introduction alone does more to establish a fundamental appreciation for the "Europe vs. America" conflict within NATO than do dozens of other efforts. The remaining chapters consider the roots of this conflict in the guise of détente vs. alliance, problems of nuclear weapons, the peace movement, conventional vs. nuclear defense, and the Alliance as a player in the world order.

Joffe's credentials establish him as a scholar whose concepts and recommendations deserve consideration. Currently a faculty member of the Johns Hopkins School of Advanced International Studies and a former fellow of the Woodrow Wilson International Center for Scholars, Joffe has called on some of the keenest academic minds to refine his ideas. That refinement comes through clearly in The Limited Partnership.

One small criticism of the book is that Joffe ignores Canada as a NATO member. Since it shares more in geography and defense needs with America than with the balance of its NATO allies, it would seem an exception to his "America vs. The Rest" focus. Otherwise, there is little else to detract from the book's thesis or the

AIR FORCE Magazine / March 1988

effectiveness with which it is argued.

The United States, Joffe writes, reacts to Soviet adventurism around the world. The European NATO allies react to Soviet effrontery only in "Europe's own backyard." The Soviet invasion of Afghanistan is a case in point. What results in NATO is a split in perception over *where* the Soviet Union is a threat to NATO.

The Soviet presence in Afghanistan, according to European NATO members, is not a threat to the Alliance. Consequently, they divorce themselves from the United States in its bid to contain Soviet provocations. It is to the benefit of European NATO members to strive for equidistance from both superpowers in their "global" pursuits, siding with America only in "theater" issues.

This "decoupling" strains at the fabric of the Alliance, prompting the perennial calls from both sides of the Atlantic for US withdrawal from NATO or a reduced American presence in Europe.

In Europe, détente has succeeded where it has failed in America. European NATO allies are quick to avoid offending the Soviet Union, regardless of the effect on the Alliance itself. In the past, Europe was hostage to the Soviet military threat; today, it is hostage to Soviet goodwill.

Should that goodwill evaporate and war come to Europe, it would fall on NATO to defend its member nations. In the past, this has meant raising the American nuclear umbrella. From Europeans who worried about whether or not the indecisive Carter would honor America's commitment to use nuclear weapons to those who feared that the ideologue Reagan would provoke their use, officials with European NATO governments have seen nuclear weapons as both the cause of and solution to their security problems.

NATO members see value in the paradox that the presence of nuclear weapons prevents their use. So long as both East and West are equally vulnerable to their opponent's massive nuclear capability, then each side will refrain from resorting to the use of those weapons and remain equally safe.

Popular efforts to remove these weapons may be vocal and well attended by the media, but they do not represent grass-roots opinion in Europe. While the demonstrations may have galvanized the antimissile minority, they failed to convert a European majority more concerned about unemployment and inflation. To this same majority, the alternative to nuclear weapons is even less attractive.

This century has known more than a dozen cases in which conventional deterrence has failed and war erupted. Since 1945, however, the nuclear deterrent has been successful in preventing war between the superpowers. So long as the cost of war is unacceptable, the theory goes, there will be no war.

By eliminating nuclear weapons from the NATO arsenal, the cost of war to the Soviets decreases significantly, raising the potential for war. On the other hand, the much-ballyhooed Western conventional buildup (both quantitative and qualitative) can be seen by the Soviets as provocative, again raising the possibility of war.

The advent of new battlefield weapons offers only a utopian solution. Their cost and complexity render them vulnerable even before the outbreak of hostilities, again lowering the cost of war to the Soviets.

Joffe argues that a nuclear NATO is clearly better and more acceptable to European peoples and governments than a purely conventional alliance. What of the future role of the US?

America is a stabilizing force that is necessary to ensure a unified European alliance. To conclude that NATO without America could work is to ignore the repeated failures of European cooperation (even in today's Common Market). "Nationalism" continues to take priority over "Europeanism."

The answer to NATO's future is, according to Joffe, to maintain the Alliance. Its flexibility and adaptability temper its constant internal squabbles, all typical of problems inherent in any alliance. In the language of the

# **MCDONNELL DOUGLAS**

# Use Your Past To Design Your Future

Are you separated or retired from the military? Call 1-800-8-CAREER to find out how you can be a part of our Avionics team.

... If you've flown the F-15, F-16 and the F/A-18 or any contemporary jet fighter and have a minimum of a BS degree in EE, CS, Physics, Math, Aero or Psychology, we have immediate openings in Cockpit Design, Pilot Factors, Integration, Simulation Support and Advanced Crew Systems Concepts.

Our success in vanguard engineering and systems technology has provided us with long term contracts for major avionics updates including:

- The F/A-18 Hornet currently in full production, engineered and designed with the most state-of-the-art crew station of any aircraft.
- The AV-8B Harrier II, a subsonic aircraft with superior maneuverability.
- The F-15 Eagle, a major technological retrofit with total avionics improvements scheduled well into the 1990's.

been awarded the Air Force STOL and Maneuver Technology program. In addition, one of two Air Force Advanced Tactical Fighter (ATF) Demonstration-Validation contracts was awarded to a McDonnell/Northrop team and McDonnell Aircraft is teamed with General Dynamics to develop and test the Navy's Advanced Tactical Aircraft (ATA).

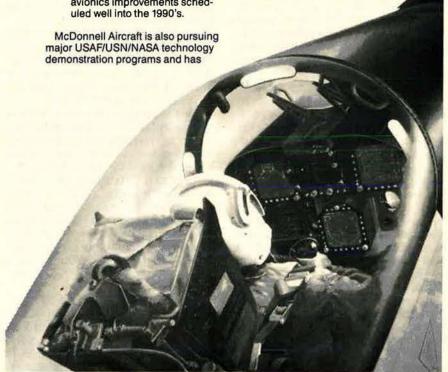
In addition to attractive salaries and benefits, we offer a fine relocation plan and the many advantages of living in St. Louis, including affordable housing and a wealth of cultural, educational and recreational opportunities.

Call us today at 1-800-8-CAREER from 11AM to 5PM (CST) to discuss your future with McDonnell Aircraft. If you are unable to call, forward your resume in confidence to:

Manager, Professional Staffing MCDONNELL AIRCRAFT COMPANY P.O. Box 4012 Dept. 62-R788 Hazelwood, MO 63042 (St. Louis Metropolitan Area)

#### MCDONNELL DOUGLAS

Equal Opportunity Employer M/F U.S. Citizenship Required



#### Airman's Bookshelf

vernacular, "If it ain't broke, don't fix it."

That is not to say that NATO is without problems in need of innovative solutions. But the answers must come from reasoned debate based on solid facts and sound judgment. Josef Joffe's The Limited Partnership provides all of these essential ingredients.

> —Reviewed by 1st Lt. Robert S. Hopkins III, USAF. Lieutenant Hopkins, an RC-135 pilot, has written on the Israeli Air Force and on tactical aerial combat. He is now completing a book on the KC-135.

#### **New Books in Brief**

The Official Dictionary of Military Terms, compiled by the Joint Chiefs of Staff. As with any specialized endeavor, military science has developed a sometimes arcane vocabulary that can leave the uninitiated dizzy from confusion. This JCS-blessed lexicon, running to 6,000 entries, is the sourcebook to clear up such confusion and resolve any misunderstandings. Covering terms authorized for use by DoD, NATO, and the Inter-American Defense Board, this book will be a valuable reference not only for the military but for contractors and scholars as well. With appendix. Hemisphere Publishing Corp., New York, N. Y., 1988. 478 pages. \$49.50.

On Guard for Victory: Military Doctrine and Ballistic Missile Defense in the USSR, by Steven P. Adragna. For specialists in the field, Mikhail Gorbachev's admission last year that the Soviets were working on a strategic defense program comparable to the US's SDI came as no surprise. Indeed, as author Adragna writes in this Institute for Foreign Policy Analysis publication, the Soviets for decades have maintained "an extensive and ongoing research and development program devoted to missile defense." The author focuses in this well-researched study on how Soviet doctrine and strategy posit strategic defenses as an integral component of the Soviet force structure. For the Soviet Union, presently the only power possessing an operational ballistic missile defense system, BMD "is and will remain a Soviet national security imperative." The author advises that BMD should be a defense imperative "for America and her allies as well." With notes and appendices. Pergamon-Brassey's International Defense Publishers, McLean, Va., 1987. 93 pages. \$9.95.

## Valor

## The Quiet Hero

The Group soon found out that their new and untested commander had both brains and guts.

#### BY JOHN L. FRISBEE CONTRIBUTING EDITOR

N background and temperament, Fred Castle was far from typical of World War II combat commanders in the Eighth Air Force. The son of a West Pointer, he graduated from the Military Academy in 1930, seventh in a class of 241. On completing pilot training, he flew pursuits at Selfridge Field, then was assigned duty with the Civilian Conservation Corps.

The financially starved Air Corps of Depression days seemed to offer little opportunity for either flying or advancement. In 1934, Lieutenant Castle resigned his Regular commission for one in the Reserve and went with industry as a statistician. Four years later, he joined Sperry Gyroscope and soon became assistant to the president. It was rumored that despite his youth, he was in line for the top job.

A month after Pearl Harbor, Fred Castle was called to active duty at the request of Brig. Gen. Ira Eaker, who had learned of Castle's managerial talent. Eaker was bound for the UK to set up what would become VIII Bomber Command. Castle was given the job of organizing the base and depot structure for the USAAF forces that would be coming soon. In a year he had been promoted to colonel and was the Command's Assistant Chief of Staff for Supply.

What Fred Castle really wanted was a combat assignment. In June 1943 it came. He was sent to command the newly committed 94th Bombardment Group, which had suffered heavy losses in its early missions. The new CO was not welcomed with enthusiasm. He was, among other things, a staff man from supply, at that. In his first meeting with Group officers, he made it clear in a quiet but firm way that the term "officer and gentleman" implied proper dress and decorum, even at parties.

The next day, Colonel Castle flew his first of many missions with the Group. The pilot of his B-17 reported that the Colonel calmly took notes while under attack by enemy fighters. To the displeasure of crews, the new commander then began to schedule frequent practice missions to improve formation flying and air discipline. His collection and analysis of data on every Group activity rapidly began to pay off in greater efficiency. A particular concern was the welfare of the enlisted men.

When Castle had been in command for less than a month, VIII Bomber Command scheduled the 4th Wing for the deepest penetration of Germany to that date, July 28, against a FW-190 assembly plant at Oschersleben. It would be a hot mission. Colonel Castle led the 94th into bad weather and fighter attacks. Some elements of the bomber stream became disorganized and turned back, but Castle decided to go on to the target with his group and a few stragglers.

His judgment proved sound. A break in the clouds allowed Castle's force, followed by the 388th Group, to put their bombs on target with an estimated loss of a month's production of FW-190s. The 94th lost no B-17s that day, and Group morale soared. The Group decided that their slight, somewhat aloof commander had both brains and guts.

In April 1944, Castle was given command of the 4th Bombardment Wing. Ten months later he was promoted to brigadier general. He continued to fly the tough missions and worked himself to the point of exhaustion carrying out an organizational experiment with the Wing. Then, in mid-December, the Germans launched their Ardennes offensive under cover of persistently bad weather.

On the evening of December 23, General Castle returned to his headquarters after visiting some of his groups and learned that a maximum effort against Luftwaffe fields and communications centers that could support the enemy drive had been laid on for the next day. His DCS/ Operations, Colonel MacDonald, would lead the more than 2,000 heavy bombers, escorted by 1,000 fighters-the largest force ever assembled. But Fred Castle saw it as his duty to lead. He would fly with the 487th Group on this, his thirtieth combat mission.

The next morning, flying at 22,000 feet over Belgium, Castle's Fortress was hit by Me-109s and could no longer hold position. Two more attacks set the Number 3 and 4 engines afire, damaged the controls, and wounded two crew members. Castle ordered the crew to bail out of the barely controllable B-17. Six of them left the doomed bomber while the General took over the controls to give the pilot time to retrieve his parachute.

It was too late. The right wing tank exploded, and the big bomber spun in from 12,000 feet, killing Fred Castle and the pilot, Lieutenant Harriman.

Brig. Gen. Frederick W. Castle, for whom Castle AFB, Calif., is named, was awarded the Medal of Honor posthumously for his valiant attempt to save his crew at the cost of his own life. This quiet, reserved man, so untypical of air combat commanders of his time, demonstrated by his life and in his death that there is no common mold for either leadership or heroism. The Doolittle Salute pays tribute to one of AFA's founding fathers.

# 'A Real Hero'



Gloria Stewart looks on as AEF Chairman Emeritus Barry Goldwater offers his congratulations to her husband, Doolittle Salute honoree Jimmy Stewart (right).

#### **BY ARTHUR HYLAND**

**O** NE of the original twelve founders of the Air Force Association is a command pilot and recipient of two Distinguished Flying Crosses, four Air Medals, and the French Croix de Guerre with Palm. He flew thirty-five World War II combat missions with Eighth Air Force.

He is also an actor with five Academy Award nominations and is a two-time Oscar winner. His two careers spanned twenty-seven years in the Air Force and more than fifty years in Hollywood. This actor/aviator is Brig. Gen. James M. Stewart, USAF (Ret.), who was honored last December at the Aerospace Education Foundation's annual Jimmy Doolittle Salute.

AEF Chairman Emeritus and former Arizona Sen. Barry Goldwater discarded his prepared script and fondly recalled Jimmy Stewart and the early days of the Air Force. "We were both licensed pilots," he remembered, "and I didn't think the Air Force could make any progress without the two of us flying."

In a specially prepared videotape highlighting General Stewart's Hollywood and Air Force careers, his friend and former boss, Jimmy Doolittle, said, "Stewart was a very modest hero, but he was a real hero." The videotape concluded with a tribute by another good friend, President Ronald Reagan.

AEF presented General Stewart and his wife Gloria with a crystal sculpture bearing the USAF coat of arms as a token of AEF's respect, affection, and appreciation. In his remarks, General Stewart expressed his longtime admiration and respect for Jimmy Doolittle and recalled that in 1945, he joined General Doolittle and ten others to form the Air Force Association. It is remarkable and heartwarming, General Stewart observed, that AFA now has more than a quarter million members. He concluded, "My service in the military has made me a better citizen, and for that I am grateful to the United States Air Force."

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.

Five Corporate Fellowships were presented at the Doolittle Salute. Anheuser-Busch, Inc., represented by its Director of Military Sales, Thomas Moore, and the Harry Frank Guggenheim Foundation, represented by its former Executive Director, George Fontaine, were invested as Corporate Jimmy Doolittle Fellows.

The Florence Borchert Bartling Foundation, represented by its Trustee, Bill Borchert Larson; Hughes Aircraft Co., represented by its Vice President for Government Operations, W. B. Merritt; and Northrop Corp., represented by its Senior Vice President for Government Operations, Stanley Ebner, were invested as Corporate Ira C. Eaker 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** The Harry Frank Guggenheim Foundation (five times) Gulfstream Aerospace Corp. Hughes Aircraft Co. Hughes Helicopters, Inc. Lockheed Corp. Loral Corp. LTV Aerospace & Defense Co. Martin Marietta Aerospace McDonnell Douglas Corp. (twice) MITRE Corp. (twice) Mutual of Omaha Insurance Co. Northrop Corp. (twice) John M. Olin Foundation (twice) **Reader's Digest Foundation** The Singer Co. Textron Inc. (twice) United Technologies Corp.

#### Corporate Ira C. Eaker Fellows

Florence Borchert Bartling Foundation Bendix Aerospace Corp. Fairchild Industries General Dynamics Corp. Hughes Aircraft Co. (five times) Lockheed Corp. LTV Aerospace & Defense Co. (twice) McDonnell Douglas Foundation Northrop Corp. (twice) Pratt & Whitney Aircraft Group Rockwell International Corp.

## Intercom



#### By Robin Whittle, ASSISTANT TO THE EXECUTIVE DIRECTOR FOR COMMUNICATIONS

#### AFA Region Sponsors Conference

AFA National Vice President Chuck Durazo reports that his Central East Region, in cooperation with the Air Force, sponsored a Competition Advocate Conference on December 2 at the Crystal Gateway Marriott Hotel in Arlington, Va. The conference provides the military and industry with an opportunity to discuss the major concerns and challenges surrounding competition today. The event marked the first time AFA was involved in the Air Force conference, which has been conducted annually since 1985.

According to Mr. Durazo, conference speakers discussed the benefits and problems that have arisen from competing defense contracts as well as the frustrations for contract winners when second-source companies are allowed to draw on the technological know-how of the winners without providing subsequent compensation for the development risk and R&D investment.

D. Kenneth Richardson, Executive Vice President of Operations at Hughes Aircraft Co., said, "If allowed to fully compete without forced technical leveling and with a reasonable chance of returns on our investment ...industry can do a much better job for the government in the long term. The current trends are leading to a precipice over which we must not fall or be pushed."



Participants at the USAF/Central East AFA Region Competition Advocate Conference included, from left to right: D. Kenneth Richardson, Executive Vice President, Hughes Aircraft Co.; Chuck Durazo, National Vice President/AFA Central East Region; Anthony DeLuca, USAF Competition Advocate; Marty Harris, AFA Board Chairman; and Tom McKee, AFA National Secretary.

Maj. Gen. Henry Viccellio, Jr., TAC's Deputy Chief of Staff for Logistics, discussed the strengths and weaknesses of competitive programs in the acquisition and central procurement areas. He went on to add that "competition can be and has been good for what ails us. As a prime player in changing the environment that led to the pricing 'horror stories' of the early 1980s, as a catalyst for innovation in an arena where our potential adversaries are matching—and per-

#### Life Member Questionnaires on the Way

AFA's new "Directory of Life Members" is well under way. Life Members will be sent a special questionnaire in May so that they can update their listing. It is critical to the success of this project that all Life Members complete and return the form promptly. If you don't respond, you will be listed by name only. If your current address is not in our files, please contact AFA headquarters immediately to ensure receipt of the questionnaire update.

The Directory, which is being done by Harris Publishing of New York, will be an excellent resource for locating AFA Life Members around the country and overseas, and it will be easy to use because of its geographical and alphabetical listings. The Directory will include name, address, spouse's name, current military status, occupation, firm name, business address, and telephone numbers.

If you are not a Life Member now but would like to be included, AFA must receive your application no later than May 31, 1988. Participation in this project is strictly voluntary. The Directory will be made available for sale to AFA members only. haps even surpassing—our attempts to exploit new technology, and as a timely partner to our growing commitment to R&M, competition is making things happen."

USAF Vice Chief of Staff Gen. Monroe W. Hatch, Jr., made the Air Force keynote address, and Don Fuqua, President of the Aerospace Industries Association, delivered the industry keynote address.

General Hatch outlined the Air Force approach to meaningful competition.

 Investment in time and resources has to be offset by gains that would accrue.

• The Air Force will not compete contracts just to improve statistics on competition.

• Price will not be the only driver. Quality and performance will also be considered.

Conference participants included Lt. Gen. Spence Armstrong, Vice Commander, Air Force Systems Command; Dr. Richard DeLauer, former Under Secretary of Defense for Research and Engineering; Anthony J. DeLuca, Air Force Competition Advocate; former US Rep. Don Fuqua,

#### Intercom

President, Aerospace Industries Association; Gen. Monroe W. Hatch, Jr., Air Force Vice Chief of Staff: Dr. Donald Hicks, former Under Secretary of Defense for Research and Engineering; Rep. Earl Hutto (D-Fla.); Lt. Gen. Charles McCausland, Vice Commander, Air Force Logistics Command; Lt. Gen. George L. Monahan, Jr., Principal Deputy for Acquisition; Gen. Bryce Poe II, USAF (Ret.), former Commander, Air Force Logistics Command; D. Kenneth Richardson, Executive Vice President for Operations, Hughes Aircraft Co.; Gen. Alton D. Slay, USAF (Ret.), former Commander, Air Force Systems Command; Dr. Harold W. Sorenson, Air Force Chief Scientist; Eleanor R. Spector, Deputy Assistant Secretary of Defense/Procurement; Maj. Gen. Henry Viccellio, Jr., Deputy Chief of Staff/Logistics, Tactical Air Command; and Hon. John J. Welch, Jr., Assistant Secretary of the Air Force for Acquisition.

During the event, the 1987 Competition Advocate awards were presented.

#### **On the Scene**

AFA National President Sam E. Keith, Jr., was the featured speaker at the seventieth anniversary celebration of Brooks AFB in San Antonio, Tex., on November 13. Festivities spanned an entire week and were sponsored by the San Antonio Southside Chamber of Commerce.

A highlight of the week was the Confederate Air Force air show—a first for San Antonio—which included reenactments of the attack on Pearl Harbor, the Battle of Midway, and the Normandy invasion. Another crowdpleaser were the flights of a replica of the Wright-B Flyer, owned and operated by Wright-B Flyer Inc. of Dayton, Ohio. The fragile-looking airplane performed flybys for several events and was on display for the Brooks AFB open house.

The week culminated with the dedication of the Sidney J. Brooks Memorial Garden. Mr. Keith served as keynote speaker for the dedication. The ceremony included the unveiling of a sculpture of an eagle perched atop a marble and granite pedestal. 2d Lt.



Lake Superior-Northland Chapter leaders group around the new Chapter-sponsored Lt. Gen. Richard M. Hoban Trophy, which will be presented on an annual basis to the best wing in Eighth Air Force. The "Mighty Eighth" Commander, Lt. Gen. James McCarthy, and Col. Antonio Maldonado, 410th Bomb Wing Commander, accepted the trophy on behalf of the Air Force.



Pictured inside Hangar No. 9 at Brooks AFB, Tex., during the recent anniversary celebration are, left to right: former Alamo Chapter President Claire M. Garrecht; Lt. Gen. John A. Shaud, Commander, ATC; Sam E. Keith, Jr., AFA National President; and Paul "P.D." Straw, Alamo Chapter President. The hangar is the last remaining World War I hangar in existence.

John Cmar, chief of the analytical division at the Air Force Occupational and Environmental Health Laboratory at Brooks, sculpted the piece.

In his address, Mr. Keith pointed out the importance of the work done by the men and women at Brooks and the singular contributions they have made to the security of the nation and to knowledge of the aerospace sciences and aerospace medicine.

Mr. Keith also discussed the details of AFA's White Paper on "What Deep Cuts in Defense Would Really Mean," which was released last November 6.

In a similar vein, **Brig. Gen. John R.** Allen, Jr., Vice Commander of the Sacramento Air Logistics Center at McClellan AFB, Calif., addressed AFA's Greater Seattle Chapter on "Defense Spending: What Are We *Really* Cutting?" The event was held November 12, six days after AFA released its White Paper on the devastating effects of potential deep defense budget cuts.

In his talk, General Allen said that the rationale for defense spending "is being pulverized." The defense budget, he contended, should be keyed to the threats the US faces. But instead of weighing threats and calculating risks in determining defense spending, Congress simply applies fiscal yardsticks geared to the economy and domestic spending.

Later in his talk, General Allen warned that "this nation does face a real and serious threat-the Persian Gulf situation is the only convincing I need-and we know that although we must be able to react to short-term conflicts, we must be just as able to sustain our military capabilities in a longer scenario.... To remain a strong deterrent force, we need the understanding of the American people-the acceptance by them that there is a threat, that it must be met with all of the strength and dedication we can muster, and that it can be done if we [resolve to] do it."

He went on to cite members of the Air Force Association as "one of the most important elements in getting this message across. Talk to your associates, talk to your civic leaders, talk to your church groups. Spread the word. The Air Force is alive and well, and we'd like to keep it that way. The choice is either to preserve defense or turn back the clock to the late 1970s when so many of our planes couldn't fly and our ships couldn't sail for lack of parts and trained personnel. Let's not do that again! We of the active-duty Air Force do appreciate AFA's help."

AFA's General Doolittle Los Ange-



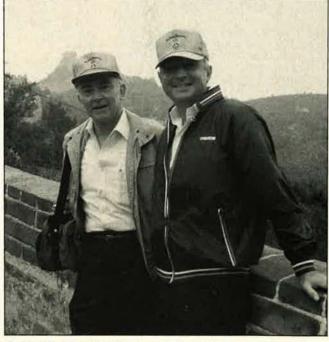
Now that's the way to bet on a great state meeting. New York AFA conducted its state business early and then met spouses in a reserved section of the Saratoga Club House for the races. New York AFA's horse, "Precious JJ," was a star attraction for state leaders, who gathered around the horse and driver, H. Story.

les Area Chapter in California, with assistance from the Pasadena Area Chapter, sponsored an award-winning booth at the Western States Gun and Militaria Show, which attracted 100,000 to the Los Angeles County fairgrounds last November 6–8. Chapter officials set up a VCR and TV monitor to show DoD's "Soviet Military Power 1987" videotape as well as AFA's documentary "Off We Go" and the AFA/AEF-produced documentary "Me-262: The Superplane That Hitler Wasted." Copies of DoD's Soviet Military Power 1987 publication were handed out to those who signed up on the spot as AFA members. Also on hand were copies of AIR FORCE Magazine, membership applications, charts of the armed services' medals and decorations, numerous US flags, and a USAF uniform.

According to **Don Zweifel**, Doolittle Chapter Membership Chairman,



Greater Seattle Chapter Vice President Bill Gleaves presents thank-you gifts to Brig. Gen. and Mrs. John R. Allen, Jr., following the General's address on defense budget cuts at a recent meeting. General Allen is Vice Commander of the Sacramento Air Logistics Center at McClellan AFB, Calif.



During his recent Pacific tour, Air Force Secretary Edward C. Aldridge, Jr., right, and his assistant, Robert J. McCormack, attended a reception in Honolulu, hosted by AFA's Hawaii Chapter, during which the Secretary and Mr. McCormack were presented AFA caps. Here, they're on China's Great Wall.

#### Intercom



Wilmington, Del., Chapter President Dick Kyle, far right, presents the Chapter's first Premiere Salute Award to Francis I. "Nick" duPont, center, who is joined by his wife, Betty. At left are National Vice President/Central East Region Chuck Durazo and Delaware AFA President Horace Cook.

twenty people signed up as members. Plenty more took copies of the magazine, indicating they would peruse it and use the membership application later. The AFA booth, manned by Mr. and Mrs. Zweifel, Pasadena Chapter President Gordon Meinert, and Doolittle Chapter volunteers Bruce Bauer, Bud Chamberlain, Bob Dunham, Milt Fuir, and Bruce Kitchen, received the "outstanding military ex-

#### **Coming Events**

April 22-23, Alabama State Convention, Birmingham ... April 22-23, South Carolina State Convention, Columbia . . . April 30, Connecticut State Convention, Vernon... May 20-22, Louisiana State Convention, New Orleans . . . June 17-19, Georgia State Convention, Athens...June 17-19, New Jersey State Convention, Cape May . June 17-19, Ohio State Convention, Columbus ... July 8-9, Missouri State Convention, Springfield July 15-16, Mississippi State Convention, Columbus ... July 15-17, Pennsylvania State Convention, Pittsburgh . . . July 22-24, Texas State Convention, Kerrville . July 23-24, North Carolina State Convention, Raleigh . . . July 29-30, Colorado State Convention, Lowry AFB . . . July 29-31, Florida State Convention, Fort Lauderdale . August 4-6, California State Convention, San Diego ... August 5-7, New York State Convention, Long Island ... September 19-22, **AFA National Convention and Aerospace Development Briefings** and Displays, Washington, D. C.

in Delaware sponsored its first "Premiere Salute" in honor of an outstanding American. Held at the Army

Zweifel said.

National Guard Armory, the event honored **Francis I.** "**Nick**" **duPont** for distinguished service to the Delaware Valley Community as Chairman of the Kalmar Nyckel Foundation. The Foundation is building a replica of the ninety-one-foot Dutch vessel, the *Kalmar Nyckel*, which brought Swedish and Dutch settlers to the area in 1638, according to Chapter President **Dick Kyle.** 

hibit award" at the event. Plans are to

be back for the May 1988 show, Mr.

Last fall, AFA's Wilmington Chapter

More than 250 people turned out for the reception, awards banquet,



Doolittle Chapter Membership Chairman Don Zweifel gives a sample copy of Air Force Magazine to a prospective new member at the AFA exhibit during the Western States Gun and Militaria Show in November.

and dinner dance honoring Mr. du-Pont. During the evening, AFA Community Partner plaques were presented to Boscov's Department Store, represented by **Kenneth J. Brennan**, manager, and Copy Graphics Printing, represented by the owner, **Kenneth W. Turoczy.** 

The surprise of the evening was Delaware AFA's first "Person of the Year" award presentation. Honored by Delaware AFA President **Horace Cook** was longtime AFA leader **Jack Strickland**, a charter member, past treasurer, past vice president, and past president of AFA's Delaware Galaxy Chapter as well as a former Delaware AFA president. Mr. Strickland is currently serving as Delaware AFA Vice President.

Also during the evening, Delaware's newest chapter, the University Chapter, was officially chartered, and a gavel was presented to its President, **James McAlpin.** In addition, Mr. Kyle was recognized for his outstanding leadership in staging the Wilmington Chapter's first "Premiere Salute."

Wilmington radio personality **John E. Watson** served as commentator for the Salute, and a four-man team from the AFROTC unit at the University of Delaware provided the Honor Guard. AFA Certificates of Appreciation were presented to the 198th Signal Battalion and the 590th Air Force Band.

"We published a twenty-page blueand-gold program, which was sponsored by advertising. It chronicled the event and included a letter of welcome and congratulations by Wilmington Mayor **Daniel S. Frawley**," Mr. Kyle said. Plans are tentatively set for another Premiere Salute to take place at the Delaware AFA convention next August.

Further south, AFA's Scott Berkeley Chapter in Goldsboro, N. C., held a Christmas dinner meeting with **Maj. Gen. Henry Viccellio, Jr.,** Deputy Chief of Staff for Logistics at Tactical Air Command. The dinner attracted more than 100 people as well as the mayors of Goldsboro and Kinston, reports Chapter President **Joseph Kuhlman.** Other distinguished guests included state **Rep. John Kerr** and the two wing commanders from nearby Seymour Johnson AFB.

During his slide presentation, General Viccellio said that major military budget cuts will require "not just a little paring, but some big changes of pace, some big cuts in programs." Mr. Kuhlman reports that "the slide presentation caused a lot of people to ask themselves some serious questions about our future security."

# **SOARING TO NEW HEIGHTS ON VIDEO**

#### Airshow

Tomcats...Hornets...Thunderbolts...Blackbirds; Airshow puts you in the pilot's seat of the world's fastest and most formidable aircraft. Special USN Blue Angels show off their renowned precision flying and will give you the ultimate power surge. SV 0564 60 Minutes \$29.95

\$59.95

\$59.95

#### 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-15's go head-to-head against F-14's, F-16's, and F/A-18's. This one is for anyone interested in aviation!

ST 6015 **85 Minutes** 

#### Advantage Hornet

Strap yourself into the F/A-18 Hornet, the newest strike-fighter now operational with the US Navy. This is the fighter aircraft that is the choice of the Blue Angels. Experience the exhilaration of flight from tree top level to 50,000 feet with unmatched filmed sequences.

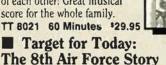
ST 6010 **62 Minutes** 

#### 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. TT 8057 **30 Minutes** \$19.95

#### Touch The Sky

Christopher Reeves takes you inside the cockpit, and into the sky with the world's fastest and most spectacular stunt flying team, The Blue Angels. Experience the Blue Angels aerobatic maneuvers at 550 mph and all six jets within three feet of each other! Great musical score for the whole family.



This is the definitive film, utilizing rare authentic footage of 24 hours in the life of WWII's 8th Air Force bomber crew, from the first weather report to final debriefing. \$29.95 90 Minutes VC 7010

#### The Wild **Blue Yonder**

The history of the Air Force is magnificently told in this grand video. From its early beginning in 1909 to the present, this is one film any Air Force enthusiast can not do without. Great aerial footage!

MP 1184 50 Minutes \$29.95

#### One Small **Step For Man**

With these words, one of man's eternal dreams was realized as Astronauts Armstrong, Aldrin, and Collins became the first space team to land on the moon. Using rare NASA footage, we experience the beauty and mystery of man reaching beyond the bounds of Earthly reality.

MP 1070 56 Minutes \$19.95

#### Jet Fighter

An exciting overview of America's current front line jet fighters that puts you in the cockpit for a 9G ride you won't soon forget. This is a close-up look at the F-14, F-15, F-16, F/A-18, and the new F-20. Jet Fighter puts you in the cockpit as you can experience dogfights and weapons demonstrations that will leave you speechless. All action! FG 9101 **45 Minutes** \$39.95

#### The MiG-29 "Fulcrum"

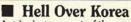
Here it is, recently de-classified, this formerly TOP SECRET footage was taken as part of a covert photo mission by daring Finnish cameramen. This is a close look at the all-new Soviet counter-air jet fighter. Combined with this exciting new program is a hard-hitting cockpit view of the state-of-the-art F/A-18. Two superb fighting, flying machines for your collection! \$39.95

FG 9100 **30 Minutes** 

#### Naval Air Power: The Fighting Navy

Three separate programs in one take you on an historical journey from reliving the first days on the decks of the USS Langley through Korea and Vietnam. Also included is a look at five naval aviation cadets as they prepare as pilots. **83 Minutes** FG 9101 \$39.95





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. 100 Minutes FG 2973 \$39.95

#### The Nazi Strike

Hitler's war machine sweeps into Austria, Czechoslavakia and Poland. A disturbing look at the relentless enslavement of a continent by the forces of fascism. Frank Capra at his best MP 1073 41 Minutes \$19.95

Col. Culpepper's

**Flying Circus** 

flight enthusiasts.

Take a trip back to the days of WWII when

Messerschmitts, Spitfires, and Mustangs filled

the air. This special film shot in Texas skill-

fully recreates some of the most stunning

aerobatic dogfights ever staged. A thrill for



# ONE SMALL

**60 Minutes** HV 1212 139.95 Vietnam: Experience A gripping portrait of the war seen through rare footage never-before-available and put to the stirring music of Country Joe McDonald. "For it's one, two, three; What are we fighting for.'

MP 1386 **30 Minutes** \$19.95

#### Korea: MacArthur's War

This thought provoking film explores the war that has been passed over by history but not forgotten by the millions of men who served. Includes captured footage from North Korea never before seen...until now!

MP 1518 **60 Minutes** \$24.95 TO ORDER, please send check, money order or credit card (no cash) to: **FUSION VIDEO** 6730 North St. - Dept AF 8803 - Tinley Park, IL 60477 ALL CASSETTES ARE VHS ONLY. Inside Illinois 312-532-2050 1-800-338-7710 Name Address \_\_\_\_ City\_ State . Zip CASSETTE NUMBERS

Din my Gr	eun caru.	L) V150	D Waster Gridige
Account Number		-	Expiration Date
Authorization Signature	of Cardh	older	
Video Cassette Total \$ _	_		-
Shipping & Handling	\$3.95	;	

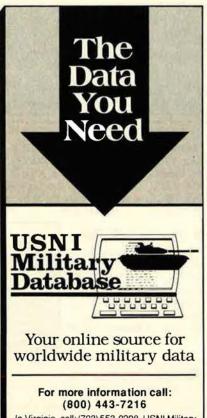
Illinois residents add 7% sales tax.

**TOTAL Amount \$** 

For 24 Hour/Toll-Free Service Call Now! 1-800-338-7710







In Virginia, call: (703) 553-0208. USNI Military Database, 1745 Jefferson Davis Highway, Suite 501, Arlington, Virginia 22202

## **Unit Reunions**

#### Cannon AFB

Personnel who were stationed at Cannon AFB, N. M., will hold a reunion on June 17–19, 1988, in Clovis, N. M. **Contact:** Cannon Reunion, 1721 Cain Ave., Clovis, N. M. 88101 (SASE). Phone: (505) 762-0594 (Brad or Gayle Telshaw) or (505) 762-0491 (Nelson Rutter).

#### **CBI Hump Pilots Ass'n**

The China-Burma-India Hump Pilots and support personnel will hold a reunion on September 14–18, 1988, at the Niagara Hilton in Niagara Falls, N. Y. **Contact:** Jan Thies, 808 Lester St., Poplar Bluff, Mo. 63901. Phone: (314) 785-2420.

#### Flamingo Wing Ass'n

The Flamingo Wing Association will hold a reunion for members of the 435th Troop Carrier Wing and affiliated units (1947–79) on April 29–May 1, 1988. Contact: Ray Dunkman, The Flamingo Wing Association, Inc., 1370 N. E. 200 Terrace, North Miami Beach, Fla. 33179.

#### International Bird Dog Ass'n

The International Bird Dog Association (IBDA) will hold a reunion in June 1988 at



SAC Museum, Bellevue, Nebraska

"The 55th Fighter Group Reunion in Omaha was a smashing success. These people really know how to treat veterans. Everything was perfect, in fact we're returning to Omaha in '89."

Regis F. A. Urschler Brig. Gen. (Ret) for complete information on the "perfect reunion" contact: Reunions Greater Omaha Convention & Visitors Bureau 1819 Farnam Suite 1200



the Shangri-La, an aviation resort near Afton, Okla. **Contact:** Phil Phillips, Jr., International Bird Dog Association, 3939 C-8 San Pedro N. E., Albuquerque, N. M. 87110.

#### Korean War Veterans Ass'n

Korean War veterans (all services) will hold a reunion on July 25–28, 1988, near Arlington, Va. **Contact:** Korean War Veterans Association, P. O. Box 12205, Baltimore, Md. 21281. Phone: (301) 327-2854 or (304) 535-2259.

#### **Red River Rats**

The Red River Valley Fighter Pilots Association "River Rats" and the Vietnam Ex-POWs, Inc., will hold their second joint reunion on June 21–26, 1988, at the Crystal Gateway Marriott Hotel in Arlington, Va. **Contact:** Lt. Col. Mike Pearce, USAF, 6036 Bitternut Dr., Alexandria, Va. 22310. Phone: (202) 694-5133 (office) or (703) 922-6136 (home).

#### Shuttle-Bombing Airmen

Members of the Eighth and Fifteenth Air Forces who participated in "shuttlebombing" operations against Germany during World War II have been invited by the Soviet War Veterans Committee for a "Return to Poltava" tour that will be leaving the US on May 2, 1988. **Contact:** Galaxy Tours, P. O. Box 234, Wayne, Pa. 19087. Phone: (800) 523-7287 or (215) 254-6600 (within Pennsylvania).

#### 7th Antisubmarine Squadron

Members of the 7th Antisubmarine Squadron will hold a reunion on June 2–5, 1988, in Fort Walton Beach, Fla. **Contact:** Pete Werdung, 3 Doral St., Shalimar, Fla. 32579. Phone: (904) 651-5317.

#### 11th Service Squadron

Members of the 11th Service Squadron, 482d Service Squadron, Headquarters Squadron, and the 8th Service Group will hold a reunion on April 29–May 1, 1988, in Williamsburg, Va. **Contact:** Col. John J. "Jack" Heckler, USAF (Ret.), 76 E. Harbor Dr., Teaticket, Mass. 02536. Phone: (617) 540-1303.

#### **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.

# Ican save<br/>you money<br/>PesIcan save<br/>you money<br/>on your new car!

## ...And help with your comparison shopping, too!

Whether you want to purchase or lease a new car, truck or van-or simply get a price listing for comparative shopping-I can help save you money through this AFA sponsored program.

Customers tell me it's a lot more convenient, too, than spending a lot of time visiting automobile dealer showrooms to get comparison prices. They just complete a form like the one

below and ask me to send them an itemized total price for the car they choose. Actually I send them two prices-our price and the retail price-as well as instructions to follow if they want me to order the car and have it delivered through an automobile dealer in their local area. One of my repeat customers called it "a good deal with no muss and no fuss!"

And most of the time it really is. About the only exception is that I can't order foreign made cars directly from the factory ... but I can almost always help you in leasing or price costing a new foreign car.

Do if you're in the market for a new car, please ask us to help. I think we can save you both time ... and money!

#### New Vehicle Cost Request Year \_\_\_\_\_ Make \_\_\_ \_ Body Style Model \_\_\_\_ **Equipment Selection** Engine 🗆 4 cyl. 🗆 6 cyl. 🗆 Other. Transmission 🗆 Automatic 🗆 Manual Air Conditioning 🗆 Standard 🗖 Auto. temp. control Emission 🗆 California 🛛 High altitude Gauges 🗆 Standard 🗆 Electronic Mirrors 🗆 LH remote 🖾 RH manual 🗆 Other\_ Moldings Bodyside Rocker panel Other Paint 🗆 two-tone 🖾 stripe Power Equipment Brakes Steering □ Antenna □ Door locks □ Mirrors □ Windows □ Tailgate/trunk release Seats \_\_\_\_\_ driver \_\_\_\_\_ passenger \_\_\_\_\_ bench Radio 🗆 AM 🗆 AM/FM Stereo □ AM/FM Stereo with cassette player □ AM/FM Stereo w/cassette & premium sound Roof 🗆 Full vinyl 🗆 Other \_ Seats 🗆 Bench 🖾 Notchback 55/45 🖾 45/45 Bucket O Other Seat Trim 🗆 Cloth 🗇 Vinyl 🗇 Leather Steering Wheel Tilt Telescopic Tires 🗆 White SW 🗆 Black SW 🗆 Other \_ Wheel Covers Standard Wire Wheels C Aluminum C Other. W/S Wipers 🗆 Intermittent 🛛 Rear Window Other 🗆 H. D. battery □ H. D. cooling □ Bumper guards □ Impact strips □ Console Cruise control Defogger, rear window Glass, tinted □ Door edge guards □ Light group Visor, illuminated vanity □ Floor mats (F & R) □ Headlamps group Luggage rack



Additional Equipment

#### Payment Plan

□ I will pay total in cash □ I will pay over □ 36 □ 48 □ 60 months

with \$\_\_\_\_\_ down payment

Check enclosed for new inquiry-payable	\$ (\$7 for each
	A 🗆 Other VISA 🗆 MasterCard
Acct. No	Exp. Date
Signature	
Name	Rank
Address	
City	State Zip
Phone H: ()	O: ()
	Request and \$7 for each new car Program, c/o PES, Box 208,
For more information (419) 335-2801.	call (800) 227-7811, or in Ohio,

#### **Unit Reunions**

#### **33d Fighter Group**

Members of the 33d Fighter Group, which includes the 58th, 59th, 60th, and Headquarters Squadrons, will hold a reunion on May 4–6, 1988, at Eglin AFB, Fla. **Contact:** Lt. Col. Ibrie M. Beatty, Jr., USAF (Ret.), 18 Sherwood Rd. N. W., Fort Walton Beach, Fla. 32548. Phone: (904) 862-8891. Lt. Col. William D. Jones, USAF (Ret.), 25 Country Club Rd., Shalimar, Fla. 32579. Phone: (904) 651-5898.

#### P-40 Warhawk Pilots Ass'n

P-40 Warhawk pilots will hold their reunion on September 21–25, 1988, at the Galt House in Louisville, Ky. **Contact:** Lt. Col. Clifford E. Sachleben, USAFR (Ret.), 1138 Standiford Lane, Louisville, Ky. 40213.

#### Class 43-A-1

Members of Class 43-A-1 (Mather Field, Calif.) will hold a reunion on September 21–25, 1988, at the Clarion Hotel in Colorado Springs, Colo. **Contact**: John L. Greenleaf, 1034 Princeton Ave., Billings, Mont. 59102. Phone: (406) 248-5343. Lt. Col. Wallace E. Linn, Jr., USAF (Ret.), 2300 Nacogdoches Rd., #232-I, San Antonio, Tex. 78209. Phone: (512) 828-1277.

#### P-47 Thunderbolt Pilots Ass'n

The P-47 Thunderbolt Pilots Association will hold its annual reunion on May 27–29, 1988, at the Marriott Copley Hotel in Boston, Mass. **Contact:** Dan Kenney, 160 Main

\_\_\_\_\_

- A Ladies AFA Stickpin 14K Gold with AFA Logo \$16.00 each (specify: Member or Life Member.)
- B **AFA Buttons** set of nine with AFA Logo in Two Sizes \$25.00 per set or \$3.00 each
- C AFA Jewelry Complete with full color AFA Logos 1 Tie Bar \$20,00 each 2 Tie Tac \$10.00 each 3 Lapel pin \$15.00 each (specify: Member, Life Member, President or Past President.)
- D AFA Flag Pins 25 @ \$25.00, 50 @ \$45.00, 75 @ \$60.00, and 100 @ \$80.00

#### TOTAL ENCLOSED

**ORDER FORM:** Please indicate below the quantity desired for each item to be shipped. Prices are subject to change without notice.

Enclose your check or money order made payable to Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198. (Virginia residents please add 4% sales tax.)

ADDRESS	
STATE	ZIP

Please send me an AFA gift brochure.

St., Box 777, South Dennis, Mass. 02660. Phone: (617) 394-0021.

#### 47th/479th Service Squadrons Ass'n

Members of the 47th and 479th Service Squadrons will hold a reunion on May 5–8, 1988, at the Clarion Hotel in Colorado Springs, Colo. **Contact:** Cecil T. Barrett, 2514 Linda Lane, Colorado Springs, Colo. 80909. Phone: (303) 473-8325.

#### Class 49-A

Members of Pilot Class 49-A will hold a reunion on February 25, 1989, in Phoenix, Ariz. **Contact:** William F. Casey, 15242 S. 37th Pl., Phoenix, Ariz. 85004. Phone: (602) 759-1401. Jack M. Smith, 634 Lakeview Dr., Lindale, Tex. 75771. Phone: (214) 882-9772.

#### **50th Tactical Fighter Wing**

Personnel assigned to the 50th Tactical Fighter Wing between 1978–86 will hold a reunion on June 10–12, 1988, in Tucson, Ariz. **Contact:** CMSgt. George A. Kontos, USAF, 4332 S. Boxwood Ave., Tucson, Ariz. 85730. Phone: (602) 747-2614.

#### P-51 Mustang Pilots Ass'n

The P-51 Mustang Pilots Association will hold a reunion on October 13–16, 1988, at the Red Lion Inn in Ontario, Calif. **Contact:** Col. Harvey W. Gipple, USAF (Ret.), 7927 Borson St., Downey, Calif. 90242. Phone: (213) 869-6512.

#### 58th Fighter Group

Members of the 58th Fighter Group, which includes the 310th and 311th Fighter Squadrons, will hold a reunion on June 9–12, 1988, in Phoenix, Ariz. The 58th Fighter-Bomber Group (Korea) and 69th Fighter Squadron are invited also. **Contact:** Anthony J. Kupferer, 2025 Bono Rd., New Albany, Ind. 47150. Phone: (812) 945-7649.

#### 63d Station Complement Squadron

The 63d Station Complement Squadron, Ninth Air Force, will hold a reunion on June 10–12, 1988, in Charlottesville, Va. **Contact:** Hampton P. Howell, 6 Canterbury Rd., Bellair, Charlottesville, Va. 22901. Phone: (804) 295-6525.

#### 79th AEW&C Squadron

Former crew members and support personnel of the 79th Airborne Early Warning and Control Squadron, which flew EC-121 "Connies" and operated from Homestead AFB, Fla., and of the 915th Airborne Early Warning and Control Group are planning to hold a reunion in late summer. **Contact:** Laurie A. Haire, 2321 Chestnut Ct., Pembroke Pines, Fla. 33026. Phone: (305) 435-8916 or (305) 825-7000.

#### 90th Bomb Group

The 90th Bomb Group "Jolly Rogers" will hold its annual reunion on July 28–30, 1988, at the Royce Carlin Hotel in Melville, N. Y. **Contact:** Ed Panetta, 17 Agatha Dr., Plainview, N. Y. 11803. Phone: (516) 935-9376.

<image>

#### 95th FITS

The 95th Fighter-Interceptor Training Squadron will hold a reunion on March 31-April 3, 1988, at Tyndall AFB, Fla. Contact: Maj. William A. Mannecke, USAF, or Lt. Col. Bill Yantiss, USAF, 95th FITS, Tyndall AFB, Fla. 32403. Phone: (904) 283-3113/2658. AUTOVON: 523-3113/2658.

#### 99th Bomb Group

The 99th Bomb Group will hold a reunion in June 1988 in Fort Lauderdale, Fla. Contact: Julius Horowitz, 3507 Oaks Way, Apt. 911, Pompano Beach, Fla. 33069. Phone: (305) 973-1677.

#### 308th Airdrome Squadron

The 308th Airdrome Squadron will hold a reunion on June 2-5, 1988, in Louisville, Ky. Contact: Sam Duncan, 3520 Grandview Ave., Louisville, Ky. 40207. Phone: (502) 896-0490.

#### **315th Fighter Squadron**

Members of the 315th Fighter Squadron, 324th Fighter Group, will hold a reunion on May 19-22, 1988, in Milwaukee, Wis. Contact: Eugene J. Orlandi, 311 Third St., East Northport, N. Y. 11731. Phone: (516) 368-9193.

#### 330th Bomb Squadron

Members of the 330th Bomb Squadron, 93d Bomb Wing, will hold a reunion on June 10-12, 1988, at Castle AFB, Calif. Contact: Mike Bogna, 535 Baker Ct., Atwater, Calif. 95301. Phone: (209) 358-5320.

#### **350th Fighter Group**

The 350th Fighter Group and the 345th, 346th, and 347th Fighter Squadrons, including the 1st Brazilian Fighter Unit, will hold a reunion on June 9-12, 1988, at the Air Force Museum Memorial Park at Wright-Patterson AFB, Ohio. Contact: Stephen H. Howell, 47 W. Oak St., Farmingdale, N. Y. 11735. Phone: (516) 694-0473.

#### 446th Bomb Group Ass'n

The 446th Bomb Group, which served in Bungay, England, will hold a reunion on June 18-20, 1988, in Omaha, Neb. Con-tact: G. W. "Buzz" LeRoy, 1211 Union, North Platte, Neb. 69001.

#### 504th Bomb Group

Veterans of the 504th Bomb Group will hold a reunion on July 20-24, 1988. Contact: Art Tomes, 2409 Oakwood Dr., Burnsville, Minn. 55337.

#### 556th/6091st Reconnaissance Squadrons

Members of the 556th and 6091st Reconnaissance Squadrons stationed at Yokota AB, Japan (1953-72), will hold a reunion on April 1-3, 1988, in Las Vegas, Nev. Contact: William "Terry" Wilson, 2980 Stanford Lane, El Dorado Hills, Calif. 95630. Phone: (916) 933-2898.

#### 674th AC&W/Radar Squadron

Members of the 674th Aircraft Control and Warning/Radar Squadron stationed at Osceola AFS, Wis. (1950-75), along with members of Det. 5 and the 8th RSM, will hold a reunion on June 21-26, 1988, at

AIR FORCE Magazine / March 1988

Eagle Park in East Farmington, Wis. Contact: Rick Kao, 3777 S. 15th Pl., Milwaukee, Wis. 53221.

#### 815th Tactical Airlift Squadron

Members of the 815th Tactical Airlift Squadron who served at Tachikawa AB, Japan, during the Vietnam War will hold a reunion on April 22-24, 1988, near Atlanta, Ga. Contact: David Conley, 2648 Club Forrest Dr., Conyers, Ga. 30207. Phone: (404) 922-3076.

#### **1000th Satellite Operations Group**

Members of the 1000th Satellite Operations Group (formerly 4000th Satellite Operations Group) will host a Defense Meteorological Satellite Program (DMSP) anniversary party and reunion on May 27-30, 1988, at Offutt AFB, Neb. All present and past officers and enlisted and contractor personnel associated with DMSP are invited. Contact: 1st Lt. Joseph J. Guthart, USAF, Hq. 1000th Satellite Operations Group, AFSPACECOM, Offutt AFB, Neb. 68113-5000. Phone: (402) 294-5455.

#### 1509th Air Base Squadron

Members of the 1509th Air Base Squadron, Military Air Transport Service, who served on Johnston Island will hold a reunion on May 14-16, 1988, at the Best Western Mountain Oak Lodge in Branson, Mo. Contact: Loren C. Mitchell, Rte. 5, Box 9, Neosho, Mo. 64850. Phone: (417) 451-4760.

#### 6147th Tactical Control Group

The 6147th Tactical Control Group "Mosquitos" will hold a reunion on July 28-31, 1988, at the Lowell Hilton in Lowell, Mass. Contact: William M. Cleveland, 1106 Maplewood Ave., Portsmouth, N. H. 03801. Phone: (603) 436-5835.

#### Strategic Control Services

I would like to hear from military members and civilians who served with the 34th Strategic Control Unit, Hg. Fifth Air Force Strategic Services, and the 9th SSU. Plans are being made to hold a reunion this fall, and we need to hear from members who are interested in attending this event so as to coordinate a date and place.

Please contact one of the addresses below.

> Frank R. Occhiuti 1023 Harpersville Rd. Newport News, Va. 23601

James R. "Jim" Harris 719 Pine Forest Dr. Wetumpka, Ala. 36092

Phone: (804) 596-4892 (Occhiuti) (205) 567-6531 (Harris) AUTOVON: 446-3625 (Harris)

#### Class 69-01

I am seeking the names and addresses of former members of Class 69-01 for the purpose of planning a reunion this spring or summer.

Please contact the address below. Gary Totten Rte. 14, Box 270 Cumming, Ga. 30130 Phone: (404) 887-8296

AIR VIDEOS
A-26 Flying Tips\$19.95
<ul> <li>Air Siege Ploesti (15th AF) \$19.95</li> </ul>
B-17 Flying Fortress \$59.95
B-29 Flight Procedures\$39.95
Berlin Airlift\$19.95
Combat America \$59.95
Drop Zone Normandy \$49.95
8th Air Force Reports \$49.95
The Earthquakers \$29.95
15th Air Force Reports \$49.95
5th Air Force Reports \$49.95
Flying the P-47\$49.95
Flying the P-51 Mustang \$29.95
Forever Battling: 320thBG \$79.95
14th Air Force Reports \$49.95
How to Fly the B-24\$59.95
How to Fly the B-26\$39.95
How to Fly the B-25\$19.95
Korea: The Air Force Story\$39.95
Lockheed P-38 Lightning\$19.95
9th Air Force Reports \$49.95
P-40 Warhawk\$29.95
Target Italy\$29.95
The Memphis Belle\$59.95
The Thunderbirds\$29.95
Thunderbolt
12th Air Force Reports \$49.95
Target Nevada
(Add \$2.50 Postage Per Order)
MONEY-BACK GUARANTEE!
Write for FREE Catalog
Phone Orders (303) 423-5706
BOOMERANG PUBLISHERS
6164 W. 83rd Way, Arvada, CO 80003



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 print your NEW address here:

-			-
NI.	Δ.	8 4	-
IM	А	NЛ	-

ADDRESS

CITY, STATE, ZIP CODE

Please fasten your mailing label here

# AFA's CHAMPLUS<sup>®</sup>... With the

### Exceptional Basic Benefits

**1.** Four year basic benefit. Benefits for most injuries or illnesses are paid for up to a four-year period.

**2.** Up to 45 consecutive days of in-hospital care for mental, nervous or emotional disorders. Outpatient care for these disorders may include up to 20 visits by a physician or \$500.00 per insured person each year.

**3.** Up to 30 days per year for each insured person confined in a Skilled Nursing Facility.

**4.** Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Residential Treatment Center.

**5.** Up to 30 days per year (to a 60-day life-time maximum) for each insured person receiving care through a CHAMPUS-approved Special Treatment Facility.

**6.** Up to five visits per year for each insured person to Marriage and Family Counselors under conditions defined by CHAMPUS.

### And the New 'Expense Protector' Benefit

While CHAMPUS Supplement coverage was originally intended to cover the cost of medical services not provided by CHAMPUS, practitioners and service institutions may charge fees that are considerably greater than those approved for payment by CHAMPUS. And, because Supplement policies traditionally base their payments on the amount paid by CHAMPUS, the insured can be left with sizable out-of-pocket expenses. AFA's Cham<u>PLUS</u>® coverage includes a special feature which places a limit on these out-of-pocket expenses.

Called the 'Expense Protector' Benefit, this program limits out-of-pocket expenses for CHAMPUS covered charges in any single calendar year to \$1,000 for any one insured person (or \$2,000 for all insured family members combined). Once those outof-pocket expense maximums are reached, Cham<u>PLUS</u><sup>®</sup> will pay 100% of CHAMPUS covered charges for the remainder of that year.

An example of the way the 'Expense Protector' works follows. Assume you are hospitalized for 35 days, that the hospital charges you \$330 per day and that this is \$75 per day *more* than allowed by CHAMPUS. This would mean that you have an out-of-pocket expense of \$2,625. With AFA's 'Expense Protector' benefit, your cost would be limited to \$1,000. All covered costs over this amount—for the whole calendar year—would be paid by Cham<u>PLUS</u>\*! It's an important benefit that can mean significant savings to you and your family.

#### Who Is Eligible?

1. All AFA members under 65 years of age who are currently receiving retired pay based upon their military service and who are eligible for benefits under Public Law 89-614 (CHAMPUS their spouses under age 65 and their unmarried dependent children under age 21, or age 23 i in college.

2. All eligible dependents of AFA members of active duty. Eligible dependents are spouses under age 65 and unmarried dependent children under age 21 (or age 23 if in college). (There are some exceptions for older age chil dren. See "Exceptions and Limitations.")

#### **Renewal Provision**

As long as you remain eligible for CHAMPUS benefits and the Master Policy with AFA remain

Care	CHAMPUS Pays	AFA CHAMPLUS® PAYS
For Mi	litary Retirees Under Age 65 and	Their Dependents
Inpatient civilian hospital care	CHAMPUS pays 75% of allowable charges	CHAMPLUS* pays the 25% of allowable charges not paid by CHAMPUS plus 100% of covered charges after out-of- pocket expenses exceed \$1,000 per person (or \$2,000 per family) during any single calendar year.
Inpatient military hospital care	The only charge normally made is a \$7.55 per day subsistence fee, not paid by CHAMPUS.	CHAMPLUS* pays the \$7.55 per day subsistence fee.
Outpatient care	CHAMPUS covers 75% of out- patient care fees after an annual deductible of \$50 per person (\$100 maximum per family) is satisfied.	CHAMPLUS* pays the 25% of allowable charges not paid by CHAMPUS after the deductible has been satisfied plus 100% of covered charges after out-of- pocket expenses exceed \$1,000 per person (or \$2,000 per family during any single calendar year.
Fo	or dependents of Active Duty Milit	ary Personnel
Inpatient civilian hospital care	CHAMPUS pays all covered services and supplies furnished by a hospital less \$25 or \$7.55 per day, whichever is greater.	CHAM <u>PLUS*</u> pays the greater of \$7.55 per day or the \$25 hospital charge not paid by CHAMPUS.
Inpatient military hospital care	The only charge normally made is a \$7.55 per day subsistence fee, not paid by CHAMPUS.	CHAMPLUS* pays the \$7.55 per day subsistence fee.
Outpatient care	CHAMPUS covers 80% of out- patient care fees after an annual deductible of \$50 per person (\$100 maximum per family) is satisfied.	CHAMPLUS* pays the 20% of allowable charges not paid by CHAMPUS after the deductible has been satisfied plus 100% of covered charges after out-of- pocket expenses exceed \$1,000 per person (or \$2,000 per family) during any single calendar year.

# **New 'Expense Protector' Benefit!**

in force, termination of your coverage can occur only if premiums for coverage are due and unpaid, or if you are no longer an AFA member. Your certificate cannot be terminated because of the number of times you receive benefits.

#### **Exceptions and Limitations**

Coverage will not be provided for conditions for which treatment has been received during the 12-month period prior to the effective date of insurance until the expiration of 12 consecutive months of insurance coverage without further treatment. After coverage has been in force for 24 consecutive months, pre-existing conditions will be covered regardless of prior treatment. Children of active duty members over age 21 (age 23 if in college) will continue to be eligible if they have been declared incapacitated and if they are insured under CHAMPLUS\* on the date so declared. Coverage for these older age children will only be provided upon a) notification to AFA and b) payment of a special premium amount.

	and Dep	y Retirees	
In	-Patient B	enefits Only	y
Member's Attained Age*	Member	Spouse	Each Child
Under 50	\$22.97	\$ 45.12	\$16.34
50-54	\$34.33	\$ 56.21	\$16.34
55-59	\$50.32	\$ 60.17	\$16.34
60-64	\$62.98	\$ 69.27	\$16.34
In-Patie	ent and Ou	t-Patient B	enefits
Under 50	\$33.90	\$ 61.02	\$40.84
50-54	\$46.59	\$ 69.87	\$40.84
55-59	\$64.41	\$ 96.11	\$40.84

\$102.15 \$40.84 60-64 \$77.38 \*Note: Premium amounts increase with the member's attained age

Plan 2 For Dependents of **Active Duty Personnel** ANNUAL PREMIUM SCHEDULE

In	-Patient B	enefits Only	y Each
	Member	Spouse \$ 9.68	Child
All Ages	None	\$ 9.68	\$ 5.94
In-Patie	ent and Out	t-Patient B	enefits
All Ages	None	\$38.72	\$29.70



#### **Coverage After Age 65**

Upon attainment of age 65, the coverage of members insured under CHAMPLUS® will automatically be converted to AFA's Medicare Supplement program so that there will be no lapse in coverage. Members not wishing this automatic coverage should notify AFA prior to their attainment of age 65.

#### Exclusions

Date

22209-1198

This plan does not cover and no payment shall be made for:

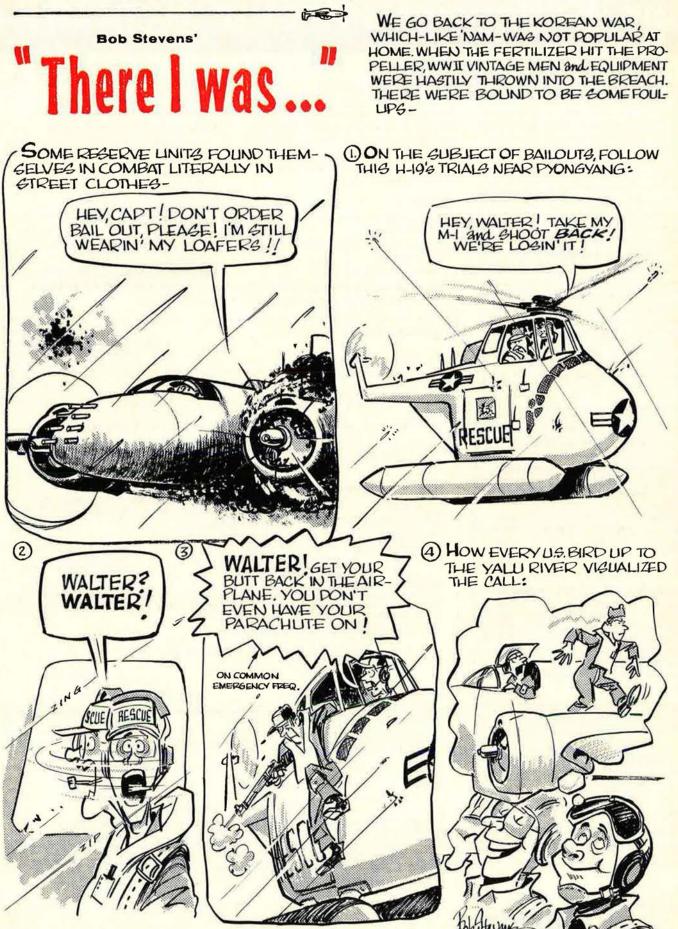
- routine physical examinations or immunizations
- domiciliary or custodial care
- dental care (except as required as a necessary adjunct to medical or surgical'treatment)

- routine care of the newborn or well-baby care
- injuries or sickness resulting from declared or undeclared war or any act thereof
- injuries or sickness due to acts of intentional self-destruction or attempted suicide, while sane or insane
- · treatment for prevention or cure of alcoholism or drug addiction
- eve refraction examinations
- prosthetic devices (other than artificial limbs and artificial eyes), hearing aids, orthopedic footwear, eyeglasses and contact lenses
- expenses for which benefits are or may . be payable under Public Law 89-614 (CHAMPUS)

		N	lutual of Omaha In	o Policy GMG-FC7 Isurance Compan Omaha, Nebrask
Full name of Member	Last	First	Midd	ie
Address				
Number and Street	City	5	State	ZIP Code
Date of Birth Curre	nt Age Height	Weight	_ Soc. Sec. No	
This insurance coverage may only be	e issued to AFA member	s. Please check t	he appropriate box	below:
I am currently an AFA Member.			ual AFA membershi n (\$18) to AIR FORC	
PLAN & TYPE OF COVERAGE REQU	JESTED			
Plan Requested (Check One)			litary retirees & dep ependents of active	
Coverage Requested (Check One)	Inpatient Benef		8	
Person(s) to be insured (Check One)	Member Only Spouse Only Member & Spo	AN	☐ Member & Ch ☐ Spouse & Ch ☐ Member, Spo	ildren
PREMIUM CALCULATION		130		use a oningren
All premiums are based on the attaine normally paid on a quarterly basis bu	d age of the AFA membe	applying for this	coverage. Plan I pre	emium payments ar
PREMIUM CALCULATION All premiums are based on the attaine normally paid on a quarterly basis bu (multiply by 4) basis. Quarterly (annual) premium	d age of the AFA membe it, if desired, they may be	applying for this made on either a	coverage. Plan I pre	emium payments a
All premiums are based on the attaine normally paid on a quarterly basis bu (multiply by 4) basis.	d age of the AFA membe t, if desired, they may be for member (age	applying for this made on either a )	coverage. Plan I pre	emium payments ar
All premiums are based on the attaine normally paid on a quarterly basis bu (multiply by 4) basis. Quarterly (annual) premium	d age of the AFA membe it, if desired, they may be for member (age for spouse (based on m	applying for this made on either a )	coverage. Plan I pre	emium payments a
All premiums are based on the attaine normally paid on a quarterly basis bu (multiply by 4) basis. Quarterly (annual) premium Quarterly (annual) premium	d age of the AFA membe it, if desired, they may be for member (age for spouse (based on m	applying for this made on either a )	coverage. Plan I pre a semi-annual (mult \$ \$ \$ \$	emium payments ar
All premiums are based on the attaine normally paid on a quarterly basis bu (multiply by 4) basis. Quarterly (annual) premium Quarterly (annual) premium	d age of the AFA membe it, if desired, they may be for member (age for spouse (based on m for children @ \$	applying for this made on either a ) ember's age) Total premium	coverage. Plan I pre a semi-annual (mult \$	emium payments a tiply by 2), or annu
All premiums are based on the attaine normally paid on a quarterly basis bu (multiply by 4) basis. Quarterly (annual) premium Quarterly (annual) premium Quarterly (annual) premium	d age of the AFA membe it, if desired, they may be for member (age for spouse (based on m for children @ \$ or your spouse and/or eli equesting coverage.	applying for this made on either a ) ember's age) Total premium	coverage. Plan I pre a semi-annual (mult \$	emium payments ar tiply by 2), or annu:
All premiums are based on the attaine normally paid on a quarterly basis bu (multiply by 4) basis. Quarterly (annual) premium Quarterly (annual) premium Quarterly (annual) premium If this application requests coverage f for each person for whom you are re	d age of the AFA membe it, if desired, they may be for member (age for spouse (based on m for children @ \$ or your spouse and/or eli equesting coverage.	applying for this made on either a ) ember's age) <b>Total premium</b> gible children, ple	coverage. Plan I pre a semi-annual (mult \$	emium payments a liply by 2), or annu

In applying for this coverage. I understand and agree that (a) coverage shall become effective on the last day of the calendar month during which my application together with the proper amount is mailed to AFA. (b) only hospital confinements (both inpatient and outpatient) or other CHAMPUS-approved services commencing after the effective date of insurance are covered and (c) any conditions for which I or my eligible dependents received medical treatment or advice or have taken prescribed frugs or medicine within 12 months prior to the effective date of this insurance coverage will not be covered until the expiration of 12 consecutive months of insurance coverage without medical treatment or advice or having taken prescribed drugs or medicine for such conditions. I also understand and agree that all such pre-existing conditions will be covered after this insurance has been in effect for 24 consecutive months.

19 Member's Signature Form 6173GH App 3/88 Application must be accompanied by a check or money order. Send remittance to: Air Force Association, Insurance Division, 1501 Lee Highway, Arlington, VA



FROM A DEC'86 FLVING STORY

AIR FORCE Magazine / March 1988

# "Without the Osprey, the hostages might still have been with the hijackers."

"First word of the hijacking set a fast chain of

events into motion . . . "Although the airport was many miles away, the Air Force CV-22s slipped up on them quickly, quietly. In fact, we were on top of them before they could react. The Ospreys gave us clandestine pre-cision and surgical accuracy. There was not one

casualty among the hostages. "Maybe, just maybe, this kind of response will send terrorists a message; Using innocent people for your purposes just won't work any more " It's possible. This Department of the Navy pro-

gram is producing an aircraft that streaks forward

gram is producing an aircraft that streaks forward at turboprop speeds, providing unmatched rapid-response capability at very long ranges. Yet, it takes off, hovers and maneuvers like a helicopter. Credit the Bell Boeing TiltRotor Team for turn-ing a challenging concept into a startling reality. The TiltRotor will bring speed and range you'd need in a fast combat transport. It can reach up high or race across the terrain at transport level high or race across the terrain at treetop level.

And it will rewrite mission profiles like no other aircraft in the world, ushering in a new era in special operations aviation.



## We're helping air crews spread their wings faster, farther and higher than ever before.

There's a new force on the wing for military and commercial air crew and maintenance training.

McDonnell Douglas Training Systems and Services brings together our training expertise with our engineering, operational, and support functions to form a single, integrated training organization. Its goal is to develop and deliver the *total* flight and maintenance training programs, civil and military, required in the 21st century.

Working with you, we'll define your training requirements and develop the program which suits your specific needs. Then we'll use computer-based academics and state of the art simulation systems to get the program running,



and a training management system to keep it running smoothly.

Our commercial airline crew training, the Navy T45TS, and our Air Force KC-10 Air Crew Training all serve as models for the advanced, totally integrated training system we can

produce for the new C-17 airlifter. For more information, write to: McDonnell Douglas, Dept. CI-M60, Mail Station 76-60, Long Beach, CA 90846. Or call Richard Fry, (213) 593-3354.

