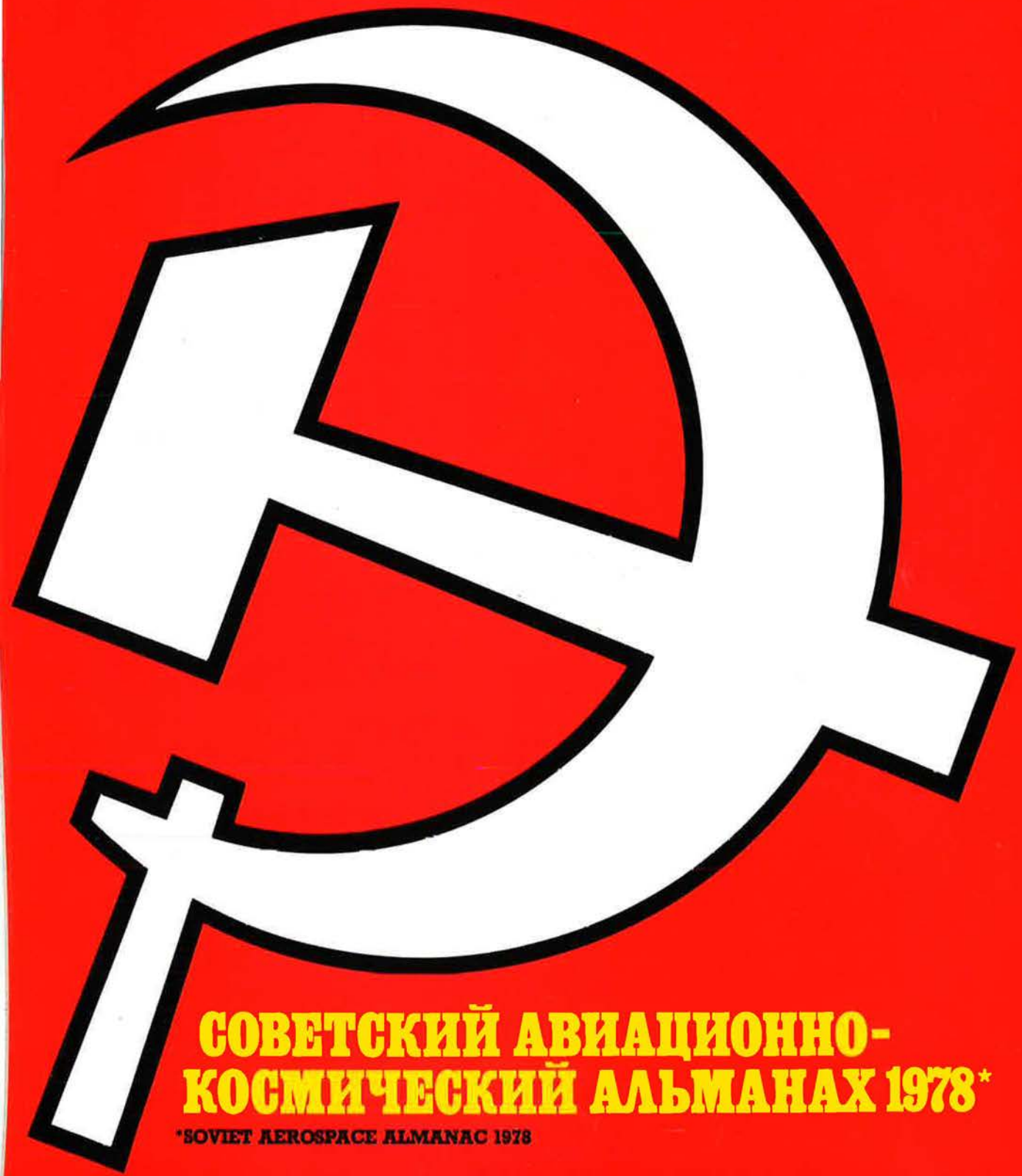
MARCH 1978/$3

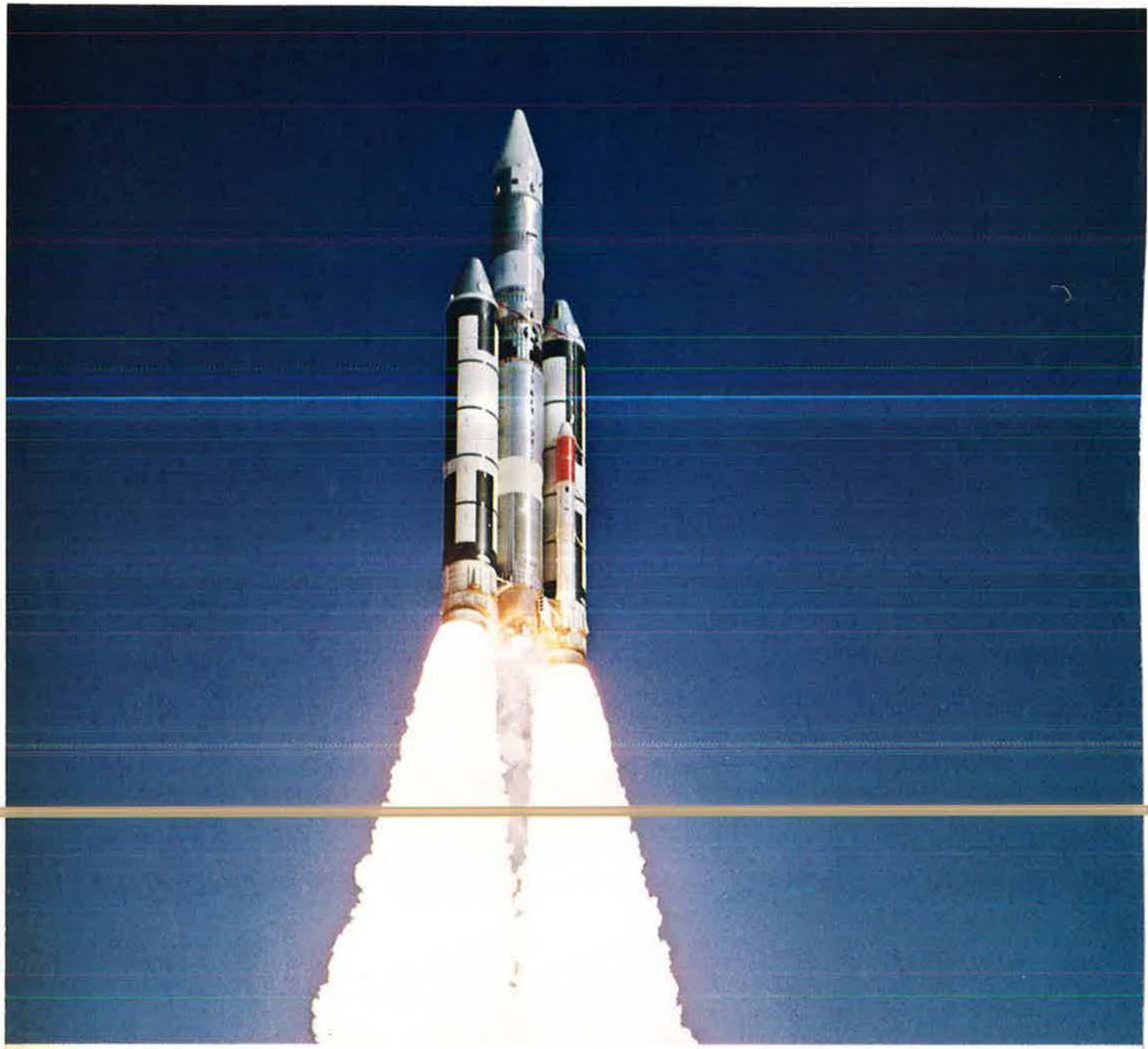
AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



СОВЕТСКИЙ АВИАЦИОННО-КОСМИЧЕСКИЙ АЛЬМАНАХ 1978*

*SOVIET AEROSPACE ALMANAC 1978



The 120

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The CSD team that conceived, developed and now produces the reliable 120-inch booster stage is ready for new challenges. It is prepared to serve the Air Force and the nation in the same reliable and responsible manner in new propulsion projects. The people, the know-how and the facilities required for tomorrow's propulsion systems exist at CSD today.

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ACTIVE CONTROL TECHNOLOGY enabled General Dynamics to maximize F-16 performance, maneuverability and handling qualities, making it the most advanced air combat fighter in the world.

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Proud to be a member of the team, Lear Siegler is pleased to work with GENERAL DYNAMICS and ANNEBROG ELEKTRONIK A/S, our European co-production partner, in this vital aerospace program.

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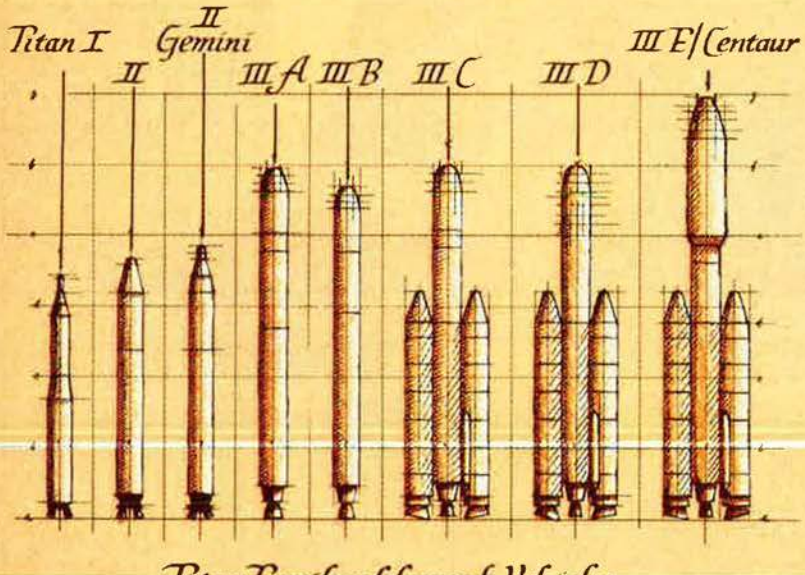
What is the value of experience in developing big systems?

It reduces the risk.



Titan Family of Launch Vehicles

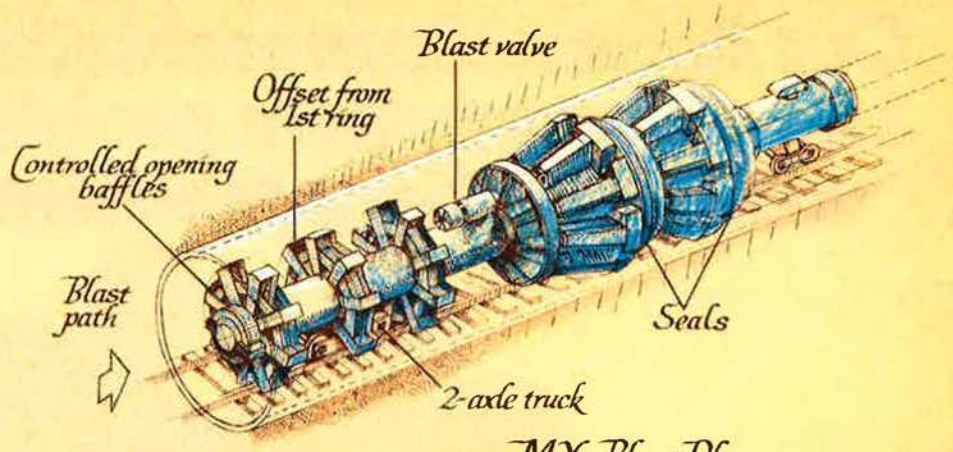
A prime requisite in developing a major we
pon system is the ability to put innovati
ideas to work reducing risk. Through thr
decades, during which we developed 26 maj
missile systems and performed 700 on-si
missile assemblies and launch-support oper
tions, we've gained that ability.

When it comes to innovation prove
through experience, Martin Marietta is t
leader.

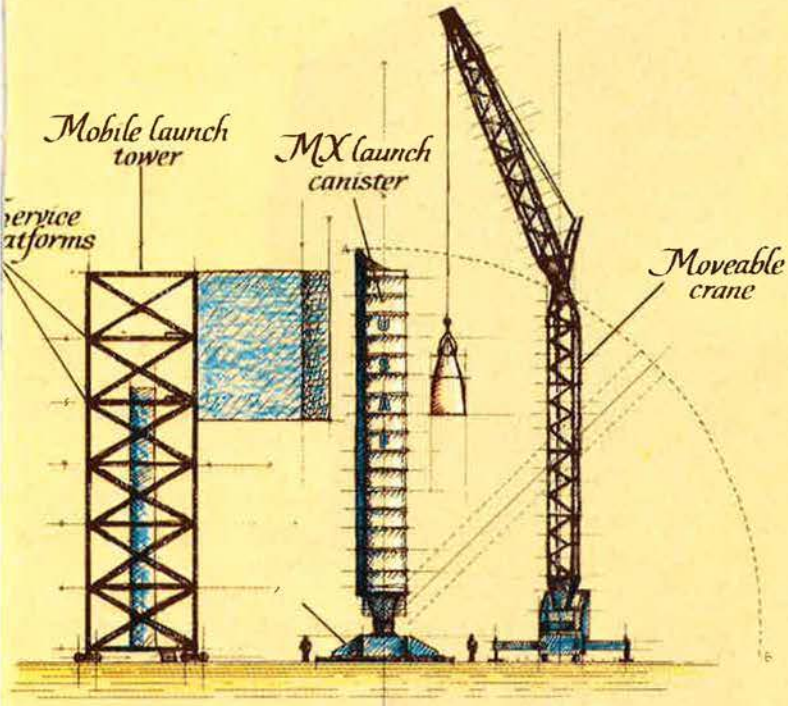
We produced the ground-mobile Matad
Mace and today's Pershing. These have giv
us first-hand knowledge and experience in d
veloping our concepts on mobility and erect
launchers, which are so important in toda
weapon systems. Our work on the canist
launched Patriot, the air-defense weapon
the 1980s, has further refined this skill.

We delivered the silo-launched Titan
and II ICBMs, and the Sprint missile int
ceptor, gaining the technology required
hardened launch sites and severe flight
gimes, technology shared by few in the wor

We honed our management techniques a
abilities to handle complex interfaces simu
taneously with many government agenci
and a variety of associate contractors.



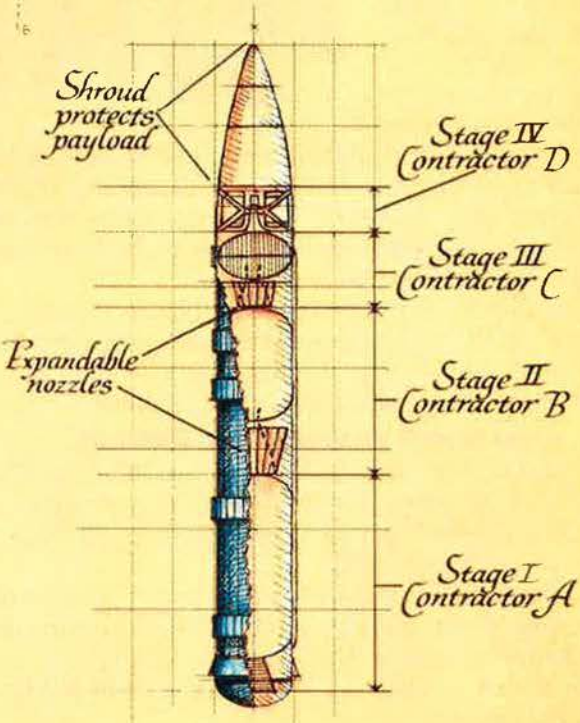
MX Blast Plug



Assembly & Flight Test

Martin Marietta has participated in field- ; more types of missiles that meet broader d more stringent operational, environmen- and management requirements than any ıer company.

This nation's next major strategic system, ssile X, has unusual requirements for mo- ty, canister-launching and site assembly. rtin Marietta is uniquely prepared to sup- t the U.S. Air Force in development of this al system for the defense of our country.



Missile X

MARTIN MARIETTA

rtin Marietta Aerospace
01 Rockledge Drive, Bethesda, Maryland 20034

Our Account Representatives know that a lot of government problems are really communications problems in disguise.

"As Bell Account Representatives, it's our job to analyze your problems. To find the cause. And then put the resources of the world's largest communications company to work solving them."

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Poor communications can make your staff less efficient, strain your budget and delay implementation of your decisions. Improving your communications can raise employee morale and increase the impact of your administration.

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You can turn to the Bell System for help. We have set up teams of communications experts trained to solve specific problems. Each specializes in a different field.

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Your account executive will analyze your problem and then design an overall communications system to help solve it.

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Whether the solution is improved voice communications, data communications, or a complex mix of both, you'll find the Bell System will stand behind it end to end.

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We take total responsibility for the design, supply, installation, maintenance and repair of your system.

When you work with the Bell System, Bell is the only communications company you have to work with.

If you haven't talked systems with your local Bell Account Representative lately, you're missing something.

The system is the solution.

Bell System

AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

This Month

ABOUT THE COVER

This fourth annual "Soviet Aerospace Almanac" has been expanded to include aerospace elements of the Soviet Army and Navy in addition to the three separate Soviet services that are counterparts to elements of the US Air Force. A compact, year-round reference, the Almanac section of this issue begins on p. 33.

Departments

MARCH 1978
VOLUME 61, NUMBER 3

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All you have to do is ask.

Providing complete, accurate technical information when you ask for it is an important way Bell & Howell can help you find the right instrumentation magnetic tape recorder. A dynamic program of continuing, new product development is another. Bell & Howell gives you a powerful resource for data recording.

Here are some of our newest recorder/ reproducers for data recording and retrieval:

★ **New System 100** Modular Hi-D Digital with EDAC. Operates error-free (better than 1 in 10^{10} BER) on 28 tracks/33 KBPI. Data rate to 100 MBPS on one transport. Multiple transport synchronization "gangs" transports in parallel to double, triple or quadruple I/O data rates to 300 MBPS and u Built in test equipment for rapid fault isolation.

★ **New System 300** Modular Hi-D Digita with Hybrid electronics design. Data rate to 15 MBPS on 42 tracks or 300 MBPS on 84 tracks on one transport. Multiple transport synchronization "gangs" transports in parallel double, triple or quadruple I/O data rate to 1 Gigabit/second and up. Low BER with EDAC.

★ **New 3700E** laboratory recorder/reproducer. Fully modularized addition to the field-proven 3700 Series. Improved SNR; ½, 1 and 2x IRIG; full phase and amplitude equalized bi-directional operation.

★ **New M-14L** militarized portable. Latest in the field-proven M-14 Series wideband 2 MHz; smaller, lighter, lower cost, up to 14 track record.

★ **New 4020** laboratory portable. Wideband and intermediate band IRIG standards; 7, 14 or 28 tracks; Direct, FM and digital formats. Digital multiplexing for 8 channels per track.

★ **New AN/USH-29 (V)** Audio loop, 6 to 90 second loop cartridge for monitoring, temporary storage or continuous repetition in 50 Hz to 16 KHz data bandwidth, 8 track, single or double unit configurations.

★ **New AN/USH-24 (V)** Fully MIL-qualified (ship and airborne) portable recorder/reproducer. True laboratory performance. Dual motor wideband servo for spectral purity, seven speeds, 14 or 28 tracks, 2 MHz direct or Wideband I/II FM, 1000 hours MTBF, field proven in MIL programs.

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300 SIERRA MADRE VILLA
PASADENA, CA 91109

Airmail

Military History Symposium

The Department of History, United States Air Force Academy, announces its Eighth Military History Symposium, to be held October 18–20, 1978. The topic, "Air Power and Warfare," was chosen to commemorate the seventy-fifth anniversary year of the Wright brothers' flight at Kitty Hawk.

Coverage will be international in scope, ranging over the full spectrum of twentieth-century aerial warfare. Included in the program, along with leading scholars from the US and abroad, will be a number of distinguished military aviators who helped shape the course of history. For further information about the symposium, write

Maj. John F. Shiner or
Maj. Russell W. Mank
Department of History
USAF Academy, Colo. 80840

Everyone's Loss

For some twenty years, I read with admiration the articles by Claude Witze in AIR FORCE Magazine.

Therefore, it was with a real sense of loss that I realized first that his column was missing and then learned that he had died.

As a fellow journalist, I came to realize that Claude Witze was one of the very best at our craft. His writing was always lucid and interesting. His opinions were grounded in facts. I didn't always agree with his conclusions, but I understood why he had reached them. His columns about the press were trenchant indeed, and, as you noted, sometimes caustic.

The only time I spoke to him personally, he also was caustic. I had so much respect for him that I once sought him out as a source for something I was writing myself. I found him much more reticent about expressing an opinion than he would have been in writing. In effect, I guess he was telling me to do my own reporting. He discounted his own expertise, saying he was just another reporter. It came off as an unpleasant experience, but, strangely, I remember it fondly, and felt affection for him.

In recent years, every time I read his articles I would tell myself that sometime I must write to AIR FORCE Magazine and tell them how good Claude Witze is. Now I'm sorry I didn't do it sooner. But I'm sure you knew it even better than I.

Stanley E. Degler
Arlington, Va.

I just found out about Claude Witze in your January issue. His loss will be the Association's and the Air Force's.

In my capacity as an information officer from 1955 until my retirement in 1973, my path crossed his many times and I am proud to believe I was numbered among his many friends.

Thanks for letting us read him all these years.

Col. Irving H. Breslauer,
USAF (Ret.)
St. Louis, Mo.

THAT Bad?

I am writing to complain about your magazine. I don't mind paying for a magazine that is at least half good and of some interest; but this magazine has absolutely nothing of interest in it except to the generals and officers who fly and have their pictures in it.

Why not revise it so it's of interest to the common folk?

Crawford G. Adams
Chester, Mass.

Divorce Dilemma

The proposed legislation discussed in the January issue article "Should Your Ex-Spouse Get Your Benefits?" will be complex beyond description and/or unfair and, in any case, the legal profession will be the biggest beneficiary. Following are some of the obvious considerations that prompt this conclusion:

a. The legislation will be discriminatory unless it applies to husbands as well as wives of government employees.

b. Application of such a law to government employees only would be discriminatory since the problem is not limited to that group. It would make government careers less attractive and deter marriage by those affected. To compel US taxpayers to subsidize health care for divorced spouses no longer affiliated with government service would be both unfair and unpopular. Even nondisabled veterans do not enjoy this benefit. Apparently the proponents recognize their inability to secure application of such a law but are able to impose it on those within their authority regardless of the discriminatory aspects of so doing.

c. Since reward derives directly from contributions, a fair law would require the measurement of both spouses' contribution to their economic status. Length of marriage, external incomes, number of children, and employment of domestic servants are but some of the factors that must be considered. Should a spouse who raised no children and spent the time on the cocktail and bridge circuits receive the same benefits as a parent and homemaker? Will the adulterous spouse receive the same as the deserted spouse? How will the law treat the divorced spouse who was an economic liability rather than an asset? Is there any reason to believe that these complex judgments will be better made by a bureaucrat than by present divorce courts? To be fair, the awarded benefits would also have to vary with the specific settlement decreed by the courts.

d. Before such legislation is made retroactive, consideration should be given to the hardship and resentment generated in the new families of remarried breadwinners whose family planning and expectations were based on an anticipated income greater than that which would result if this law were made retroactive.

e. The existence of such a law will certainly make the Survivor Benefit Plan a far less attractive option for retired service persons. The results will be that the second spouses of retirees will suffer, either because the SBP was declined or the benefit is shared with a former spouse.

f. There is no moral basis for cutting off, upon marriage of the beneficiary, the economic reward for services previously rendered. Such a provision deters remarriage by beneficiaries and encourages unmarried cohabitation. Termination of benefits upon remarriage makes

sense only if the intent of the law is *welfare* for destitute divorced spouses. In this case, the sole criterion is *need,* not contribution, and there is no logical basis for tying the size of the benefit to the size of the breadwinner's salary/pension unless the intent is to be punitive.

In summary, if this is "welfare" legislation it need not, by historical precedent, be fair. However, if it is "equal rights" legislation it must be nondiscriminatory and morally fair. The best test will be whether or not the Congress includes its own members within the provisions of such a law.

Col. Robert F. Hegenberger, USAF (Ret.)
Harrison, Ark.

A "Singles" Fights Back

James A. McDonnell's article "Battle of the Marrieds vs. Singles" in your December '77 issue offers an explanation of why the present pay and entitlement system is like it is, but, as a single participant in that battle, I wholeheartedly disagree with the Air Force's position.

I do not feel that someone should be paid more simply because his employer arbitrarily determines that his "needs" are greater. To this single troop, that position is irrelevant. As far as I'm concerned, that married member is being paid more than I am. If we both happen to live on base the perceived difference is greater. The married man has a house with kitchen, living room, storage space, his own bedroom, etc., while I'm in the BNCOQ with, maybe, two rooms and a bath, no kitchen or living room, and restrictions on guests. He can eat what and when he wants and I'm subject to the dining hall or the club.

For the lower-ranking enlisted men it's worse. They are limited in space, usually less than that DoD authorizes for dependent children, they usually have roommates not of their choosing, opposite sex visiting privileges are nonexistent on most bases, they are slaves of the chow hall, and they are always subject to inspections.

For these reasons, I am strongly in favor of a salary system based on BMC, with housing coming under the Fair Market Rental proposal. I don't care if my taxes end up a bit higher, at least I will be drawing the same pay as my married counterpart before deductions.

Furthermore, why should single people be relegated to the barracks in the first place? Let's open base housing to everybody and tear down or turn the old barracks into one- and two-bedroom apartments. If a single person wants a one-bedroom place he should be able to get it. The same with picking his, or her, own roommate(s) to share the expenses of a larger place.

In most communities, the married and the single, the young and the old, live together in harmony. It is time the Air Force community housing patterns were changed to bring together the married and the single, the young and the old, the officer and the enlisted.

SMSgt. Jerome T. Czeikus
APO New York

What *Really* Separates Them

Regarding the "lower aptitudes" of females in areas where the Air Force needs are highest ["Widening Horizons for Air Force Women," by Ed Gates, January '78 issue], our problem is not one of aptitude. "Mechanics" and "electronics" genes are distributed equally among the sexes and we get half from each parent (except in the case of holandric traits, which males inherit solely from their mothers).

The problem is, rather, that we are seeing the result of attitudes and cultural shaping, *e.g.,* giving dolls to little girls and trucks to little boys. If the Air Force is serious about giving women greater opportunities, shaping attitudes and aptitudes will have to begin at a younger age. High school is too late.

We also must realize that the Airman Qualification Examination (AQE) is not a totally reliable and valid test, and, as far as I know, the Air Force never measures a far more important factor in this equation—motivation. This very relevant variable is really what separates the men from the boys—er, ah, successes from failures!

Ruth E. Heidrich
Wright-Patterson AFB, Ohio

Research on ANG

I am an Air Force Reserve officer and a doctoral candidate in Military History at Ohio State University conducting dissertation research on the development of the Air National Guard during the 1946–68 period. My research, which has been awarded a fellowship by the Office of Air Force History, focuses upon factors that have had a major impact on the Air Guard program, including mobilization performance; the technician program; Guard inputs to Air Force Reserve components planning; Guard ties with the major gaining air commands; responsiveness of the Guard to changing Air Force mission requirements, levels of funding, and other support for the Air Guard; etc.

I would appreciate hearing from present or former Air Guardsmen as well as active-duty Air Force personnel who were involved with the Guard during the '46–68 period. In particular, I would be interested in hearing from individuals who either participated in Guard mobilizations or were involved in planning Guard programs at the air staff or major air command level.

Capt. Charles J. Gross, USAFRes.
3451 Brazzaville Rd.
Westerville, Ohio 43081

Bombs on Monte Cassino

I am gathering material for a documentary book on what has been described as "the most widely advertised single bombing in history" —the bombing by the Twelfth and Fifteenth Air Forces of Monte Cassino Abbey in Italy on February 15, 1944.

Wishing to describe the Air Force mission from beginning to end, I would appreciate hearing from anyone who had a part in that episode; mainly, those who were attached to the 2d, 97th, 99th, and 301st Bomb Groups, Fifteenth Air Force; the 319th, 321st, and 340th Bomb Groups of the Twelfth Air Force; as well as the 79th and 324th Fighter Groups and the 86th Fighter Bomb Group, who made the Abbey a target on February 16 and 17.

David W. Richardson
11240 Oak St.
Kansas City, Mo. 64114

94th Bomb Group's "Lost Souls"

Our WW II B-17 group was based at Bury St. Edmunds as part of the Eighth Air Force in England. We need help in finding one of our "lost souls." Silas Nettles was identified as piloting the last aircraft to bomb

We suggest that readers keep their letters to a maximum of 500 words. The Editors reserve the right to excerpt or condense as required in the interests of space or good taste. Names will be withheld on request, but unsigned letters are not acceptable.

Airmail

Schweinfurt on October 14, 1943, in Thomas Coffey's excellent book *Decision Over Schweinfurt* (page 315).

Of the 1,300-plus former 94th members found, Nettles is not among them. Can anyone help us get in touch? A note or call would be appreciated.

Of course, there are many others not yet found who served with the 94th or its supporting units whom we'd like to locate, and we'll send each a copy of our quarterly newspaper, *94th Nostalgic Notes,* if they will contact me.

Col. Frank N. Halm, USAF (Ret.)
94th BG Memorial Association
433 N. W. 33d St.
Corvallis, Ore. 97330
Phone: (503) 752-1845

Crash in Northern Ireland

On Thursday, June 1, 1944, at approximately 12:20 p.m., a B-17 attached to the Eighth Air Force crashed into Cave Hill near Belfast, Northern Ireland. All crew members were killed. They were buried in Lisnabreeny Cemetery, County Down, Ireland. The bodies were later disinterred and returned either to the States or England. I am requesting assistance in locating the bomb group number to which this aircraft belonged.

I have tried every channel known to me. Perhaps a reader has the answer.

John Sloan
219 Albinson St.
Sudbury, Ont., Canada

If You Want 54th ASG History—

I have put together a volume entitled *The 54th Air Service Group, An Historical Compilation,* which is to be printed by the Kerner Printing Co., New York. The publication will contain 550-plus pages of orders, letters, unit histories, diary excerpts, pictures, etc., and will be made available to libraries for posterity. But we want it to reach as many 54th members as possible. It is not intended as a money-maker and several 54th members will guarantee the cost of printing.

What we need are names and addresses of 54th members who desire copies. The exact cost has not been established but will not be prohibitive nor will it yield a profit. Persons who may wish copies should write me so that we will know how many to print.

John P. Bondurant
P. O. Box 192
Athens, Ga. 30603
Phone: (404) 543-0161

History of the Constellation

I am writing a book on the history of the Lockheed Constellation and would greatly appreciate contributions of accounts, anecdotes, and photos. Specifically, I'm interested in hearing from individuals involved in the following:

Initial use by Air Transport Command of Lockheed C-69s in 1944–46.

Service of C-121As by USAF, especially in helping supply the Berlin Airlift in 1948–49 across the Atlantic.

USN WV-1 (PO-1W) radar picket aircraft.

USAF units based at Otis and McClellan Air Force Bases using RC-121s.

Airlift or AirEvac flights using C-121C or G aircraft.

USN units flying WV-2s on radar picket duty or on weather reconnaissance.

Utilization of RC- and EC-121s in Southeast Asia in the 1960s.

Replies should include full name and current address as well as rank and unit at the time of association with the military versions of the Constellations. All materials submitted will be returned unless replies state otherwise. Replies will be acknowledged in the "Acknowledgments" section of the book and photos will be properly credited.

Claude G. Luisada
381 Springdale Lane
Buffalo Grove, Ill. 60090

Guam—1945–1946

I would like to hear from anyone who was in the 21st Bomb Squadron, 501st Bomb Group, 315th Bomb Wing, of the Twentieth Air Force on Guam during the above time.

John D. (Dan) Vaughan
N. C. State Motor Club
P. O. Box 1183
Rocky Mount, N. C. 27801

Wanted: New Members

The Pearl Harbor Survivors Association is looking for new members. To be eligible you must have been in the US Armed Forces stationed on the island of Oahu or on a ship within three miles of the shore when the Japanese attacked us on December 7, 1941.

We have members from every branch of the service—Army, Air Force, Navy, Marines, Coast Guard, and White Caps (nurses). I was at Hickam Field in the 31st Bomb Squadron myself.

Ken Magee
5632 Shipp Dr.
Watauga, Tex. 76148

CBI Casualty

I am seeking information regarding my brother, who was killed on his sixty-fifth mission between India and China during World War II. And, if possible, I would like to obtain copies of the lost aircraft report and death report.

PFC Walter A. Rabbitt was a radio operator assigned to the 1327th AAF Base Unit, Air Transport Command. His aircraft, believed to be a C-87 out of Tezpur, India, crashed on January 7, 1945, sixteen miles northeast of Mowting, China. The wreck was located by a ground party from Tsuyung, China.

Other crew members killed were: F/O Joe D. Barringer, F/O Presley, and TSgt. Robert Murdock.

Any information on the circumstances of his death would be appreciated.

Frank K. Rabbitt
5209 Ninian Ave.
Alexandria, Va. 22310

Ol' Shag Nasty

I am most interested in obtaining details of the wartime activities of a USAAF B-24 aircraft. The aircraft in question flew with the 715th Bomb Squadron, 448th Bomb Group, 2d Air Division, and was based at Seething, Norfolk, England. The name of the plane was "Shag Nasty."

Would appreciate hearing from anyone with information.

Allan Garnett
42 Warley Road
Hayes
Middlesex, England

A Book on the A-26

At the present time I am doing a photo-oriented book on the Douglas A-26 Invader. It will cover the history of the aircraft from World War II through its use in Vietnam.

I would like to contact anyone who was associated with the A-26 and am particularly interested in obtaining photographs for use in the


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ATF3s save at maintenance time, too: crews pull only the basic engine component that needs service. Nothing more, since modular maintenance is built into every ATF3.

For the full story on how clean-burning, quiet-running ATF3 turbofans help give the U.S. Coast Guard the world's outstanding multi-mission capability, contact: Manager, Aircraft Propulsion Sales, AiResearch Manufacturing Co. of Arizona, P.O. Box 5217, Phoenix, AZ 85010. Or call (602) 267-3011.

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book. Any material loaned will be carefully treated and returned to owner. Full credit for used information will be given. I am looking especially for information and photos relating to World War II and Korea.

Jim Mesko
4019 LeCona Rd.
Akron, Ohio 44319

Crypto Items
As author of a column on cryptographic items in *Cryptologia* Magazine, I would like to acquire or borrow, from private owners, the WW II Allied air-ground cipher device called SYKO, or any other obsolete or foreign crypto items for photographic purposes.

Louis Kruh
17 Alfred Rd. West
Merrick, N. Y. 11566

Wing Collector
I would appreciate hearing from members who may be in possession of World War II navigator, bombardier, glider pilot, or gold flight surgeon wings. I need one pair of each in order to complete a mounted collection and would be willing to pay the price asked for same.

Joe Falcone
AFA State President,
Connecticut
14 High Ridge Rd.
Rockville, Conn. 06066

UNIT REUNIONS

Alaska Highway Vets
Arrangements are taking shape for a trip up the Alaska Highway by "AH" vets in July or August of '78. It will be a 8- to 10-day tour, in chartered buses out of Edmonton, designed to reunite many of the military and civilian personnel (engineer and quartermaster) who served on the highway during WW II. Costs will be kept minimal. For further information contact

Col. Victor O. McNabb
2000 Huntington Ave.
Alexandria, Va. 22303
Phone: (703) 768-0291

Antique Aircraft Fly-In
The 14th Annual West Coast Antique Aircraft Fly-In and Air Show will be held at Watsonville, Calif., Airport, Friday afternoon, Saturday, and Sunday, May 26–28. Cosponsored by the Northern California Chapter, Antique Airplane Association and the Watsonville Chamber of Commerce. Further information from

Earl W. Swaney
525 Saratoga Ave., #3
Santa Clara, Calif. 95050

Jolly Greens
A reunion of the Jolly Green Rescue Forces will be held April 21–22, at the Ramada Inn, Fort Walton Beach, Fla. Contact

Col. Ed Modica
222 Sotir Ave.
Fort Walton Beach, Fla. 32548
Phone: (904) 863-1959

8th Fighter Group
The 8th Fighter Group members who fought during WW II in the Southwest Pacific will hold a reunion July 28–30, at the George Washington Motel, Allentown, Pa. Headquarters, 33d, 35th, 36th, and 80th Squadrons included. Further information from

Vincent W. Steffanic
21 Curson St.
West Warwick, R. I. 02893

9th Troop Carrier Sqdn.
The 2d anniversary reunion of the "Pelican Squadron"—9th Troop Carrier Squadron, 7th AF—will be held the weekend of July 4, in Columbus, Ohio. All pilots, copilots, navigators, crew chiefs, crews, and members get in touch with

George Hamilton
1857 Tamarack Circle, So.
Columbus, Ohio 43229

11th Materiel (Service) Sqdn.
A reunion of the 11th Materiel (Service) Squadron will be held May 6–7 at the Sheraton Regal Inn, Hyannis, Mass. Contact

John J. (Jack) Heckler
76 East Harbor Dr.
Teaticket, Mass. 02536

Class 35, Kelly Field Grads
The February 1935 Kelly Field graduating class will hold a reunion in San Antonio, Tex., May 31–June 3, at the El Tropicano Hotel. For further information contact

Col. Thomas M. Bartley,
USAF (Ret.)
4003 Towering Oaks
San Antonio, Tex. 78217

B-58 Hustlers
This year's reunion of the B-58 Hustler Association will be held May 5–7, at Kahler Green Oaks Inn, Fort Worth, Tex. Write

B-58 Hustler Association
P. O. Box 26058
Fort Worth, Tex. 76116

Class 61-E
The annual reunion of USAF Pilot Training Class 61-E (Cadets and Student Officers) will be held April 18–20, in Atlanta, Ga. Contact

Francis C. Reidinger
3718 Stonewall Circle
Atlanta, Ga. 30339
Phone: (404) 432-1547

98th Bomber Group (H)
The annual reunion of the 98th Bomb Group (H), "The Pyramidiers," will be held in Albuquerque, N. M., at the Sheraton Old Town Inn, July 17–20. Former members of the 98th who wish to attend or to be put on the mailing list should contact

Walter H. Bolling, Jr.
Rt. 3, Box 67
Gonzales, La. 70737

121st & 167th Liaison Sqdns.
A joint reunion of the 121st and 167th Liaison Squadrons, WW II, will be held in Tallahassee, Fla., June 29–July 2. Contact

Bill Rieger
3945 Parkview
Monroe, Mich. 48161

AC-130 Spectres
All Spectres and others associated with the 16th SOS are invited to the 3d annual minireunion to be held at the Fontenelle Hills Country Club near Omaha, Neb., May 26–28. Further information from

Col. R. A. Wicklund
602 Martin Drive North
Bellevue, Neb. 68005
Phone: (402) 291-4690

319th Bomb Group
The 319th Bomb Group will meet in Dayton, Ohio, July 20–23.

and

320th Bomb Group
The 320th Bomb Group will hold its 1st reunion in conjunction with the 319th BG in Dayton, Ohio, July 20–23. For both reunions contact

Harold E. Oyster
662 Deering Dr.
Akron, Ohio 44313

345th Fighter Sqdn.
The 345th Fighter Squadron "Devilhawks" are holding a reunion in Colorado Springs, Colo., July 27–29. Please contact

Jake Kingsburg
2106 Wesley Ave.
Collinsville, Ill. 62234

475th Fighter Group
"Satan's Angels," the 475th Fighter Group, 431st, 432d, and 433d Squadrons, 5th AF, WW II, are holding a reunion in Niagara Falls, N. Y., June 30–July 2, at John's Flaming Hearth Motor Inn. Please contact

George W. Rath
134 Attridge Rd.
Churchville, N. Y. 14428

Focus On...

The Defense Budget

By Edgar Ulsamer, SENIOR EDITOR

Washington, D. C., Feb. 7

The FY '79 Defense Budget—like those that have preceded it—is a compromise between political and military necessities. Precedent makes it safe to predict that it will be faulted on both counts. Secretary of Defense Harold Brown tried to blunt the inevitable charges of "too much" and "too little," by terming the proposed budget sensitive to "the demands of domestic programs on the government's revenue" as well as "the national commitment to the security of our country on which everything else depends."

The most telling comment on the state of national security came from the Chairman of the Joint Chiefs of Staff, Gen. George S. Brown. In his report to Congress on the "United States Military Posture for FY 1979," he stated that ". . . in light of the extensive growth in the military capabilities of the Soviet Union, it is questionable whether what has been done is enough to assure the security and well being of our country in the coming years."

Measured by almost any fiscal standard, the new budget is up from last year's. The total obligational authority (TOA) sought for the next fiscal year that starts on October 1, 1978, is $126 billion, compared to $116.8 billion in FY '78 (assuming congressional approval of still-pending supplemental requests). In outlays, the FY '79 total is $115.2 billion, compared to $105.3 billion for the current fiscal year. Assuming correct inflation forecasts, calculated by the Defense Department at six percent for TOA and 6.1 percent for outlays, the new budget would provide for real growth over FY '78 on the order of 1.8 percent in TOA and 3.1 percent in outlays. Even a modest overshooting of the predicted inflation rate could transform this "growth" budget into a no-growth or even a declining state. Actual inflation rates for the FY '76–FY '77 period experienced by the Defense Department turned out to be 7.2 percent for TOA and 6.9 percent for outlays, or roughly one percentage point higher than those assumed for FY '79.

Down Sharply from Ford Budget

Measured against the Ford Administration's defense budget projections, the new budget and estimates for succeeding years are down by a wide margin. The Carter Administration's FY '79 TOA request is $8.4 billion less than that projected by President Ford while the reduction in outlays is $5.6 billion. In both TOA and outlays, President Carter's projections average $7 billion a year less than President Ford's five-year forecast. The Carter Administration's forecast for the out-years, FY '80 through FY '83, envisions a real growth of about 2.7 percent annually, reaching $140.3 billion in constant FY '79 prices for the last year.

The Administration proclaims, therefore, that it has met two of the President's basic pledges on the defense budget: the 1976 campaign promise that he would reduce defense spending by about $7 billion, and last year's commitment to the NATO nations to raise defense expenditures in real terms by three percent.

It is possible to challenge the latter claim since TOA—slated to grow by 1.8 percent—rather than outlays is probably a more valid measure of growth. Further, there is no growth at all in the strategic forces budget from FY '78 to FY '79 ($9.8 billion in constant dollars for both years, down from the FY '77 total of $10.2 billion). Yet NATO's so-called triad of forces relies, according to the Alliance's 1975 Ministerial Guidance, on a "balanced force structure of interdependent [mainly US] strategic nuclear, theater nuclear, and conventional force capabilities." The mutually agreed policy of the Alliance specifically calls for modernization of the three elements of this triad, "including both strategic and nuclear capabilities." Whether a no-growth US strategic budget represents compliance with this requirement would seem open to question.

Areas emphasized in the new defense budget, according to Secretary Brown, are maintaining the strength of the strategic forces; enhancing the combat capability of US NATO forces and "the combat capability of NATO as a whole by cooperative efforts with the NATO countries"; improving US combat forces readiness worldwide; and "greater efficiency in defense expenditures."

An examination of the new budget in terms of major program areas supports the Administration's assertion that it is "austere." General-Purpose Force funding is the only area showing appreciable growth in constant dollars—$45.1 billion to $46.9 billion. Research and Development—at $11.0 billion—is less than the FY '77 total of $11.2 billion but more than the current level of $10.9 billion. Intelligence and communications remain essentially level at $8.3 billion. There are no appreciable changes in the allocations for airlift and sealift, for central supply and maintenance, and for Guard and Reserve Forces, compared to the preceding two budgets.

Among the service budgets, the Navy continues in the lead with $41.7 billion, followed by the Air Force ($35.6 billion), and the Army ($32.1 billion). In constant dollars, the Army's budget is up significantly over the preceding two fiscal years. Navy funding shows a slight increase over FY '77, but is lower than in the current fiscal year. The Air Force remains level compared to FY '77, but is up from FY '78.

The new budget provides for a cut in active-duty military manpower by about 20,000 and in Reserve Forces by about 14,000. DoD civilian manpower is expected to drop by about 13,000, but defense related industry employment is projected to rise 120,000 from September 1977 to September 1978, and another 120,000 by September 1979. Spending with industry, according to the Defense Department Comptroller, will amount to about $5 billion, up by about $7 billion from

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Focus On...

the current fiscal year, and will provide employment for about 2,050,000 workers in defense-related industry.

Strategic Forces and Programs

Even though Soviet strategic capabilities are rising alarmingly, US strategic forces remain level in FY '79 at 1,054 Minuteman and Titan II ICBMs, 656 Polaris-Poseidon submarine-launched ballistic missiles (SLBMs), twenty-four strategic bomber squadrons (349 B-52s and sixty-six FB-111As), and six regular air defense interceptor squadrons supplemented by ten Air National Guard squadrons.

Only one Trident ballistic missile-launching submarine is being procured in FY '79, in accord with last year's program stretch-out that provides for buying three boats every two years. Minuteman force funding is down to $122.8 million, compared to $768.5 million in FY '77 and $[illegible] million in FY '78, because "of the completion of the production and force modernization" of this weapon.

The FY '79 Defense Department Annual Report sheds some light on the Administration's US strategic posture goals and directions through the following assertion: "We are quite uncertain as to how an adversary with increasingly sophisticated strategic nuclear forces might consider employing them in the event of a deep and desperate crisis. . . . As a consequence, we must have the flexibility to respond at a level appropriate to the type and scale of his attack. . . . We must be able to launch controlled counterattacks against a wide range of targets—including theater nuclear and conventional forces, lines of communication, war-supporting industry, and targets of increasing hardness: from aircraft runways and nuclear storage sites to command bunkers and ICBM silos. . . . Though the probability of escalation to a full-scale thermonuclear exchange would be high in these circumstances, we must avoid making the probability a certainty."

As a result, Secretary Brown told Congress, "we cannot afford to make a complete distinction between deterrent forces and what are so awkwardly called war-fighting forces. . . . If control and selective targeting are to be more than an abstraction, sufficient numbers of both missiles and bombers must be designed to deliver both high-yield and low-yield nuclear weapons with great accuracy."

It is ironic that funds for production of the B77 full fuzing option (FUFO) nuclear bomb with a rapidly variable yield ranging from a few kilotons to more than a megaton and safely deliverable from low-flying aircraft are not provided by the new budget request.

Five specific requirements would seem to result from the strategic posture sought by the Administration: improvements in the US second-strike capability; assured, long-term survivability of the ICBM force to provide a prompt counterforce capability; the ability to deter various levels of strategic conflict through a range of suitable, rapid, and credible response options; a secure strategic Reserve; and improved warning and assessment of impending nuclear strikes against the US.

[illegible] with the FY '79 budget request requires mental agility. The new budget again defers engineering development of the medium-size, survivably based MX ICBM. R&D work on this weapon is funded at $158.2 million, up slightly from the current fiscal year. Secretary Brown attributed the continued deferral, the second in as many fiscal years, to incomplete background information required before proceeding with full-scale engineering development. He reported that "the studies of basing modes and whether the mobile basing modes, particularly the trench mode, can meet the criteria of survivability, public acceptance, and cost that have to be met have not really produced those answers. . . . Conceivably they will . . . before this year is up—and if that is so, and if the answers . . . come out favorable, I would not rule out asking for an adjustment to proceed to full-scale engineering development."

Minuteman II Upgrading Denied

The budget provides no funds for another new program sought by the Air Force—the Minuteman II Upgrade project, meant to provide modest force modernization of the ICBMs to bridge the time until MX reaches operational status late in the 1980s, or to partially fill the void if MX is not built at all. Pegged originally at about $2.5 billion, the Upgrade program would have increased the hardening of all 450 Minuteman II silos, retrofitted the missiles with a so-called post-boost vehicle and improved guidance to increase its accuracy, and equipped the reentry vehicle with a dust cover to increase its chances of surviving the dust and debris clouds encountered in nuclear war.

There is some evidence to suggest, however, that the Administration may resurrect the Minuteman II Upgrade program to facilitate congressional approval of the prospective SALT II accord.

The FY '79 budget allows for some improvement in the Minuteman force through refinements of the NS-20 guidance system's software and continued development of the higher yield MK-12A warhead. The new warhead, which is to reach initial operational capability (IOC) in 1980, is expected to produce twice the yield of the presently deployed MK-12, but without appreciable change in size and weight. It will be deployed on a portion of the Minuteman III force, according to Secretary Brown.

A major strategic weapons initiative carried forward from the current year is ALCM, the air-launched cruise missile, rated by Secretary Brown as having "our highest national priority." Both USAF's AGM-86B and an air-launched version of the Navy's Tomahawk will continue in full-scale development, leading to a "competitive flyoff . . . so that we can make an air-launched cruise missile selection in November 1979." Full IOC of the missile and modified B-52 carrier aircraft is expected for June 1981, according to Secretary Brown.

The Secretary told Congress tha "we now expect to see the firs prototype of a new modern heav Soviet bomber in the near future," in addition to the twin-engine Back fire bomber. The new bomber pre sumably is to serve as the "back bone of the Soviet intercontinenta bomber force." Nevertheless, th FY '79 budget provides no fund for a new US bomber or for devel opment of the FB-111H. In FY '78 the Administration had requeste

$20 million to start the FB-111H program, but Congress refused. (Theoretically, Congress, on its own, could take another vote on the FY '78 request and thus reinstitute the program.)

Bomber's Future in Question

Secretary Brown explained that "we need to do some thinking first about the possible future of a penetrating bomber. We'll have penetrating bombers in the B-52s for at least another ten years. Beyond that we'll just have to see." The new budget provides about $10 million to study the long-term need for a penetrating bomber. In addition, the B-1 R&D program involving four test aircraft continues at a FY '79 cost of $204 million. Research and development work on a "Cruise Missile Carrier," capable of launching cruise missiles from a standoff position, is to be funded to the tune of $41.2 million.

Two significant long-term strategic weapons initiatives to boost sea-based deterrent capabilities are being continued. The MK-500 Evader maneuvering reentry vehicle—compatible with the Trident I SLBM and capable of evasive maneuvers during atmospheric reentry to defeat hostile defensive systems—will continue in advanced development up to completion of flight testing. Engineering development will not proceed, however, according to Gen. George Brown "unless new Soviet capabilities indicate a need." Concept formulation of the Trident II missile is to continue to "provide a survivable, larger throw-weight, more accurate SLBM in the 1980s, which will ensure a redundant retaliatory capability against all types of targets," according to General Brown.

A significant aspect of the strategic posture advocated by Secretary Brown is the emphasis on attack assessment and the possibility of "launch from under attack." In evaluating the Minuteman force's future vulnerability to a Soviet first strike, Secretary Brown pointed at the risks and uncertainties attending such a "cosmic throw of the dice. . . . [The Soviets] would necessarily have to consider whether the US missiles would still be in their silos when the attack arrived, or whether, given our capability to have unambiguous confirmation of a massive attack, we would launch [our missiles] from under the attack."

The budget provides for continued upgrading of US warning and attack assessment to "give us high confidence of unambiguous confirmation of a Soviet missile attack within a very short time after launch." There is suspicion in some congressional quarters that the emphasis on the "launch from under attack" option is largely a sop to legislators concerned over the delay of advanced, survivable ICBMs.

Strategic Warning and Defense

The FY '79 budget emphasizes the survivability of space-based warning and command control and communications capabilities as well as of the associated space launch and support facilities. Secretary Brown told Congress that "a second, more survivable satellite control facility is under study which will increase the orbital support capabilities needed for our next generation of space systems. The Space Shuttle will provide an overall increase in space system survivability, since survivability measures can then be added to satellites that would otherwise make these systems too heavy to be launched by existing expendable boosters." The White House, nevertheless, instructed NASA to cut the number of Orbiters, the flyable element of the Space Shuttle, from five to four. The option to build the fifth vehicle, originally deemed necessary to meet Defense Department requirements, is kept open, however.

Development, if not deployment, of a defensive satellite killer (ASAT) seems to be provided for. "Of particular interest this year is our progress in research and development of an ASAT system. We have several efforts under way," Secretary Brown announced. Because the US hopes to ban space weapons through a bilateral accord with the Soviet Union, there will be no "operational or space testing" of such weapons for the time being, he added.

No funds are budgeted for development and acquisition of a follow-on interceptor (FOI). Instead, the Air Force is directed "to train and provide the logistics support required to commit the equivalent of one TAC F-15 wing to CONUS air defense in a crisis. In that way, we will meet requirements for a follow-on interceptor, at least on an interim basis, by using F-15s already procured or programmed for TAC, without incurring at this time the high cost of buying additional F-15s for the Aerospace Defense Command. . . . Should projected enhancement in Soviet long-range bomber capabilities and the development of a Soviet cruise missile materialize, we may later wish to modernize our strategic defense force with a separate force of some follow-on interceptor—of which the F-15 would be one possibility," according to Secretary Brown. It is noteworthy, however, that procurement of the F-15s, as well as the Navy's F-14s, has been reduced, according to DoD's Comptroller. The FY '79 F-15 buy is seventy-eight aircraft, compared to 108 in FY '77 and ninety-six in FY '78.

The new budget provides no funds for additional E-4 Advanced Airborne Command Post (AABNCP) aircraft, but leaves the door open to eventually increase the E-4 force from four to six vehicles. The E-4s carry out both the NEACAP (National Emergency Airborne Command Post of the National Command Authorities) and Commander in Chief/Strategic Air Command airborne command post missions. The E-4 program appears to be in competition, however, with tentative plans to use Polaris submarines modified to serve as survivable command posts and capable of launching their own communications satellites.

US general-purpose forces, according to Secretary Brown, continue to be keyed to a "one and a half" war capability, or the ability to engage simultaneously in a major conflict, typified by a NATO/Warsaw Pact war, and a lesser conflict elsewhere. The latter requires forces "that can be sent to any one of a number of [geographically widely] separated areas of the world, in a short time, with substantial combat capability, but not comparable to the combat capability we'd want in Europe."

The FY '79 defense funding plan bears the earmarks of a "NATO budget" that the Administration seems to be seeking. It probably will do little to correct the "relative decline [in] nearly every area of military strength . . . in relation to the Soviet Union" that JCS Chairman Gen. George Brown says this country has experienced in the past few years. ■

The Soviet Union's continuing buildup of strategic and general-purpose forces has caused rising concern over US defenses. Instead of giving praise . . .

Congress Questions Carter's Defense Budget

BY BONNER DAY, SENIOR EDITOR

The cool reception President Carter's first defense budget received in Congress promises a long, hard fight before it is approved.

Critics charged that it contained no new programs, while overall spending was falling behind the Russians. Doubts were also expressed over the abbreviated shipbuilding program and delays in strategic nuclear programs.

The budget ran into considerable lingering support among congressmen for the B-1 bomber. The President has told congressional leaders that he will fight any attempt to resurrect it.

Criticism came from Democrat and Republican alike, some even from normally friendly quarters.

A number of Democrats, including Sen. Sam Nunn of Georgia, said they were pleased with the boost in spending for NATO, but would have liked more budgeted for strategic programs.

Sen. Gary Hart (D-Colo.) was harsher, terming the budget "a serious disappointment."

Hart's criticism, one of the most scathing to be voiced: "Instead of reflecting new concepts, greater use of new technologies, and a spirit of creative innovation, it is largely a rehash of past policies."

Hart, a member of the Senate Armed Services Committee, singled out the Administration's Navy budget in particular, expressing dissatisfaction that there were no aircraft carriers or destroyers for vertical-takeoff aircraft, no 100-knot surface effect ships, and no hydrofoil ships.

But he also hit out at Army and Air Force programs, noting that while they included additional spending for NATO defenses, "just as in the naval budget, we have almost no new approaches, no attempts to solve the real problems of NATO."

Republicans found it hard to match Hart's criticism. Sen. Jake Garn (R-Utah) said: "It is a very deceptive budget. There seem to be bright spots, such as a beef-up of forces in NATO and $1 billion more in the Army budget. But when you look closer you find the President is cutting military manpower by 10,000, shortening training cycles, and sending greener troops to NATO."

Garn, on the Armed Services Committee, was concerned with strategic programs: "I would like to have funds for the B-1 bomber restored. The more the decision to stop the B-1 is examined, the more I am convinced we need a manned, penetrating bomber. We also need more in the budget for research and development and a speed-up, not further delay, of the MX strategic missile."

Others were critical of the overall spending level. Said Texas Sen. John Tower: "Since 1975, the dollar costs of Soviet military investments have been about seventy-five percent greater than those of the US."

Tower, senior Republican on the Armed Services Committee, charged: "Obviously President Carter is not concerned with these trends, as he is proposing a defense budget that provides inadequate funding to those programs which are absolutely essential to our future national security."

He noted that the increase in defense spending is much less than for the Departments of HEW, Labor, and Transportation, and commented: "The apportionment of this [$40 billion] increase among the various federal departments and government functions provides an insight into the true priorities of the Carter Administration."

Rep. Les Aspin (D-Wis.), a frequent critic of defense spending, expressed satisfaction with the overall spending level of the latest budget. Pointing out that he had advocated a real increase of defense spending of one to two percent for the past two years, Aspin said the growth in the budget was about the maximum the Pentagon could manage without waste.

Some said they were reserving judgment until the budget hearings are completed. House Armed Services Committee Chairman Melvin Price was cautious in his appraisal: "The budget is up a little, about eight percent, but I'm not sure whether it is keeping up with inflation."

Rep. Patricia Schroeder (D-Colo.) expressed some misgivings about cutbacks in civilian Defense Department employees, but said it was too early in the budget process to evaluate the budget as a whole.

Others saw the budget being caught up in election-year politics. Illinois Rep. Robert H. Michel, Republican whip, said spending proposed for NATO looked good on paper, but offered tempting targets for election-year cuts.

Michel said the budget raised concern about the nation's strategic forces, particularly the Administration's uncertainty over alternatives for the B-1 bomber. Michel says he wants to keep B-1 money in the budget until the Administration resolves its confusion over strategic programs.

The initial reception of the Carter defense program is another sign of growing uneasiness in Congress with the Administration. But the early consensus in Washington is that the President still has enough congressional support to prevent any major changes in his military plans.

The dissatisfaction expressed by Senator Hart and others in the President's party, however, indicates a lengthy debate over the Pentagon budget. ■

Sperry Update 4

timely report of Sperry Flight Systems activities in the airline, fense, space and general aviation markets.

erry scores another opilot first.

lcDonnell Douglas has autho- d Sperry to proceed with elopment of what will be the digital flight guidance system ified for commercial airline use. system is to be installed in the DC-9 Super 80.

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ry ATE users total 20.

e number of Sperry automatic quipment (ATE) users world- has risen to 20 with orders from Airways, British Airways, Air e and China Airlines.

ile British Airways is among perry ATE users with more one system, the other three es are new users.

Space experimenters to use Sperry Flexible MDMs.

Flexible multiplexer-demultiplexer units for control of experiment payloads aboard the space shuttle will be supplied to NASA by Sperry.

The units are similar in function to those being supplied by Sperry for data handling and interface between the orbiter's main general purpose computers, spacecraft subsystems and solid rocket boosters. Unlike the orbiter and SRB MDMs, the Flexible MDM offers the option of passive cooling through the use of a silverized Teflon radiator, which is effective even when directed towards the sun.

The Flexible MDM is so designated because it is field programmable for a wide variety of payloads. When placed in NASA inventory, the units will be leased by firms conducting experiments in the shuttle bay.

Sperry leads way in helicopter avionics.

Considerable attention is being focused on Sperry's role in helicopter avionics and for good reason. Sperry, working with a number of helicopter air frames and installers, has secured single pilot IFR certifications on five helicopters, including the Aerospatiale Gazelle and Dauphin, Bell 212, Boeing/MBB BO-105 and Agusta 109A.

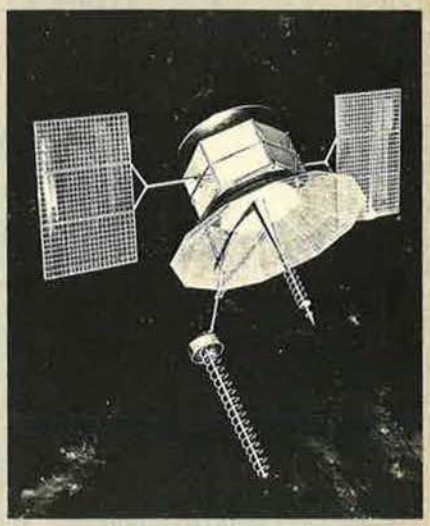
In addition, Bell selected Sperry to provide the standard IFR package for the 222 and Sikorsky will use Sperry flight director systems and gyros in its S-76.

Sperry momentum wheel stabilizes FLTSATCOM.

The first spacecraft in the Fleet Satellite Communications program is gyroscopically stabilized in space by a Sperry Flight Systems momentum wheel assembly.

Sperry's wheel provides three axis stabilization of the satellite to keep its 16-foot diameter dish antenna pointed properly.

Attitude of the 1950 lb. satellite will be controlled by varying the speed of the spinning gyroscopic wheel in response to commands from the on-board computer.



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SPERRY
FLIGHT SYSTEMS

Aerospace World News, Views & Comments

By William P. Schlitz, ASSISTANT MANAGING EDITOR

—WIDE WORLD PHOTOS

—WIDE WORLD PHOTOS

Top: Soviet Cosmonauts Oleg Makarov, left, and Vladimir Dzhanibekov after their return to earth from a mission to the orbiting Salyut-6. (See adjacent item.) *Above: Dr. Roger Eaton, an advisor to Canada's Atomic Energy Control Board, displays a piece of Cosmos-954, the Soviet satellite that crashed in Canada. Among the wreckage were parts of the on-board nuclear reactor used to power the satellite's radar.*

Washington, D. C., Feb. 6

★ Having completed their five-day stint aboard orbiting space station Salyut-6, two Soviet cosmonauts returned to earth without mishap on January 16. The usual dry landing occurred in Soviet Kazakhstan, Central Asia, where the two—Red Air Force Lt. Col. Vladimir Dzhanibekov and flight engineer Oleg Makarov—were picked up by helicopter for the flight to the Baikonur spaceflight center near Tyuratam. *(For a rundown on the Soviet space program, see p. 74.)*

The two cosmonauts performed the second docking—a major milestone in the Soviet manned spaceflight effort—in Soyuz-27 on January 11. They returned to earth in Soyuz-26, the vehicle that put Soviet Air Force Col. Yuri Romanenko and flight engineer Georgi Grechko aboard the space station on December 11.

The double docking in space thus demonstrates Soviet ability to sustain long-duration orbital missions. According to one Soviet space official: "An opportunity has been created for replenishing an orbital station with fuel, oxygen, food, and [illegible] manned transport spacecraft."

To prove their point, the Soviets on January 20 then launched unmanned Progress-1, which carried "various cargo" including fuel for Soyuz-27 to the orbiting lab.

The entire Soviet space spectacular apparently makes possible larger—and perhaps permanent—Russian orbital complexes that can be resupplied and to which fresh crews can be ferried. An additional factor is that the Soviets now have the means of launching orbital rescue missions, should they be necessary.

It remains to be seen whether the two crewmen remaining aboard Salyut-6 are taking a shot at besting the record space stay of eighty-four days held by a US Skylab crew.

While Western observers termed the Soviet accomplishment remarkable, they referred to the Russian hardware as "archaic," technologically decades behind the vastly superior equipment comprising the US's upcoming Space Shuttle system.

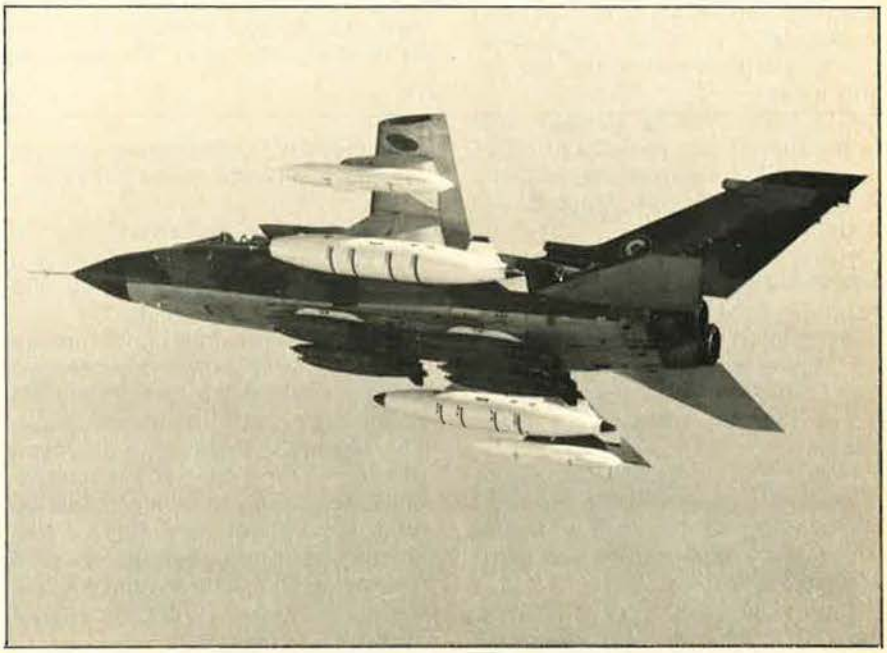
★ Among the thirty-five candidate astronauts NASA named in mid January are six women, three blacks, and an Oriental-American.

Mission Specialist; **USAF Maj. Frederick D. Gregory,** a pilot currently attending Armed Forces Staff College, Norfolk, Va., a candidate Shuttle pilot; and **Dr. Ronald E. McNair,** a physicist with Hughes Research Lab, Malibu, Calif., a candidate Mission Specialist. (There had been one earlier black Air Force astronaut—Maj. Robert H. Lawrence, Jr., killed in a crash in 1967. USAF later discontinued its astronaut program.)

USAF Capt. Ellison Onizuka, Edwards AFB, Calif., a candidate Mission Specialist is an engineer and hails from Hawaii. He's of Japanese descent.

NASA officials said that all the new astronaut candidates are highly qualified and motivated—many in-

Above, Germany's Ulf Merbold, a European/NASA Spacelab candidate, undergoes strenuous medical tests. Right, Britain is buying thirty Boeing Vertol CH-47 Chinook medium-lift helicopters for the RAF. Below, Anglo/German/Italian Tornado prototype 03 on a test flight from Warton aerodrome carrying bombs and underwing stores.



The candidates were selected from a field of more than 8,000 applicants. They'll begin two years of training this summer, and those that measure up will begin flying orbital missions in 1980. There are twenty-seven astronauts already in harness.

The women—the first ever in the US astronaut corps—are: **Dr. Anna L. Fisher,** Rancho Palos Verdes, Calif., a physician; **Dr. Shannon W. Lucid,** Oklahoma City, Okla., a postdoctoral fellow in biochemistry, and the mother of three; **Dr. Judith A. Resnik,** Redondo Beach, Calif., of the Xerox Corp. engineering staff; **Sally K. Ride,** Stanford, Calif., a Stanford University research assistant in physics; **Dr. Margaret R. Seddon,** Memphis, Tenn., a physician; and **Kathryn D. Sullivan,** a postgraduate student at Dalhousie University in Halifax, Nova Scotia.

All the women are in the Mission Specialist category, a post created specifically for Space Shuttle operations. As such, they'll undertake engineering, scientific, and medical activities.

The blacks are: **USAF Maj. Guion Bluford,** Dayton, Ohio, an engineering specialist who will train as a

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terested in becoming astronauts since childhood.

★ NASA's schedule for 1978 calls for twenty-five launches, compared to the sixteen logged in 1977.

Of the total in 1978, fifteen will be for paying customers other than the space agency such as the European Space Agency, Comsat Corp., Japan, the National Oceanic and Atmospheric Administration, the UK, and Canada. (Last year, twelve launches were "reimbursables.")

While last year's launches featured direct benefits to mankind (communications, geodetic, environmental, navigation, earth resources, and the like), in 1978 the plan is to continue such people-related missions while equally emphasizing space shots of a scientific and research nature.

Some launch schedule highlights:

• Successfully orbited on January 19 was FLTSATCOM-A, the first in a series of satellites that will make up the Navy's new worldwide communications system.

• Landsat-C on March 5 will join Landsat-1 and -2 in polar orbit to expand NASA's program for cataloging earth resources and monitoring environmental conditions.

• An experimental broadcasting satellite—Japan-BSE—is to be launched on March 23 as the predecessor to future large-scale broadcasting satellites for the island nation.

• In May, Pioneer Venus-A will be the first of two vehicles to begin its journey to examine the planet's atmosphere. Pioneer Venus-B will follow in August.

• An Alliance communications satellite—NATO-III-C—is set for launch in September.

In a related matter, NASA is keeping track of the two Voyager spacecraft currently on their way to Jupiter, Saturn, and perhaps other planets.

Voyager-1, launched second but on a shorter trajectory than its twin, has now overtaken Voyager-2 and will have a four-month lead when it reaches Jupiter in 1979.

Both spacecraft are humming along at a fair clip, with Voyager-1 at a speed of 30.8 kilometers a second—that's 68,888 miles per hour.

Airman Linda J. Hall, a radio operator with the 193d Tactical Electronic Warfare Group, Harrisburg International Airport, Pa., is the only woman enlisted aircrew member in the ANG. AFA's Olmstead Chapter in Harrisburg has presented her with a citation naming her "Ms. Aerospace Power."

★ The US and the Soviet Union in mid-January opened an improved, more reliable hotline linking the White House and Kremlin.

The hotline provides almost instant and direct communications between the heads of state of the US and the USSR in time of international crisis. The line was previously composed of underwater cables and telephone lines. According to officials, service on it was cut at least three times since it went into operation in 1963 (the most notorious instance when a Finnish farmer cultivating a field severed it accidently).

The new hotline is a dual system relying on synchronous communications, satellites, Intelsat, and the Soviet Molniya satellite system, and should be virtually interruption-proof, officials indicated. The need to use third-country facilities is also eliminated.

The hotline was established following the Cuban missile crisis when, because of communications difficulties, the two nations swayed toward the brink of nuclear war.

Officially called the Direct Communications Link, the line's terminals are teletypewriters that provide typed messages rather than oral exchanges between the two capitals. This lessens the chance of

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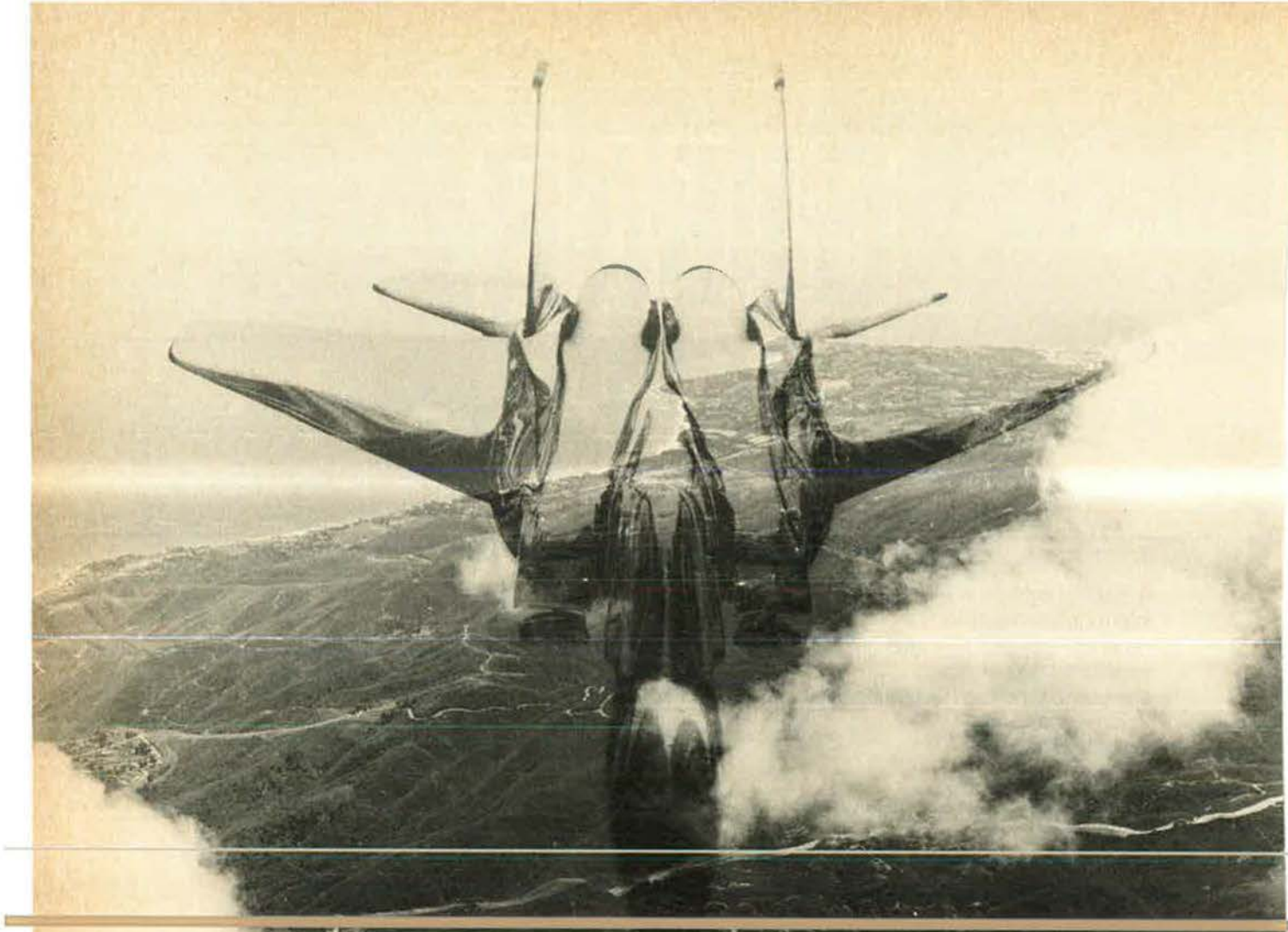

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NORTHROP

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translator error and provides printed records of message traffic.

The DCL is subjected to tests every hour; messages are automatically encoded on transmission and decoded when received. The improvements to DCL resulted from the 1971 strategic arms limitation talks. It is not known whether or not the line currently is used by President Carter and Soviet Chairman Brezhnev or how often it has been used in the past.

★ Two organizations—one Air Force and the other civilian volunteer—saved a total of 670 lives in the past year.

During 1977, the Aerospace Rescue and Recovery Service (ARRS) participated in 932 search and rescue missions during which 618 lives were saved.

For their part, members of the Civil Air Patrol, USAF's civilian auxiliary, engaged in 817 search missions that saved fifty-two people.

The above statistics sound routine, but often the missions were not. (During one hairy effort in Oregon, ARRS pararescuemen scaled a nearly vertical 1,000-foot cliff at night to reach three stranded climbers.)

Besides aerial search and rescue operations, the 63,000-strong CAP also responded in 1977 to requests for disaster assistance, bringing aid to flooded areas in Colorado; Johnstown, Pa.; and Toccoa, Ga.

Under the Military Assistance to Safety and Traffic (MAST) program, ARRS helicopter aircrews and pararescue specialists at six Air Force bases saved 143 lives.

One unheralded ARRS program that is routine but nevertheless hazardous concerns the flights of weather reconnaissance aircrews into tropical storms in the Atlantic and Pacific to report on approaching hurricanes and typhoons.

★ Following extensive flight-testing of a prototype, a program that began in mid-1975 and included long series of flights in mountainous as well as tropical terrain, USAF has signaled a go-ahead for the modification of eight HH-53 helicopters for search and rescue operations at night.

The requirement stems from the Southeast Asia experience, when the rescue of downed airmen during darkness or bad weather proved extremely difficult.

Modification of the Sikorsky heavy-lift helicopters is to be undertaken by US Navy's Naval Air Rework Facility, Pensacola, Fla., and will be completed by early 1980. (NARF conducts HH-53 depot maintenance for all the services.) MAC's Aerospace Rescue and Recovery Service will operate the modified aircraft.

According to AFSC's Aeronautical Systems Division, Wright-Patterson AFB, Ohio, which developed the prototype in-house under the PAVE LOW III program, additional HH-53s may then be modified to further enhance ARRS's night rescue capability.

★ USAF has let contracts to two aerospace firms for the design of a large structure that could be orbited via Space Shuttle, then erected in space, assembly taking place "in an automated fashion, with manned supervision."

Under terms of the contracts, Martin Marietta Aerospace of Denver, Colo., and General Dynamics, San Diego, Calif., will each design a "preprototype" antenna-like structure to "verify the Shuttle's capability to deploy future DoD spacecraft that might require assembly in orbit." When erected, the objects must exceed the size of the Orbiter's cargo bay, which is fifteen feet (4.3 m) in diameter by sixty feet (18.3 m) long.

Applications of the large-structure technology could include communications, space-based radar, and use as a platform in the unique space environment for testing, rendezvous, and servicing.

★ Space research has led to a portable, hand-held, low-dosage X-ray device that would seem to have a multitude of uses.

A key element of the instrument, called a Lixiscope (for Low Intensity X-ray Imaging Scope), is a declassified night-vision image-intensifier developed by the Army. The image intensifier allows the use of a very small radioactive source.

The Lixiscope, powered by a single pen-sized battery, was developed by Dr. Lo I. Yin, a researcher at NASA's Goddard Space Flight Center, Greenbelt, Md.

Besides its obvious medical and dental uses, the device might serve

Recent flight tests have verified that this new imaging infrared seeker can accurately discriminate targets through darkness, smoke, or low-visibility haze. Developed by Hughes Aircraft Co., the seeker gives Maverick missiles night capability in close support and interdiction missions.

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industry in surveying production-line components, scanning for flaws in pipelines, and the like.

One possible application: the immediate check of injured athletes for broken bones.

Estimated production unit cost: less than $5,000.

★ The British have high hopes for their new Sky Flash radar-guided air-to-air missile, recently the subject of a series of test firings from US Navy F-4 Phantoms at the Pacific Missile Test Center, Point Mugu, Calif.

In the test firings, "an impressive capability was demonstrated against low-flying targets in snap-down attacks," officials said.

Development of Sky Flash began in 1973, under the aegis of prime contractor Hawker Siddeley Dynamics, and the missile is due to enter squadron service with the RAF in "the near future."

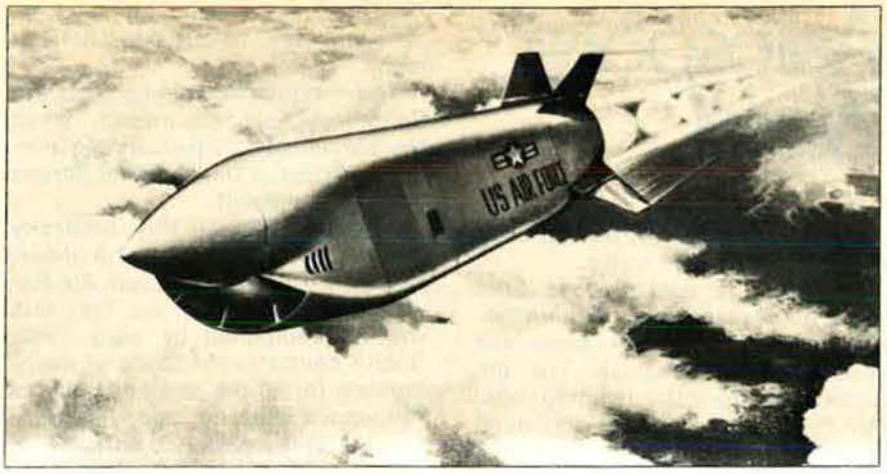
According to Hawker Siddeley: [illegible] other air forces which adopt it an unequaled air intercept capability until at least the 1990s. It is the only missile available today to counter the threat of low-level enemy air strikes by groups of aircraft operating against a background of intensive electronic countermeasures."

★ This coming spring, a second flight test program will be conducted of the new time-division multiple-access (TDMA) system, an all-military-service digital communications network.

The network, intended eventually for use by many types of users including ships at sea, fighter aircraft and helicopters, and even infantrymen in the field, will be an essential part of the armed forces' Joint Tactical Information Distribution System (JTIDS).

During the initial test flight program in mid-1977 aboard an Air Force E-3A airborne warning and control aircraft, TDMA "exceeded specifications." That aircraft is to be the first military user of TDMA. In the tests, the E-3A communicated with an NKC-135 with a TDMA terminal aboard and with two similarly equipped ground stations. USAF has in the works TDMA terminals for fighter aircraft linkup, a ground terminal for command and control center operations, and a man-pack device.

According to prime contractor Boeing Aerospace Co., the communications distribution system operates like a party line, allowing two to 1,000 users to exchange information over a single channel. "This concept is designed to overcome the problems of capacity, coverage, multiple users, security, jam resistance, and traffic flow now associated with conventional voice communications systems," the company said.



Artist's concept of the Advanced Strategic Air-Launched Missile being developed for USAF by McDonnell Douglas Corp. Supersonic, it will be powered to air or ground targets by an integral rocket ramjet propulsion system.

Index to Advertisers

The Soviets Exercise Their Airlift Capability

The Soviet Union, while fueling the Ethiopian-Somali war with an impressive military airlift, is testing its ability to rapidly deploy men and arms abroad.

In a major exercise in late November and early December, the Kremlin flagrantly ignored international overflight rules, despite the protests of Egypt and other governments.

In the normal airlift to Ethiopia, Antonov-22s and other transport planes take off from Black Sea bases, head west over Bulgaria and Yugoslavia, and swing south over the Adriatic and the Mediterranean to Tripoli, Libya. The pilots rest there for about six hours while Soviet or East European ground crews refuel the planes. From Tripoli the planes fly southeast over Libya, cross over Sudan, and land in Addis Ababa.

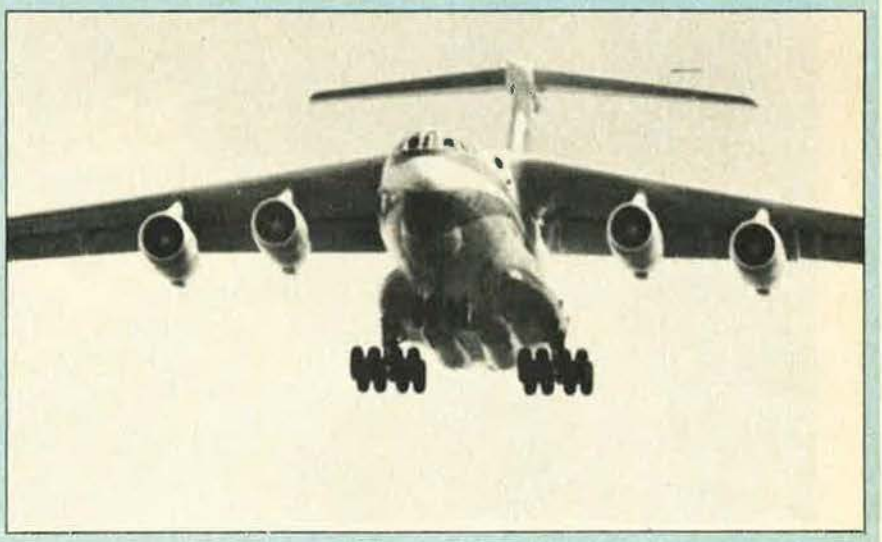
During the special exercise, however, the flight plan changed dramatically. Up to 225 air transports—about fifteen percent of Russia's military aircraft fleet—were dispatched simultaneously along seven different routes, heading for Tripoli, Aden, or Mozambique. For three weeks, the big Antonov planes were launched continuously from different bases, often at intervals of only fifteen or twenty minutes. Some took the regular route over Yugoslavia on the first leg of the trip to Tripoli, then flew over Niger and Chad for Ethiopia. Other planes flew directly south across the eastern Mediterranean, crossing over Egypt and Sudan to Ethiopia.

Meanwhile, a large number of Soviet and East European cargo ships bearing military equipment set off from Black Sea bases for Ethiopia. The Russians closed some of their railway lines to traffic, reserving them for the transport of large quantities of weapons to Soviet ports and airfields. Soviet naval units in the Mediterranean and the Indian Ocean were positioned to protect the transports.

The most dramatic move came in the second week of the operation, when the Russians drew on military stockpiles they had built up behind the Urals, to the rear of their divisions on the China border. From airfields in Tashkent and Alma Ata, supplies were flown south over Afghanistan and Pakistan by military transport, including the Ilyushin-76, the heaviest the Russians have. Some continued along the shores of the Gulf of Oman to land in Aden. The rest flew over the Indian Ocean and Madagascar to land in Mozambique, refuel, and fly on to Addis Ababa.

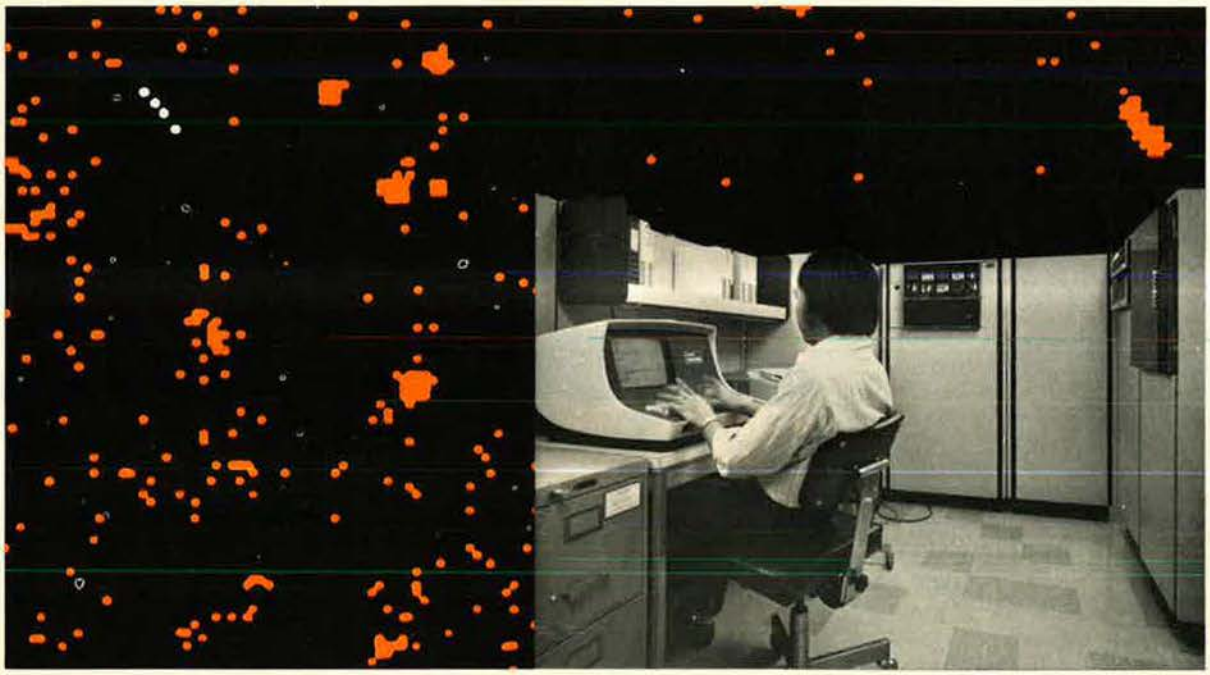
The exercise showed that the loss of bases in Somalia has crimped Soviet lines of communication. But it also demonstrated that the Soviets could move at least three divisions into the Middle East or Africa within ten hours, catching countries in the region by complete surprise.

—BONNER DAY



A heavyweight in Soviet airlift, an Ilyushin-76 four-turbofan transport comes in for a landing.

WHO'S ON FIRST...IN SPACE?



There are hundreds of military satellites in orbit and more on the way. It's vital to our defense to know which types are where at all times... particularly those that may be maneuverable.

To detect and track satellites beyond radar range, the Air Force is now developing GEODSS, which stands for "Ground based Electro-Optical Deep Space Surveillance System". It uses astronomical telescopes with electronics that enhance the light from objects far below the threshold of unaided vision.

As a leader in systems engineering in general and space technology in particular TRW has formed a team of high-technology companies to develop the overall system. Our computer specialists have worked out an ingenious solution for the most difficult problem of all: that of rapidly sorting out, from all the millions of points of light, those anomalous sources that need to be more carefully analyzed. The work is done by high-speed minicomputers and the crucial technology is in their programming. TRW's Moving Target Indicator (MTI) software, developed under contract to the Air Force Systems Command's Electronic Systems Division, almost [illegible] recognizes and eliminates the natural light sources and zeroes in on the ones that need analysis.

This is one of many areas of space defense in which TRW is active. We're also building military satellites and global communications systems as well as the complex, realtime software that's needed for defense against intercontinental ballistic missiles. We support the Air Force with systems engineering for the Minuteman and Space Transportation System programs... and our electronics people are developing advanced components and systems for digital communications. If you want to know more about our space defense capabilities, please contact Herb Greenbaum, TRW Defense and Space Systems Group, One Space Park, Redondo Beach, CA 90278.

SPACE DEFENSE TECHNOLOGY

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A subcontractor, Hughes Aircraft Co.'s Ground Systems Division, is builder of the basic terminal equipment currently undergoing integration testing at Boeing.

★ A Canadian firm and a company in West Germany, each funded by a research agency of its respective government, have agreed to jointly study the feasibility of an advanced, remote-controlled unmanned submersible capable of performing such intricate tasks as electric arc-welding and torch-cutting under water.

The two companies, Spar Aerospace Products Ltd. of Toronto and ERNO Raumfahrttechnik GmbH, Bremen, presumably will apply the experience they have gained in designing specialized equipment for space use.

Spar Aerospace, currently prime contractor in the development of the Space Shuttle's Remote Manipulator System, will tap its expertise in defining the submersible's manipulator and related systems.

ERNO, a member of the VFW-Fokker group, is prime contractor for the European Space Agency's development of Spacelab—a reusable space laboratory to be carried aboard the Shuttle. ERNO also is working on Ariane, the European launch vehicle, and on communications satellites and semisubmersible drilling platforms and underwater probes. ERNO is responsible for detailed conceptual design of the submersible vehicle.

The joint design study will require a year to complete.

★ **NEWS NOTES—The American Institute of Aeronautics and Astronautics** is sponsoring the seventh annual **communications satellite systems conference** in San Diego April 23–27. For further information contact Dr. S. J. Dudzinsky, Jr., The Rand Corp., 1700 Main St., Santa Monica, Calif. 90406.

The **Gossamer Condor,** the first manpowered aircraft to fly a mile *(see October issue, p. 14),* which won the £50,000 prize offered by a British industrialist, **has been donated to the National Air and Space Museum.** While the craft's ninety-six-foot wingspan presented some problems, the GC has been put on display.

Two ANG units—the **178th Tactical Fighter Group,** Springfield, Ohio, and the **138th TFG,** Tulsa, Okla.—will convert from the F-100 Super Sabre to the **A-7D Corsair II** this year. (The **140th TFW,** Buckley, Colo., will have its Corsair inventory raised by six, to twenty-four.) The F-100s will go to other ANG units and into storage.

Died: H. F. "Jim" Roth, AWA public relations director and Vought Corp. public relations manager, in Dallas, January 11. He was fifty-four.

Died: Armand J. Thieblot, aeronautical engineer whose career spanned four decades, in Hagerstown, Md., on January 6. He was seventy-four. ■

While NATO's focus remains fixed to the east, the Soviets pursue a flanking strategy in Africa. The Alliance needs to beef up its defenses in Europe, but it also should develop . . .

A Prudent Peripheral Perspective

By Gen. T. R. Milton, USAF (Ret.)

SOME years ago, a very persistent admiral kept coming up with a proposal to move NATO's naval boundary farther south. The southern boundary then, as it is now, was the Tropic of Cancer. In those days, the convenient thing about the Tropic of Cancer was that it lay well north of Portugal's embattled colonies, Angola and Mozambique, and thus gave the Salazar government no legitimate recourse to NATO support for its colonial wars. The admiral was thus predictably rebuffed by the NATO politicians as regularly as he came in with his proposal.

A lot of things have changed since then. There are no longer any Portuguese colonies in Africa. There is, instead, growing evidence of a new form of colonialism in the former Portuguese colonies and elsewhere, directed by the Soviets. The Soviet foreign legion—or Soviet Gurkhas, to use Senator Moynihan's name for the Cubans—is moving through Africa as the situation demands.

The aims of this campaign are still a matter of conjecture in this country, but King Hassan of Morocco, in a recent *Newsweek* interview, is not in doubt. His view on the Soviet African strategy is clear, perhaps because of his brush last year with the Soviet-equipped and Cuban-trained Katangan force he helped defeat when it invaded Zaire, the former Belgian Congo. King Hassan had this to say about the Soviet aim: "I agree with those who say it is to encircle, weaken, and neutralize Western Europe by controlling its sources of key minerals in Africa."

The King was saying something that should attract a little attention in Brussels. Western Europe is, after all, synonymous with NATO. It seems time to resurrect the admiral's proposal for some close examination.

Now that Senator Mansfield has retired from the field to become our Ambassador in far-off Tokyo there is no one around, in a position of power at least, who challenges our NATO commitment. The Carter Administration has reaffirmed our support of the Alliance in terms every bit as strong as the Republican administrations before it. But most new equipment is destined for Europe. The rationale for much of our force structure—Army, Navy, Air Force, and now even the Marines—rests on the NATO commitment. As the Soviet capability for a surprise attack grows, we and our allies are spending very large sums on improved communications and the other paraphernalia for command and control. As always, we worry about the Mediterranean and the threat the Soviet Mediterranean fleet poses to the southern flank of NATO.

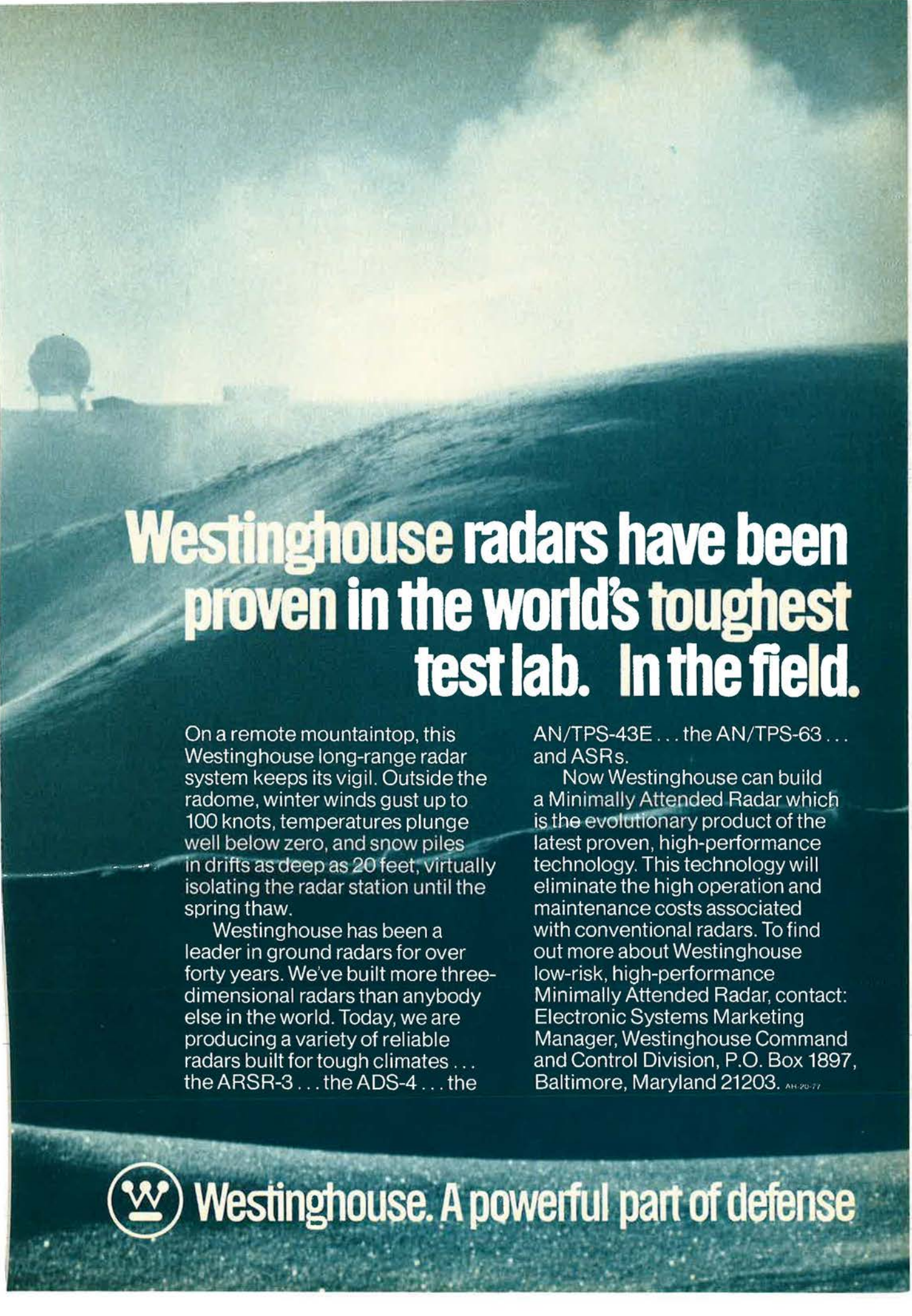
Meanwhile, Africa remains out of bounds. Only that NATO member a-la-carte, France, seems to be pursuing an African plan and that may change if the left is successful in this month's elections. It was French airlift that took the Moroccan troops to Zaire's Shaba Province last March. Without that cooperative intervention it seems probable that Zaire and its Western-oriented Mobuto regime would have lost.

The massive Soviet airlift to Ethiopia last winter showed that the USSR now has a sophisticated military air transport system, and wants the world to know it. As a curious sidelight, the Ethiopian airlift reportedly used 225 transports, exactly the number the United States employed in the Berlin Airlift almost thirty years ago. At any rate, it was a major effort, and it is unmistakable evidence of the importance the Soviets attach to their African strategy. Since these are the same Soviets who devise the Warsaw Pact strategy, there must be some connection. If King Hassan has it right, the threat to NATO will come from Soviet domination of African resources and trade routes, not from an attack across the North German Plain.

It is not easy to see what NATO, as it is presently constituted, could do about it. Even though the Portuguese colonies are gone, there still would be opposition to broadening NATO's area of responsibility. From a purely military standpoint, NATO is already well short of what it needs to counter the obvious and visible threat in Europe. And it is out of the question politically to expect the assorted, and mainly weak, European governments to come up with any more forces. Nonetheless, the facts of the Soviet African challenge, dramatized by the Ethiopian airlift, are too plain to ignore.

A sensible first step for NATO might be to eliminate any southern [illegible] around Africa are a matter of vital interest. Having done that, there could then be a livelier interest taken in African intelligence. There could be some contingency planning, always a useful exercise, and perhaps even a little showing of the NATO flag from time to time. The Standing Naval Force Atlantic, an Allied destroyer squadron, could do this very nicely.

However, this is all probably a pipe dream, no more realizable now than in the days of the stubborn admiral. The alternative to NATO, then, is the United States, and anyone else, like France, who wants to come along. Since we have our own limitations, what with the all-volunteer concept and the cost of doing military business, anything new that we take on must be at the expense of something else. An occasional tasking of US naval and air forces from NATO for some African visibility might do wonders for the morale, and the resolve, of our remaining friends on that continent. In any case, it seems at least a little illogical to spend all our time looking resolutely eastward if the enemy is sneaking up on us from the south. ■



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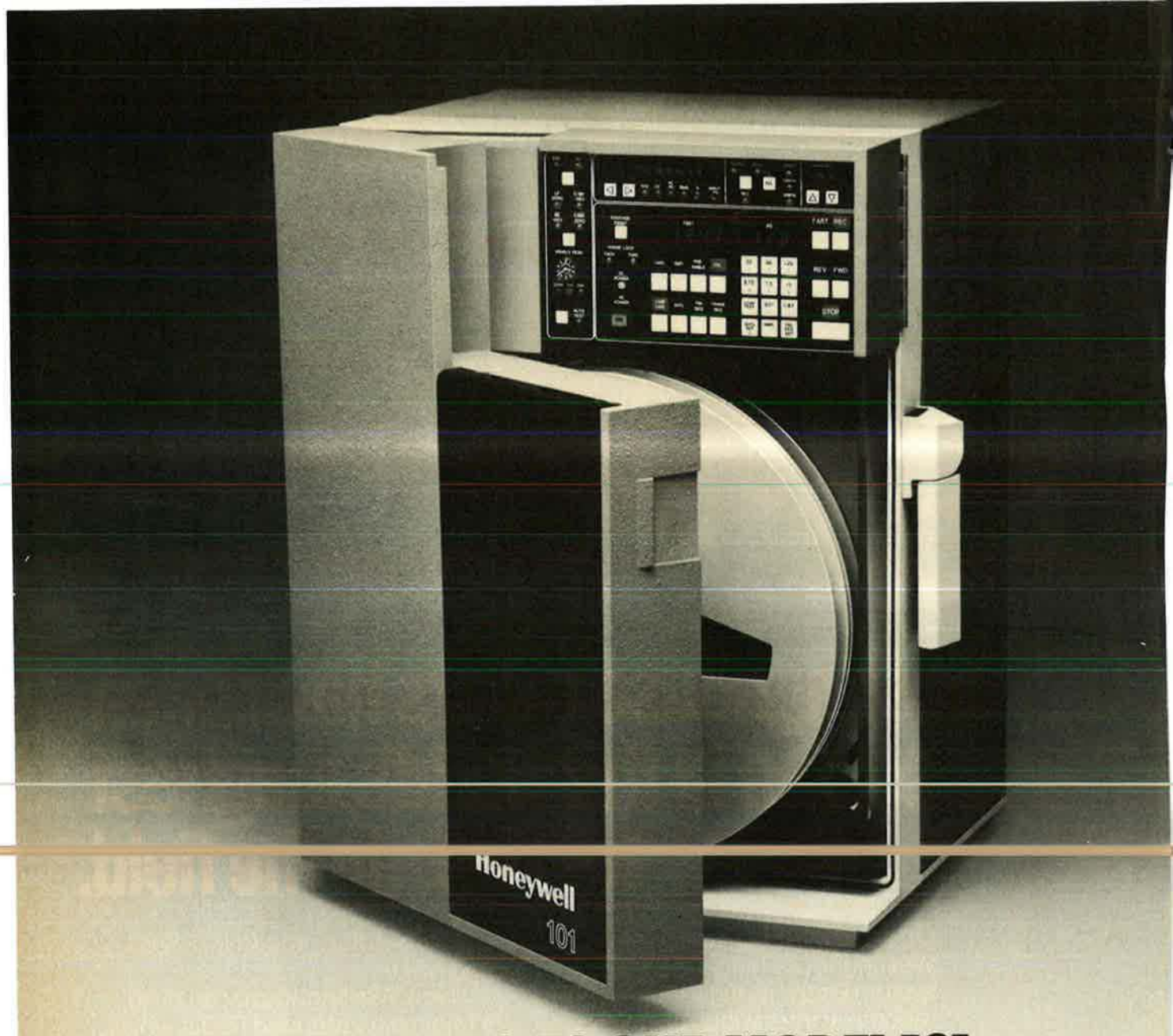

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SOVIET AEROSPACE ALMANAC

THIS fourth edition of our Soviet Aerospace Almanac comes at a time of growing doubt about the adequacy of US defense forces.

Adequacy isn't easy to define. It is both relative and conditional. Relatively, it has to be gauged against the military power of the USSR—the only country that can gravely threaten our security and vital interests—not against competing domestic programs or huge dollar signs floating in a vacuum.

Adequacy is conditional in that the relatively small strategic forces some believe sufficient to deter attack on the US would not assure a favorable outcome if deterrence failed. Nor would larger strategic forces, unless complemented by strong theater forces, necessarily prevent an attack on allies, or political pressure threatening to US external interests. Adequacy can be comprehensive or it can be limited to varying degrees, depending on policy choices and one's propensity to gamble.

Today the dominant element in military affairs is aerospace power; hence, a prime measure of the adequacy of US defenses lies in the relationship between our aerospace capabilities and those of Soviet counterpart forces. We believe there is ample evidence in this Almanac to justify serious concern over the condition of US defenses now and in the near future. We are persuaded by the facts set forth here that the USSR is seeking comprehensive military superiority—superiority at all levels—in order to project its influence, if necessary by force, on a global scale.

A sensible US response calls for defense forces that, in conjunction with allies, will deter Soviet actions against US and allied interests across the spectrum from general nuclear war to military/political threats. In short, a comprehensive deterrent. Whether we have a deterrent of that scope today is questionable. It is certain that we will not have it for long if present trends continue here and in the USSR.

Debate over the adequacy of US armed forces will intensify in the months ahead. Much of it will be, as always, emotional and uninformed. The purpose of this Almanac is to provide facts, which should form the substance of debate. National defense, the foremost responsibility of government, deserves no less than that.

—THE EDITORS

Soviet Aerospace Almanac

The Soviet Union doggedly continues its drive toward military advantage over the United States—from operational space weapons to huge new ballistic missiles and a surfeit of new fighter aircraft—seemingly to secure the political leverage that goes with strategic and tactical superiority.

THE ACCELERATING MOMENTUM OF SOVIET MILITARY MIGHT

BY EDGAR ULSAMER, SENIOR EDITOR

THE prestigious, nonpartisan Atlantic Council of the United States capped a recent in-depth study of US vs. USSR military capabilities with these findings: "The cumulative growth of Soviet military power has not been sudden; it has occurred over a decade with various surges, lapses, and variations in perceived growth, timing, and nature. Although the Soviets have moved ahead in some areas—and can move further ahead if we do nothing about improving the quality of our forces—it is equally true that if we do improve them significantly, the trend can be reversed and a state of equilibrium preserved or restored."

The Atlantic Council's report, entitled "The Growing Dimensions of Security," concluded that the Soviet Union:

- Seeks military superiority for political purposes;
- Will continue to improve its armed forces, giving it the opportunities to exploit any power vacuum or relative imbalance of power if it thinks it can do so with impunity; and
- Is not likely to threaten direct aggression, much less launch it, so long as its leaders do not think it has attained clear military superiority.

The Council's findings can be seen as a "middle-of-the-road" intelligence view of the Soviet challenge and where it is likely to go in the years ahead. The Soviet military colossus expands its power not precipitously but at a monotonously steady rate, estimated by the Central Intelligence Agency at between three and five percent annually. That growth, CIA witnesses have told Congress, will continue "into the 1980s," based on the escalating costs of new and more complex Russian weapon systems as well as the high levels of Soviet R&D activities.

Two of the strongest and most entrenched constituencies of the Politburo—the military and the affiliated industrial and political complexes—almost certainly can and will perpetuate military growth regardless of inevitable fairly drastic changes in the country's aging top leadership over the next few years. Further, most Sovietologists tend to believe that even extensive changes in the Soviet hierarchy will have only minimal effect on the USSR's external behavior and geopolitical ambitions. There is no evidence of any *young turks* waiting in the wings to alter the mixture of Soviet ideology and Russian power politics that shapes Moscow's global strategies. By all odds, the next generation of Soviet leaders will turn out to be more nationalistic, and more skillful and tougher practitioners of Realpolitik than their predecessors, but without diminishing the USSR's commitment to the export of socialism. That field of export, most likely, will be coupled to the export of more and more arms to provide Moscow with additional political leverage in the developing nations and to create new markets for the increasingly productive and qualitatively improving Russian defense industry.

The geographic orientation of Soviet military power, in the view of most US experts, also is not likely to change significantly. Trusting neither allies nor political adversaries, the USSR is bound to maintain the ability to project that power in all directions, even though the principal areas of focus will continue to be the US and NATO, on the one hand, and the People's Republic of China, on the other. A rapprochement of the world's two largest totalitarian powers—far off at the moment—probably depends more on Peking's perception of the US strategic and political position relative to that of the USSR than on Soviet policy toward China.

The High Cost of Soviet Arms

A recent study by the CIA's National Foreign Assessment Center, entitled "A Dollar Cost Comparison of US and Soviet Defense Activities, 1967–1977," concludes that "at about $130 billion, the estimated costs of Soviet defense activities for 1977 were forty percent higher than the US outlay of $90 billion."

In comparing the dollar costs of the two superpowers' defense activities, the CIA study concentrates on three

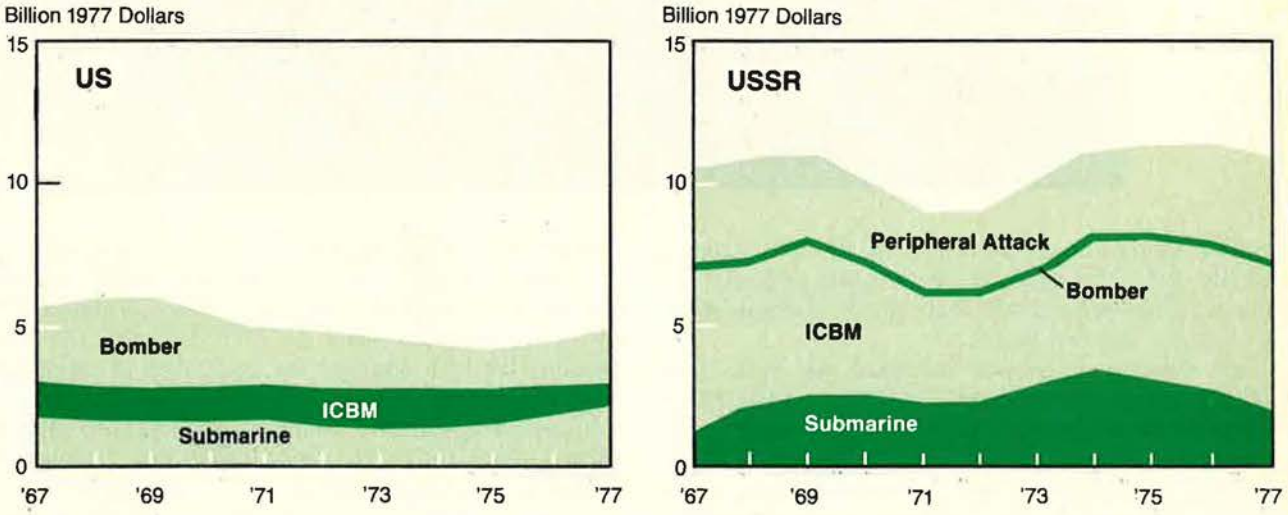
major resource categories: military investment, meaning mainly hardware and associated logistics; operating costs associated with maintaining current forces; and research, development, test, and evaluation costs.

During the 1967–77 period, the CIA finds, "the estimated dollar costs of Soviet investment were about twenty percent greater than US outlays for military investment programs. Soviet investment increased continuously over the period, driven primarily by the introduction of advanced weapon systems, particularly succeeding generations of missile programs, and, in the 1970s, introduction of a new generation of tactical aircraft. US investment declined sharply after the Vietnam buildup—to about half the 1968 level by 1975—before turning up in 1976 and 1977. As a result of these divergent trends, the estimated dollar costs of Soviet investment exceed US outlays by an increasing margin after 1970, and since 1975 have been about seventy-five percent greater than the US level."

Operating costs, according to the CIA, account for a major share of the total defense expenditures of both countries. Again, the trends over the ten-year period measured by the report are divergent, with US costs going down because of declining force levels and Soviet costs

US AND SOVIET FORCES FOR STRATEGIC OFFENSE, 1967-1977

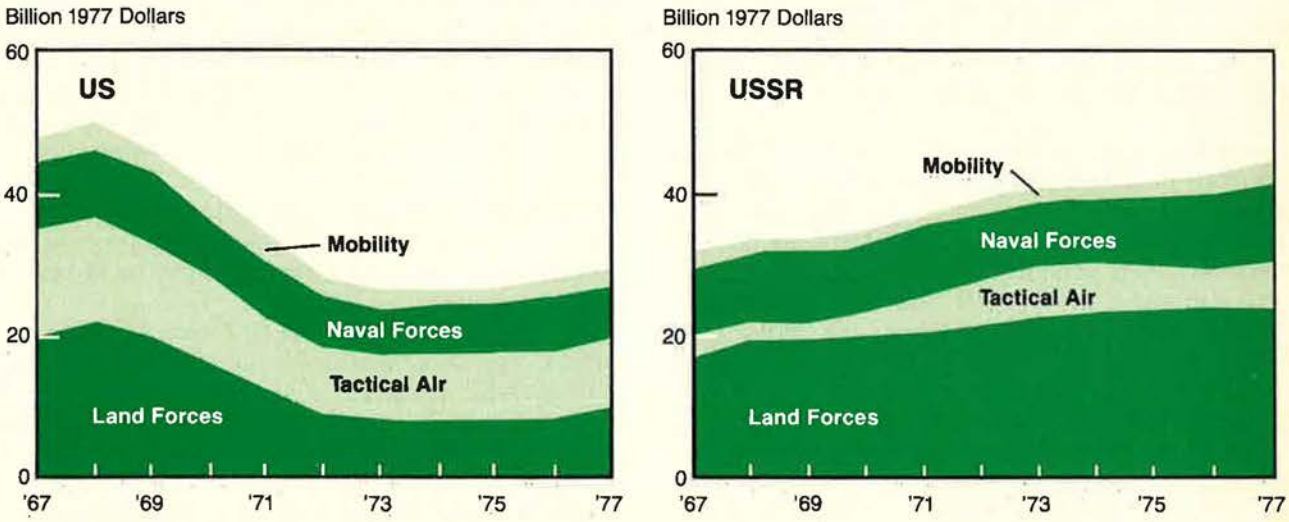
A Comparison of US Outlays with Estimated Dollar Costs of Soviet Activities if Duplicated in the US



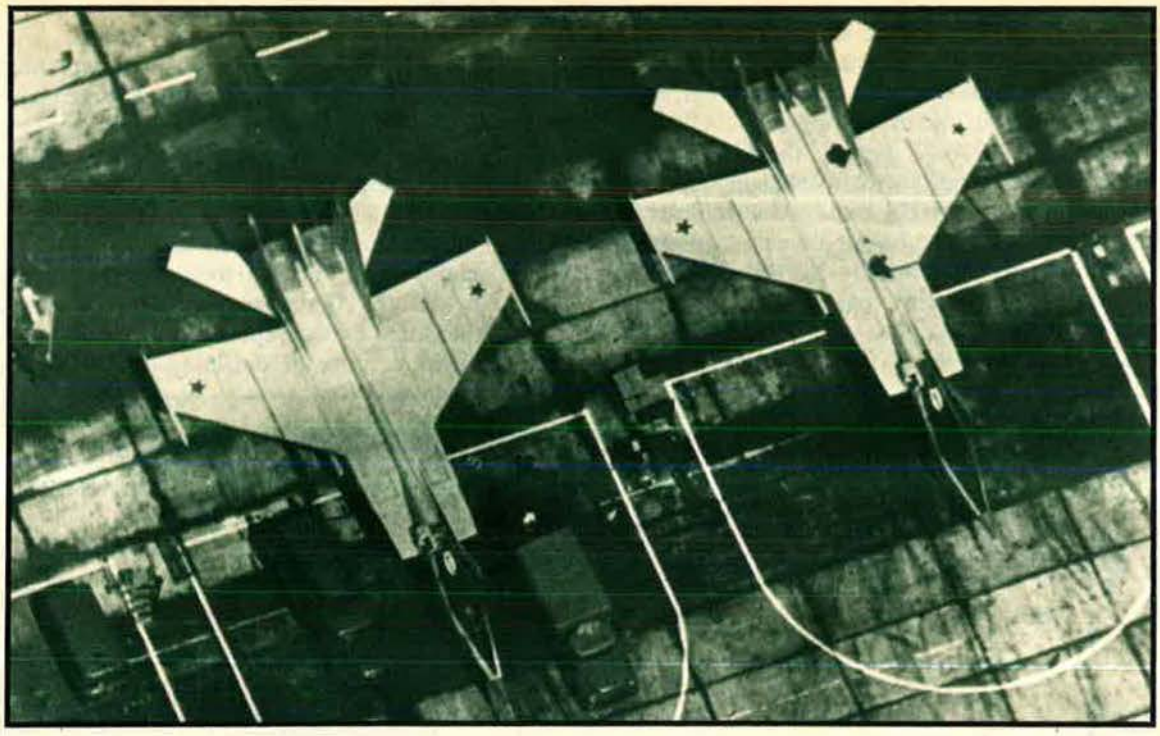
The strategic offensive mission is defined according to the US Defense Planning and Programming Categories of August 1977. Minor adjustments have been made to attain comparability with Soviet data. Costs for pensions, nuclear materials for warheads, and RDT&E are excluded.

US AND SOVIET GENERAL PURPOSE FORCES, 1967-1977

A Comparison of US Outlays and Estimated Dollar Costs of the Soviet Activities if Duplicated in the US



The general purpose mission is defined according to the US Defense Planning and Programming Categories of August 1977. Minor adjustments have been made to attain comparability with Soviet data. Costs for pensions, nuclear materials for warheads, and RDT&E are excluded.



MiG-25 Foxbat-B (left) and Foxbat-D (right) are equipped with side-looking airborne radar and provide the Soviets with high-quality reconnaissance capabilities.

increasing because of the growth of the USSR's standing forces. By 1977, the estimated dollar costs of Soviet operating activities were more than twenty percent above the US outlays, the CIA found.

Soviet military manpower increased by more than 700,000 between 1967 and 1977, to about 4,100,000 at present. Most of the increase, the CIA report claims, "was in the ground forces, although growth occurred in the other force components as well." The Soviets, the report points out, "historically have maintained a large standing force that has a broader range of responsibilities than does the US military. Soviet military manpower in 1977 was about twice the US level . . . and includes the five armed services of the Ministry of Defense and the Soviet Border Guards who are subordinate to the Committee for State Security but have some military responsibilities. Some half million additional men serve in military construction units and the Internal Security Troops of the Ministry of Internal Affairs." The CIA tally did not include the latter because in the Agency's view "they do not fill what in the US would be considered national security roles."

Presenting its comparison of US and Soviet RDT&E dollar costs in hedged terms because of far greater uncertainties in this field—compared to the other areas of the report—the CIA concluded that "it is clear from the number and increasing complexity of the weapon systems deployed and under development that the Soviet activities were both large and growing during the period under review. US outlays for RDT&E, on the other hand, declined steadily over the period before turning up in 1977. As a result, Soviet RDT&E activities in 1977 were substantially larger than those of the United States." How much larger, the report did not say in discrete terms, but one of the Agency's visuals indicates that the Soviets lead by about seventy-five percent.

Comparing US and Soviet investments within mission areas, the CIA concludes that the USSR outspent this country on strategic forces—intercontinental and peripheral attack, strategic defense, and associated command control and communications—at a rate of almost 2.5:1 during the past ten years. In 1977, however, the Soviet spending level for strategic forces climbed to about three times that of the US.

In analyzing the two countries' spending on intercon-

percent of the estimated dollar costs of Soviet activities . . . were for the ICBM force, compared to only about twenty percent for the US. On the other hand, outlays for the US bomber force comprised about forty percent, compared to a Soviet share of less than five percent." The latter figure doesn't make allowance for about 100 Backfire bombers, however, which are assigned to both Soviet Long-Range Aviation and the Navy.

Soviet spending on general-purpose forces—not counting pertinent R&D—exceeded US outlays by about ten percent over the reporting period, but since 1973 has been fifty percent higher each year than the US costs. Soviet land forces costs have registered a steady growth during the past ten years, according to the CIA, and in 1977 reached a level twice that of comparable US spending.

Counting the costs of attack carriers and their aircraft, the US outspent the Soviets on general-purpose naval forces over the past ten years by about twenty percent, the CIA estimates.

US outlays for all its tactical air forces, including attack carriers, were more than twice the estimated dollar costs of comparable Soviet forces over the past ten years. The trends for the two countries, however, were quite different, according to the CIA. US outlays declined, with 1977 costs a third less than in 1967. The Soviet 1977 level, by comparison, was twice that of ten years earlier, with the result that "US annual outlays, which once were five times that of the Soviets, were only about fifty percent greater in 1977."

The cost of US support activities during the ten-year period exceeded that of the Soviets by about a third when measured in dollar terms, the study showed. In the case of the US, "support activities accounted for almost fifty percent of cumulative defense outlays . . . while for the Soviets the share was about thirty-five percent."

Soviet military expenditures, according to estimates by the Defense Intelligence Agency (DIA), appear to absorb between fourteen and fifteen percent of that nation's gross national product (GNP). Economists of the CIA calculate a slightly smaller percentage, in the eleven-to-thirteen percent range. Either way, that value is at least twice, and possibly even three times, that of the US.

The disproportionately high Soviet defense spending —far in excess of what in Western perception would represent legitimate defensive capabilities—is, as USAF Chief of Staff Gen. David C. Jones points out, "not a crisis, but disquieting . . . for the 1980s, if the trend goes on."

Why the Soviet appetite for more and better weapons remains seemingly insatiable continues to baffle Western analysts, especially since the excessive growth is across the board and does not tilt consistently toward any particular area, such as strategic or tactical, offensive or defensive. Some US intelligence officials have sought to explain the high momentum of the Soviet arms race in terms of Russian historic experience: the not infrequent occurrence of numerically inferior but qualitatively superior invading forces defeating much larger Russian forces. Others reject this interpretation as a risky rationalization flawed logically because such a large share of the Soviet defense effort is devoted to offensive strategic forces. Moscow, both schools of thought agree, seems not troubled by the question that bedevils Washington, *i.e.*, "What is strategic superiority, and what do you do with it if you have it?"

Over the long run—considerations of geopolitical leverage aside—there is reason to fear that the totality of power that goes with military superiority in the nuclear age tends to corrupt. The temptation to brandish if not apply such omnipotence may be more than the future masters of the Kremlin might be able to resist, notwithstanding the fact that some Western ideologues are willing already to ascribe near-angelic traits to coming generations of the Soviet hierarchy.

It is fashionable also in some quarters to depreciate straightforward comparisons of US vs. Soviet military capabilities on grounds that such a narrow focus slants and blurs the real picture. The contention is that total power is a composite of economic, political, and moral factors, in addition to purely military strength. This proposition, too, is being questioned, particularly as it pertains to major crises. It can be argued that global strategic war as well as major theater wars—and their deterrence—will be decided probably by forces and capabilities in being and not the ability to mobilize industrial resources for which there may not be time and which may no longer exist.

Equally doubtful is the contention that the Soviet psyche is being traumatized by visions of deficiencies in the USSR's ideological, political, and economic posture vis-à-vis the rest of the world and thus is in need of military superiority as a psychological prop. The ideological and political track record of global communism would not seem to support any inferiority complex. It was Communist ideology and politics that triumphed in Southeast Asia, not Western democracy. It is "Eurocommunism"—whose polycentrist image is being cultivated carefully for vote-getting reasons but which hardly represents a refusal to march dutifully to the beat of the Kremlin's drummer—that disrupts NATO; there is no evidence of a "Eurodemocracy" endangering the USSR's imperial hegemony over the Warsaw Pact. Soviet influence in the so-called third world, in spite of some setbacks, is making headway. Soviet and Cuban interventionism in Africa, in particular, seems to have assured communism of enduring political leverage on that continent.

On balance, it probably is more prudent to determine US and Western defense needs primarily on the strength of Soviet military capabilities, and their growth trends, and to allow, only in a secondary sense, for perceived shifts in Soviet policy or the undisputed economic predominance of the West.

Prompt, Selectively Usable Force

Soviet nuclear strategy, from the beginning, has been contemptuous of the notion that the uniqueness of nuclear weapons has swept away the fundamental rules governing warfare in the past. The widely held US view that what matters is deterrence rather than the ability, *in extremis,* to fight and prevail in nuclear war has failed to find disciples in Moscow.

A recent study by the staff of the House Armed Services Committee at the behest of Rep. Samuel S. Stratton (D-N. Y.) concludes that the Soviets will soon achieve the capability of destroying the bulk of the US ICBM force in a first strike and that, concomitantly, by 1980 or 1981, the United States will have lost a credible ability to deter a first strike by the USSR. Specifically, the study concludes that by 1980 or 1981 "depending upon Soviet reentry vehicle [RV] warhead yield, twelve percent to sixty percent of the land-based USSR reentry vehicles could kill at least seventy-five percent of the US silos—790. This would leave thousands of RVs for other targets." Conversely, the study finds that "through 1980, if 4,285 US RVs (100 percent of the US land- and sea-based ballistic missile forces on alert) were dispatched against USSR silo targets, as many as fifteen percent—209 out of 1,300—Soviet silos would be destroyed."

SAC's Commander in Chief, Gen. Richard H. Ellis, disclosed recently that the Soviet Union's ICBM force, "the world's largest," has "one-third more missiles than ours, though it is presently armed with fewer warheads. The Soviets are now deploying three new ICBM systems at a rate of 100–150 per year and are developing four more ICBM models—a fifth generation. At the present rate, they can by 1985 place our own Minuteman missile force at considerable risk." This assessment parallels Secretary of Defense Harold Brown's view. He fears that the present generation of Soviet ICBMs—the SS-17s, SS-18s, and SS-19s—is "accurate enough to pose a substantial threat to our land-based ICBMs in the early 1980s." In his opinion, the fifth generation of Soviet ICBMs could "well . . . have more accuracy" than the most modern weapons now in the Soviet operational inventory.

Accuracy of the Soviet fourth-generation ICBMs, according to a recent congressional study, is thought to be

in the range of 1,500 to 1,200 feet. The latter figure approximates 0.2 nautical miles, and is at least twice as accurate as the preceding generation of SS-9 and SS-11 ICBMs.

Assessing Soviet ballistic missile accuracy—and the same conditions obtain presumably in the case of Moscow's estimates of US ICBM accuracies—is a matter of both art and science, involving some observable certainties and some conjecture. As a rule, the observer does not know what the other side is aiming at. But, by carefully and systematically observing flight characteristics of the weapon's post-boost vehicle—the so-called bus that dispatches the individual MIRVs to their targets—and of the RVs themselves, reasonably reliable conclusions about improvements from one RV type to another can be drawn. Put another way, the US can, within good confidence margins, establish that the accuracy of Soviet warheads has improved by some specific value even though the accuracy of the baseline remains largely a matter of projection.

The Soviet Union, presumably, gains important knowledge about the operational accuracy of its ICBMs from frequent test firings involving operational launch sites. Congress has not permitted such "operational test launches" of US ICBMs because of environmental and other reasons. A recent Congressional Budget Office study concluded that while US test firings from test silos in California toward Kwajalein atoll in the Pacific "may give weapons designers precise knowledge of the gravitational forces that this portion of the earth exerts on ballistic missile flight, they are not necessarily accurate indicators of how a missile fired over the Arctic at the Soviet Union would perform." It is especially noteworthy, therefore, that recently some Soviet test launches from operational silos have involved firings toward the Arctic, the direction an attack on the US would have to take.

If basic US assumptions about Soviet ballistic missile accuracy are indeed correct, it is likely that the predictable improvements of the now emerging fifth-generation systems will lead to accuracy comparable to that of the Minuteman III force. A January 1978 congressional report estimates Minuteman III accuracy at a CEP (circular error probable) of 700 feet, meaning that in terms of mathematical probability half of the RVs would strike within that distance from the aimpoint.

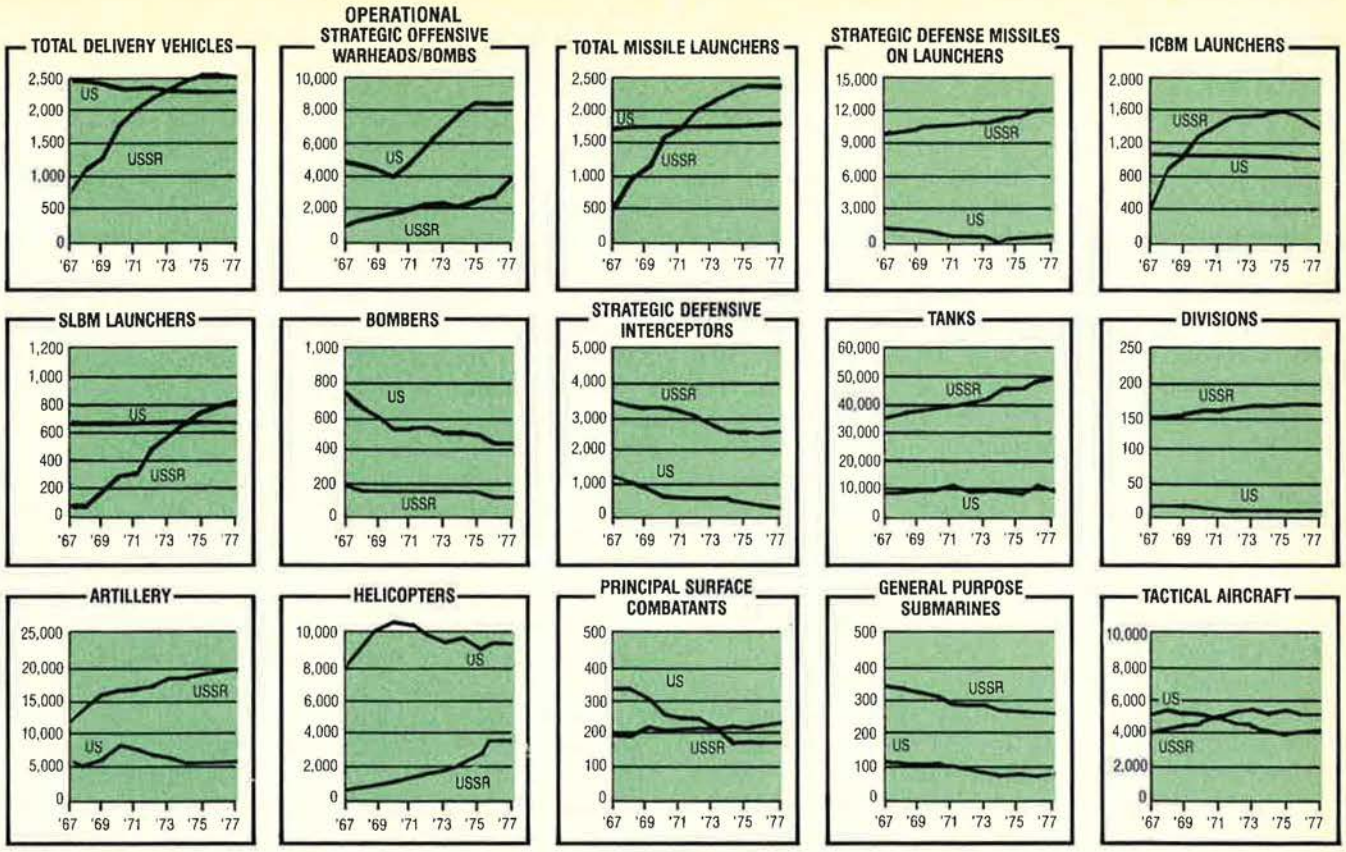
The fifth generation of Soviet ICBMs, AIR FORCE Magazine has learned, involves four completely new systems and a major but as yet not clearly understood modification of the mobile fourth-generation SS-X-16. Three of the new weapons appear to be successors to the SS-17, SS-18, and SS-19, respectively. The fourth, and most significant, development involves a medium-sized—the SS-17/SS-19 category—solid-fuel system. Soviet experience with solids, unlike that of the US which relies on that technology for the bulk of both its ICBMs and SLBMs, has not been good as exemplified by the SS-13 whose production was terminated after fewer than seventy missiles were deployed. The basic virtue of solids is greater readiness and operational flexibility.

Following the SS-13 experience, there was a hiatus in observable Soviet work on solids until the first test flight of the SS-X-16 about four years ago. But, for reasons that are not quite clear, that weapon—thought to be Minuteman sized and capable of both MIRVing and mobile deployment—has not yet entered the operational inventory. Since then another solid-fueled ballistic missile, the

US AND USSR STRATEGIC FORCE LEVELS

	JAN. 1, 1978		*END FY '78*	
	US	USSR	US	USSR
Offensive				
Operational ICBM Launchers [1, 2]	1,054	1,400+	1,054	1,400+
Operational SLBM Launchers [1, 2, 3]	656	900+	656	900+
Long-Range Bombers [4]				
Operational [5]	349	140	347	140
Others [6]	225	0	225	0
Variants [7]	0	120	0	120
Force Loadings [8] Weapons	9,000	4,000+	9,000	4,500
Defensive [9]				
Air Defense				
Surveillance Radars	57	6,500	57	6,500
Interceptors [10]	324	2,600	330	2,600
SAM Launchers [11]	–	10,000	–	10,000
ABM Defense				
Launchers [2]	–	64	–	64

[1] Includes on-line missile launchers as well as those in construction, overhaul, repair, conversion, and modernization.
[2] Does not include test and training launchers, but does include launchers at test sites that are thought to be part of the operational force.
[3] Includes launchers on all nuclear-powered submarines and, for the Soviets, operational launchers for modern SLBMs on G-class diesel submarines.
[4] Excludes, for the US: 3 B-1 prototypes and 68 FB-111s; for the USSR: Backfire.
[5] Includes deployed, strike-configured aircraft only.
[6] Includes, for US, B-52s used for RDT&E, other miscellaneous purposes, and those in reserve, mothballs, or storage.
[7] Includes, for USSR, Bison tankers, Bear ASW aircraft, and Bear reconnaissance aircraft. US tankers (641 KC-135s) do not use B-52 airframes and are not included.
[8] Total force loadings reflect those independently targetable weapons associated with the total operational ICBMs, SLBMs, and long-range bombers.
[9] Excludes radars and launchers at test sites or outside CONUS.
[10] These numbers represent Total Active Inventory (TAI).
[11] These launchers accommodate about 12,000 SAM interceptors. Some of the launchers have multiple rails.



Charts from the US Military Posture Statement for FY '79 reflect the latest information on numerical balances between the US and the USSR in terms of major strategic and general-purpose force weapon systems. Most trends favor the Soviets.

1,500-nautical-mile-range SS-N-X-17 submarine-launched ballistic missile (SLBM) has come along. It is interesting, though, that another new Soviet SLBM, the SS-N-X-18 with a range of up to 5,000 nautical miles, is a liquid-fueled system. The advent of the as yet unnamed new medium-size solid ICBM and of the SS-N-X-17, along with the modification of the SS-X-16, tend to indicate that Soviet confidence in that technology is now restored.

It may be tempting to speculate about Soviet preferences for either solid- or liquid-fueled ballistic and tactical rockets, and to theorize about shifts of emphasis between the two approaches. The bulk of the evidence, however, carries a far simpler message. Different design bureaus have been assigned different tasks, such as the development and refinement of propulsion systems using one form of fuel or another. The Soviets simply are willing to pay the price of exploring both approaches, presumably because both offer practical advantage.

The Strategic Imbalance

The massive Soviet drive toward new ICBMs of steadily improving accuracy is doubly alarming in light of other reasons: the relatively high yield of Soviet RVs—1.5 megaton for each of the eight warheads of the SS-18, and 0.8 megatons each for the six warheads of the SS-19, compared to 0.17 megatons for each of the three warheads of USAF's Minuteman III; the steadily increasing number of warheads; and the lag in US silo hardness compared to that of the new Soviet launchers. Congressional testimony indicates that silos housing the new family of Soviet ICBMs are hardened to 3,500 psi (pounds of pressure per square inch) while the so-called upgraded US silos—an authorized total of 850 out of 1,000—are hardened to between 1,000 and 2,000 psi, with 1,200 thought to be the average.

For these reasons, the recently completed House Armed Services Committee Staff study on US vs. Soviet Strategic Missile Counterforce Capability concludes that the US ICBM forces "are vulnerable at this time and they will become more vulnerable within the next four or five years as the accuracy of Soviet ICBMs improves. . . . Due to the high yields of Soviet missile warheads and the lack of sufficient hardening of the silos in the United States, the Soviet Union could put out of action a large fraction of all United States land-based ICBMs and still have a considerable percentage of its land-based missiles and all of its sea-based missile forces available for other targets."

The congressional study concludes, therefore, that the excessive imbalance in ICBM forces may soon enable the Soviets to attack the US ICBMs while entertaining the notion that the US—because of the USSR's large reserve forces—would not dare to retaliate with its remaining strategic forces. As Representative Stratton argued, under such circumstances, "a decision to launch American SLBMs would, as a practical matter, amount to a decision to wipe out our principal cities. Hence, any rational American leader would obviously think twice before launching these SLBMs. . . . With a vulnerable ICBM force and an SLBM force incapable of silo-busting [destroying hard targets], the United States would, in fact, not have a nuclear force capable of deterring a Soviet first strike."

The Congressional Budget Office, hardly harboring

alarmist views in defense matters, concluded in a recent report entitled "Counterforce Issues for the US Strategic Nuclear Forces," that the Soviet ICBM force—by 1985—could deploy 6,654 warheads with an aggregate yield of 7,131 megatons, compared to 2,154 US warheads and a yield of 1,216 megatons. The CBO report brought out also that the megatonnage carried by Soviet ICBMs will be more than twice the combined megatonnage carried by all US ICBMs, SLBMs, Air-Launched Cruise Missiles, and bombs carried by the B-52s and FB-111s. The CBO's estimate of US ICBM survivability in the mid-1980s is more sanguine than the House Armed Services Committee's prediction, but calculates nevertheless that with an assumed 1,200-foot CEP, the Soviet ICBMs could destroy about fifty-five percent of the US ICBMs. At least three basic Soviet counterforce strategies can be postulated, according to the CPO study:

- An attack on the US ICBM force designed to reduce US options in a limited nuclear war;
- An attack on US strategic forces designed to shift decisively the balance of nuclear power in favor of the Soviet Union;
- An attack on US strategic forces designed to limit damage to the Soviet Union in an all-out nuclear war.

Soviet aggregate strategic nuclear capabilities, according to General Ellis, "have increased roughly fivefold since 1964." In addition to the ICBMs and the SLBM force (*see p. 42*), SAC's Commander in Chief cited these highlights:

"The twin-engine supersonic Backfire bomber, capable of attack against the US, is now being deployed in operational units, and production continues at a rate of approximately two per month.

"The Soviet strategic equation also incorporates a Soviet civil defense program headed by a four-star Deputy Minister of Defense directing a full-time staff of more than 100,000; an extensive air defense system which includes some 12,000 surface-to-air missiles and 2,600 interceptor aircraft; and an operational antisatellite capability which could threaten our spaceborne warning, weather, and communications systems."

The Soviets, at present, are thought to have a force of about ten antisatellite weapons, called ASATs, in being. Their importance is major, especially if, as the US FY '79 Defense budget suggests, this nation's deterrence will have to place increasing reliance on warning. ASATs, not being direct ascent weapons, obviously will not be able to deny reasonably precise, short-term strategic warning of impending ballistic missile attacks owing to the redundancy of US systems. In the main, this means early warning satellites operating at such high altitudes that ASAT can't reach them. ASAT, on the other hand, presumably could put out of commission some of the small number of expensive intelligence and reconnaissance satellites that serve as the nation's eyes and ears in near-earth space. Activation of the Soviet civil defense apparatus, obviously a tell-tale sign of the Soviet leadership moving toward the brink, and other related warning signals could be picked up best and most rapidly—even though not exclusively—by satellites descending to lower altitudes.

Destruction of US intelligence satellites could impair this nation's powers of observation even though it is improbable that the Soviets could launch a surprise attack against US spacecraft. The advantage of limiting US warning capabilities by attacking one or more of its intelligence satellites—which of itself constitutes unambiguous warning and a serious provocation—is not clear to many US defense analysts. What is clear, however, is the need for US deterrence of ASAT by making the latter's use unattractive in the first place.

Soviet research and development work in ballistic missile defense (BMD) continues to increase and can be assumed to have reached a level where—in case of Soviet abrogation of the SALT I ABM treaty—a comprehensive BMD net of significant effectiveness could be activated in a relatively short period of time. The Soviet Galosh BMD system permitted under SALT—the US chose not to activate its 100 interceptor missile complex at Grand Forks, N. D.—already rings Moscow with sixty-four long-range, nuclear-armed interceptors and associated radar facilities to provide protection to the USSR's national leadership. The US Army's R&D in BMD is confined to two programs, one concentrating on advanced technology and the other on systems technology, to "avoid technological surprise by Soviet BMD developments" and to ensure "a US capability to respond" to the requirement for such defense capabilities.

A potentially important Soviet warning system is an OTH-B (over-the-horizon backscatter) radar system with installations in the Kuril Islands in the extreme eastern reaches of the USSR as well as in its westernmost European area. Because of the broad geographic spread and the resultant obtuse radar angle toward the polar region —the principal area of interest—the Soviet system seems to be relatively free from the disruptions caused by Northern Lights (aurora borealis). The US, lacking the Soviets' geographic advantages, meanwhile has deferred plans to deploy OTH-B. The importance of the Soviet system stems from the ability to detect aircraft and cruise missiles approaching the Soviet landmass from the polar region.

Conventional Capabilities in Europe

The NATO Defense Ministers noted at a recent meeting that ". . . the disparity in conventional military capabilities between NATO and the Warsaw Pact continues to widen . . . the [Pact's] ground forces have the capability to stage a major offensive in Europe without reinforcement." General Ellis feels that the growth in deployed Soviet ground forces "poses a real invasion threat to Western Europe." He cites these specifics:

"Their army has 300,000 more people now than it had in the early 1970s. It is very well equipped, with new tanks, new self-propelled long-range artillery, armored personnel carriers, ready to fight nuclear or conventional war and able to do so in a biological or chemical environment. . . . In tactical airpower, they have a modern capable force which exceeds ours in numbers of aircraft by about thirty percent. In Europe, they have in less than a decade turned a defensive tactical air capability into an offensive force capable of attacking any part of NATO/Europe."

Soviet production of fighters and fighter-bombers is excessive by any standard, with about 6,000 aircraft having been spewed out over the last six years. The present annual production rate is above 1,000 units and in-

volves seven different types of fighters. By way of a benchmark, Soviet production between 1977 and 1979 will equal the fighter inventory of USAFE, TAC's reinforcements, and the Allied forces of NATO's Central Region. Put another way, one week's production equals the authorized strength of a USAF fighter squadron.

Equally significant is the fact that the new aircraft average about three times the payload of Soviet aircraft coming off the production lines in the early 1970s. Many of them, such as Su-19 and MiG-27, are equipped with laser-guided weapons and other precision-guided munitions including TV- or laser-guided bombs as well as antiradar weapons for defense suppression. New air-to-ground weapons range from Fuel Air Explosives to the electro-optical-guided sixty-mile-plus range AS-10. Typical of the emphasis on long-range ground attack capability of new Soviet tactical aircraft is the Su-19 Fencer, a Mach 2.3 aircraft with a mission radius of 800 miles and a 5,500-pound ordnance load.

At least five of the new aircraft types—the MiG-21, MiG-23, Su-17, Su-19, and MiG-27—can carry nuclear weapons, thus further increasing the Warsaw Pact's already sizable theater nuclear capabilities residing in the Backfire and other bombers, and the new mobile, MIRVed IRBM (intermediate-range ballistic missile), the SS-20, which is being deployed in a broad belt spanning the Soviet Union.

Soviet Research and Development

Measured by any standard, the Soviet military R&D program is the largest in the world, exceeding that of the US probably by at least seventy-five percent. Compared to the US way of doing business, the Soviet style offers both pluses and minuses. Because of the Central Committee's unwavering, historic commitment to achieving military-technological superiority, funding, continuity of support, and resources allocation rank above the US experience. Further, as last year's Library of Congress study of US and Soviet military strength by John M. Collins points out, the extreme secrecy that shrouds Soviet R&D coupled with the willingness to pirate and plagiarize foreign technology enables the Kremlin to concentrate "on carefully chosen goals that simplify the search for superiority in selected areas."

Surreptitious science, on the other hand, stunts competition and the free exchange of ideas, both strong underpinnings of the way science and technology are being pursued in the US. In addition, as the Library of Congress study points out, "The United States starts with the world's richest reservoir of scientific resources. Constant feedback between civil and military markets encourages entrepreneurism and technological chain reactions not remotely equaled by our Russian rival." (*See the accompanying box from the Library of Congress report on where the two countries stand technologically.*)

An area of considerable concern is the continuing high level of effort devoted by the Soviet Union to high-energy physics, especially particle beam technology. Originally thought to involve charged particle beam research, the latest evidence suggests that the Soviets are concentrating on directed energy weapons technology involving electrically neutral particles, such as neutrons. While the payoff from such weapons—if they turn out to be feasible—could be revolutionary, US scientists believe that operational feasibility is uncertain and at best many years away.

SCORECARD ON THE TECHNOLOGICAL BALANCE

United States clearly superior	Soviet Union clearly superior
"Black box" electronics	Cast components
Computers	Commonality of components
Integrated circuits	Ease of maintenance
Microtechnology	High-pressure physics
Night vision	Magnetohydrodynamic power
Small turbofan engines	Rockets and ramjets
Space technology	Simple systems for common use
Submarine noise suppressants	Titanium fabrication
Target acquisition	Welding
Terrain-following radar	Air defense missiles
Aircraft	Antiship missiles
Air-to-air missiles	Armored fighting vehicles
Artillery ammunition	Artillery/rocket launchers
ECM, ECCM	Chemical/biological warfare
Look-down shoot-down systems	Cold weather equipment
Precision-guided munitions	Gas turbines for ships
Remotely piloted vehicles	ICBM payloads, yields
Strategic cruise missiles	Mobile ballistic missiles
Survivable submarines	Ship size vs. firepower
Status uncertain	Tactical bridging
Acoustics	**Soviets closing the gap**
Adaptive optics	Aerodynamics
High-explosive chemistry	Composite materials
Inductive storage and switching systems for pulsed power control	Inertial instrumentation
Reduced drag for submarines	MIRVs
Antiballistic missiles	Missile accuracy
Antisubmarine warfare	Satellite sensors
High-energy lasers	Tactical nuclear systems
Satellite-borne radars	

Adding up the scorecard of the US/USSR politico-military balance must, by necessity, make allowance for the goals and the national will of the two superpowers. This conclusion, drawn by the Atlantic Council's policy paper on "The Growing Dimensions of Security," is instructive:

"The Soviet Union, both in its weapons programs and in its stance in arms-control talks, seems bent on obtaining and retaining advantages over the West. While the West would be content with arms control arrangements which produced rough parity and stability so that mutual deterrence would result, Moscow speaks and at times acts the part of a State determined to obtain superiority, with all the opportunities for initiatives that would afford. . . . The West must view the possibilities of Soviet 'superiority' in conjunction with the basic Marxist tenet of the ultimate worldwide victory of communism and the obligation of the USSR to expedite its triumph. Apart from the nightmare possibilities of nuclear warfare, the political and psychological consequences of clear Soviet 'superiority' would be devastating on the morale of the American people and their allies."

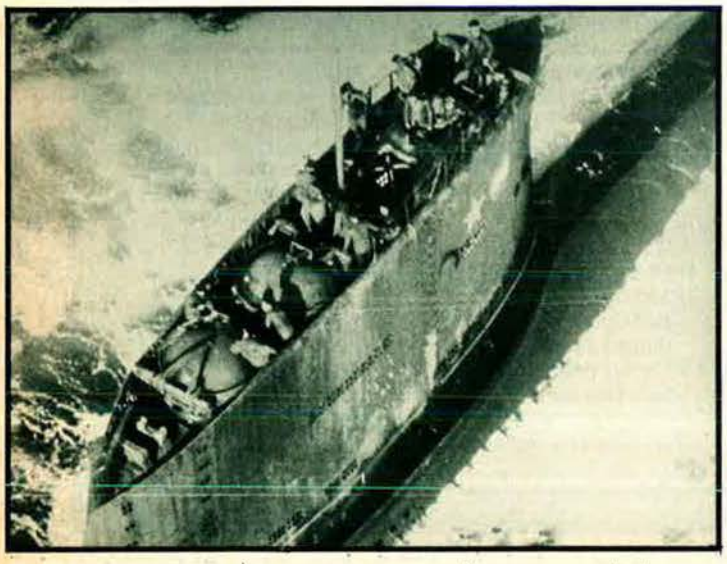
Sustained Western resolve would seem vital to keep the "nightmare" of Soviet superiority from becoming reality. ■

Soviet Aerospace Almanac

The USSR has more than sixty modern ballistic missile submarines—some fitted with 4,200-nm missiles—compared to the US Navy's forty-one. A powerful element of Soviet strategic aerospace power thus resides in . . .

THE SOVIET SLBM FORCE

BY NORMAN POLMAR



In the 1950s, several Zulu-class submarines were modified to carry two ballistic missiles in their "sails."

THE MOST surprising development in US-Soviet strategic arms competition probably has been the Soviet creation of a large, modern, submarine-launched ballistic missile (SLBM) force.

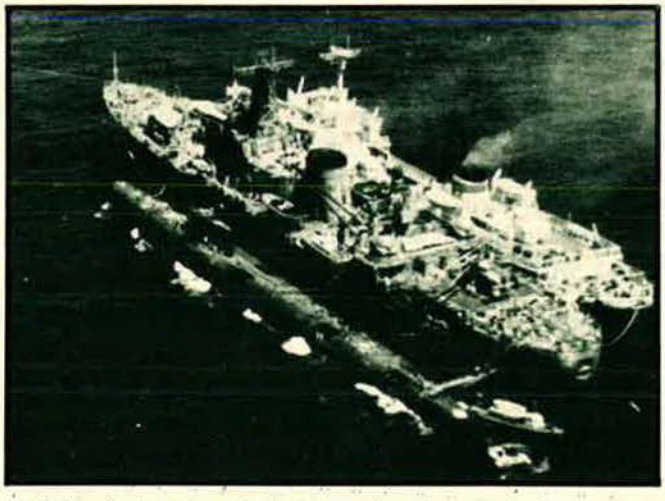
After the Cuban missile crisis of 1962 and the subsequent fall of Nikita Khrushchev, the Soviet Union embarked on a massive land-based ICBM program that has resulted in overwhelming Soviet superiority in missiles and megatonnage over the US Minuteman/Titan force. But the Soviet lag in nuclear submarine development, problems with existing Soviet submarines, US breakthroughs in solid-propellant missiles and small nuclear warheads, and other factors led to predictions that the Soviets would not attempt to deploy a modern SLBM force.

Both the United States and Soviet Union had acquired German missile technology after World War II. During the war the German Navy had experimented with firing short-range rockets from submerged submarines and launching V-2 missiles from cannisters towed behind submarines.

Building on those efforts, the US and Soviet navies began developing guided or cruise missiles for submarine launching. The US Navy's subsonic, 575-mile-range Regulus I became operational in 1955. From 1960 to 1964, the Navy had five submarines, carrying a total of seventeen Regulus missiles, that were deployed on rotation in the Western Pacific, their nuclear-tipped missiles targeted against objectives in Soviet Siberia. The Regulus I and follow-on submarine cruise missile programs were canceled because of the success of the Polaris SLBM.

A similar Soviet submarine-launched cruise missile program resulted in sixty-two submarines—thirty-four with nuclear propulsion—armed with the Shaddock missile. Capable of strikes against surface ships or, in some versions, against shore targets, the Shaddock carries a 2,000-pound conventional or nuclear warhead. Its effective range is about 250 nautical miles against ships or 400 to 500 miles against shore targets.

However, the Soviet Navy was alone in the early 1950s in initiating development of submarine-launched ballistic missiles. The Red Navy first adopted the Army's land-launched Scud battlefield missile for submarine use. A diesel-propelled, torpedo-armed submarine of the Zulu class was apparently converted during construction to carry two Scud missiles in the superstructure or "sail." (Soviet submarine classes are assigned code letter designations by the NATO-US intelligence community. Generally, the phonetic word for the letter is used in reference to the class.)



An Echo-class cruise missile submarine photographed by the US Navy near the Cape Verde Islands.

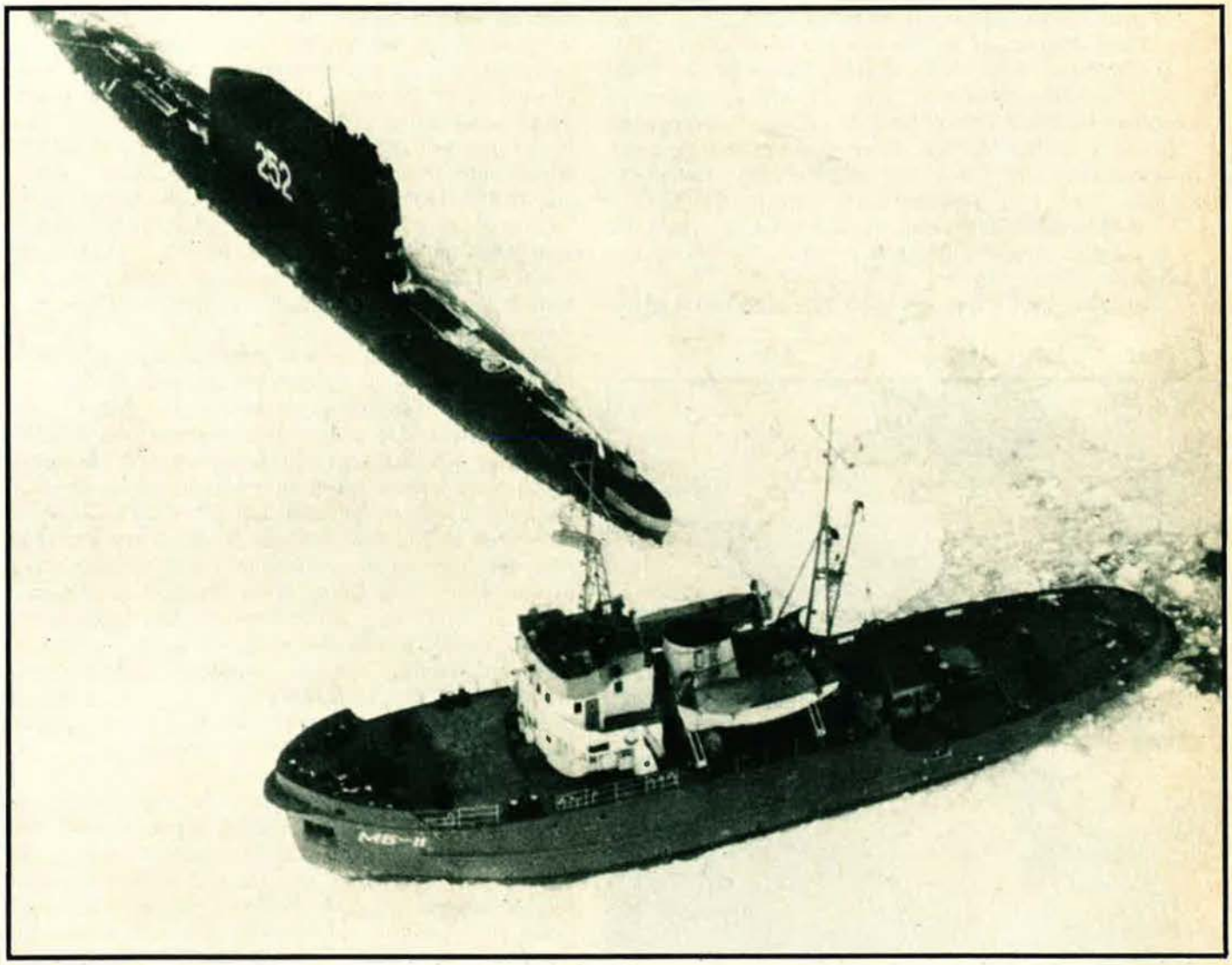
The thirty-five-foot Scud missile is liquid fueled. Early versions had a range of some eighty miles, and carried a small nuclear warhead. In September 1955, a Zulu fired a Scud in the world's first launch of a ballistic missile from a submarine. This predated the first ballistic missile launch from a US submarine by almost five years.

The Soviets completed six Zulu-class ballistic missile submarines by 1959, equipped to carry an improved Scud-type weapon, the SS-N-4 Sark missile. (In NATO-US missile designations, "SS" indicates surface-to-surface [or subsurface-to-surface], "N" indicates naval use, and the number indicates the missile sequence. Surface-to-surface missiles have names beginning with the letter "S.") More significantly, the Soviets began to build large numbers of diesel-powered Golf- and nuclear-powered Hotel-class submarines designed specifically to fire SLBMs.

vice in 1959 *(see also the article beginning on p. 49).*

Apparently, the newly formed SRF was given the strategic attack mission along with Long-Range Aviation, the Soviet Air Forces' strategic bomber force. The Navy was ousted from the strategic role; the diesel-propelled Golf-class program was stopped at twenty-three submarines (with components for another given to Red China), and the nuclear-propelled Hotel class was cut to only eight subs. By comparison, twenty-nine of the contemporary Echo II-class nuclear cruise missile subs were built.

Although the Hotels and most of the Golfs were later fitted with the improved SS-N-5 Serb missile, the development of SLBM submarines and submarine-launched missiles halted. (The original SS-N-4 missile was surface-launched; the SS-N-5 and later Soviet SLBMs are underwater-launched, as are all US Navy SLBMs.) Without the strategic attack role, the Soviet Navy's overall priorities and funding were reduced.



This diesel-powered Golf-class ballistic missile submarine was caught in an ice floe in the Sea of Okhotsk.

But the Soviet efforts to develop a sea-based strategic strike force were halted by 1960, eclipsed by progress in land-based ICBMs. The Soviet missile program had reached a milestone on August 3, 1957, with the first successful test firing of an ICBM by any nation. Production of these missiles was ordered, and the Strategic Rocket Forces (SRF) was established as a separate ser-

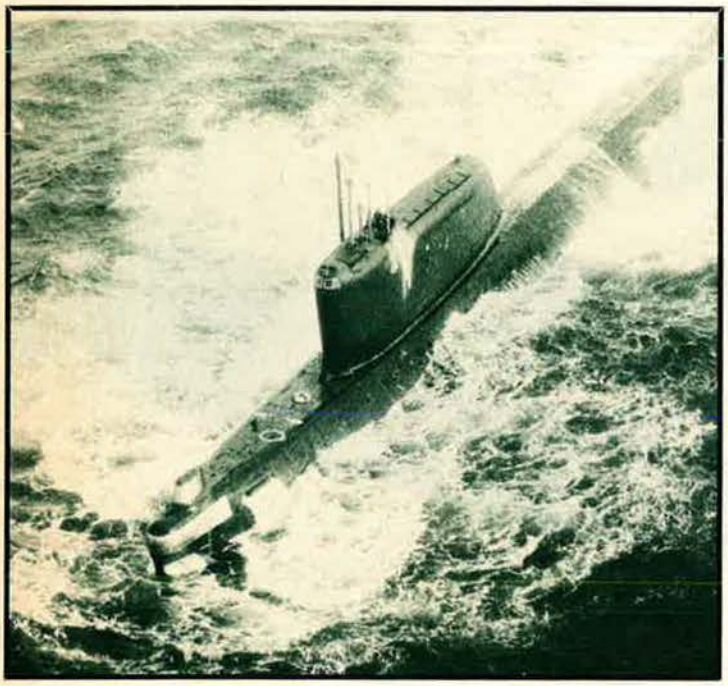
Polaris and a Revived Soviet Program

As the Soviet SLBM program was brought to a halt, the United States accelerated its efforts in that field, and

gained a seemingly insurmountable lead in sea-based strategic weapons. In the mid-1950s, the Navy had been directed by Secretary of Defense Charles Wilson to join the Army's Jupiter IRBM development program with a goal of possibly deploying that liquid-fueled missile aboard *surface* ships. The size of the missile (forty-four feet long and weighing 160,000 pounds) and its highly volatile liquid fuel would pose too many problems for submarine use. But Soviet space and missile developments soon brought pressure for an increased Navy effort. At the same time, the development of solid propellants and smaller nuclear warheads gave promise of Fleet Ballistic Missiles (FBMs)—IRBMs fired from submarines. Interestingly, the Navy's leadership strongly opposed an SLBM program. The Army-Air Force debate over strategic missiles brought to the fore memories of the B-36 vs. supercarrier battles and debates over missions of the late 1940s, in which the Navy had suffered brutal defeat.

Three factors led to the decision to have an FBM/SLBM force: First, Adm. Arleigh Burke became Chief of Naval Operations in 1956. A young, aggressive, ordnance-trained officer, he soon became a strong supporter of the SLBM. Next, Soviet space and missile developments led the Eisenhower and Kennedy Administrations to seek other types of strategic weapons in addition to land-based missiles and manned bombers. Third, the solid-fueled missile with a small warhead became technically possible.

On New Year's Day 1957, the Polaris SLBM program



The first nuclear-powered Soviet submarine built to carry ballistic missiles was the Hotel class, shown here.

was established, and only two and a half years later the USS *George Washington* was launched. The "GW" was the world's first "modern" ballistic missile submarine. It was nuclear-propelled and carried sixteen missiles, initially with a range of 1,200 nautical miles. In contrast, the contemporary Soviet Hotel-class nuclear submarine carried only three SS-N-4 Sark missiles with a range of about 350 nautical miles, had inferior navigation accuracy, and lacked many other advanced systems found in the US submarine.

Forty-one Polaris submarines were launched through 1966, a building rate of almost six per year. These submarines displaced more than any submarine built previously by any nation. Before the last Polaris submarine was finished, improved missiles were being fitted to the subs. Those forty-one submarines carried a total of 656 missiles.

This force was highly survivable as the submarines prowled the depths. The subs, which were immune to preemptive attack and even to significant attrition, represented a US strategic capability which, it was believed, could never be equaled or countered by the Soviet Union.

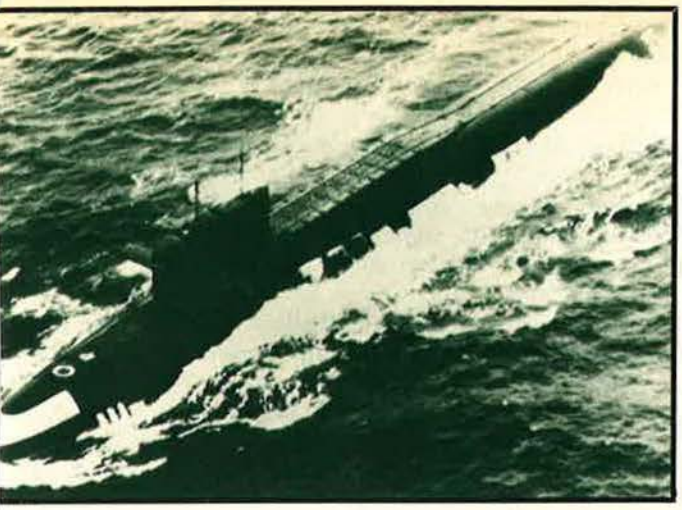
All calculations of strategic balance were destroyed after the Cuban missile crisis of 1962 and the resulting ouster of Nikita Khrushchev from the Soviet leadership two years later. By deploying missiles in Cuba, the Soviets had attempted to redress the strategic imbalance caused by the qualitative and quantitative shortfalls of their ICBM program, the limited capabilities of Soviet ballistic missile submarines, and US basing of manned bombers and IRBMs in several nations around the Soviet Union.

This situation, coupled with the massive US Minuteman ICBM and Polaris SLBM programs, as well as the Soviet perception that America would produce the B-70 bomber and Skybolt air-launched ballistic missile, led to a major acceleration of Soviet strategic efforts. There was a rapid development of new strategic defense forces—both antibomber and antimissile—and new ICBMs, surpassing the United States in numbers of ICBMs in 1969.

On the naval side, construction of a new class of ballistic missile submarine was given top priority. Obviously, Soviet Navy interest and some research and development had continued after the naval strategic attack mission was preempted by the new Strategic Rocket Forces in 1959. Although large missile submarines could be built in two to four years from laying down the keel or first steel plates to completion, another two to four years before that are needed for detailed designs to be drawn up, subsystems developed, components ordered, shipyard preparations made, etc. Thus, drawing on some work already under way, the Soviets decided, about 1962, to construct the so-called Yankee class of Soviet ballistic missile submarines.

The first Yankee was completed in 1967 and became operational in 1968. The submarine displaces some 7,000 tons, is 428 feet long, nuclear-propelled, and carries sixteen ballistic missiles. In size and configuration the Yankee resembles the US Polaris/Poseidon submarines. There are significant internal differences, however. The Soviet subs have a more powerful nuclear plant, producing some 60,000 horsepower, compared to 15,000 in US subs, and hence higher speeds. Soviet hull design techniques probably make possible a greater operating depth, but US subs are believed to have better navigation equipment and improved habitability, and are quieter.

The Yankee initially carried the SS-N-6 ballistic missile. This weapon has a range of some 1,300 nautical miles, similar to the initial Polaris A-1, and carries a warhead with a comparable yield of about one megaton.



The Yankee-class nuclear-powered SSBN became operational in 1968. The Soviet Navy now has thirty-four of them.

Soviet shipyards at Severodvinsk on the frigid White Sea and at Komsomolsk in Siberia produced thirty-four Yankee-class submarines in six years, a rate close to the US Polaris effort of a few years earlier. But the US Polaris program had stopped with forty-one submarines; after completing thirty-four Yankees, the two Soviet shipyards turned immediately to the larger, more-capable Delta-class ballistic missile submarines. (In addition to forty-one US missile submarines in service, the British Navy operates four and the French Navy five.)

The Delta I, the first of which was completed in 1973, was essentially an elongated Yankee. At 450 feet and some 9,000 tons, the Delta I is larger than any previous submarine except the one-of-a-kind US nuclear sub *Triton,* which has been laid up in reserve for the past few years.

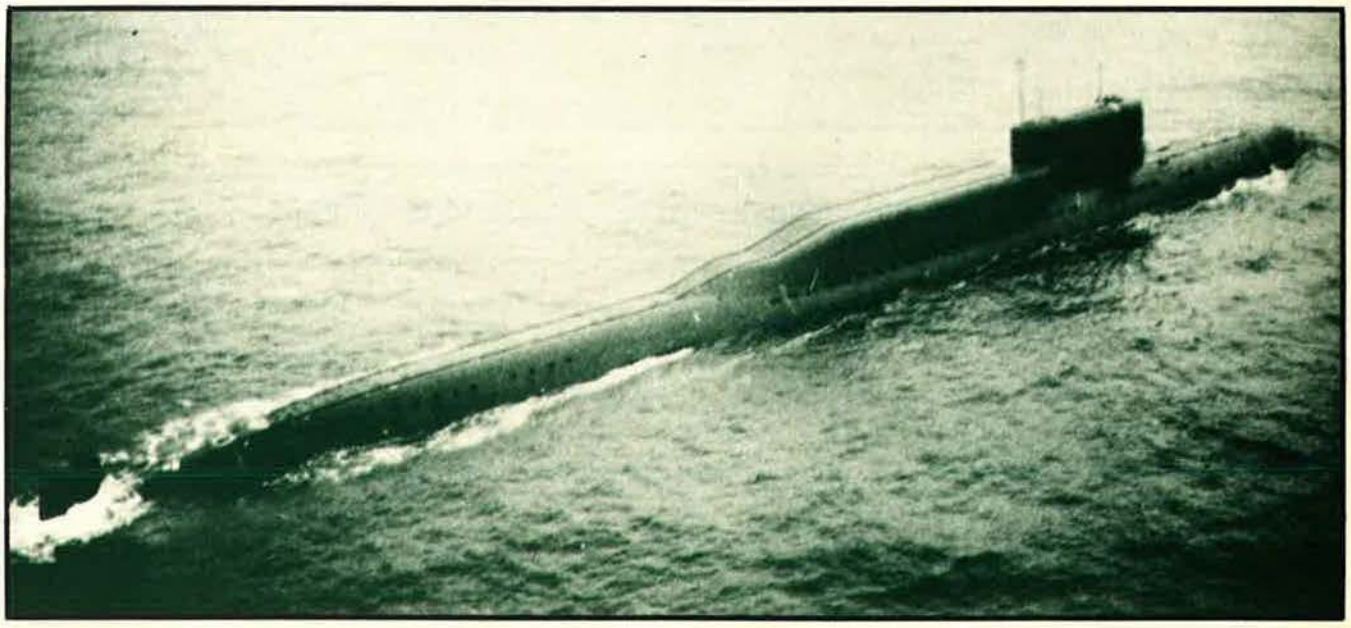
However, though the previous Yankee class and all Western ballistic missile submarines carry sixteen missiles, the Delta I has only twelve SLBM tubes. But the initial Delta missile was the SS-N-8 with an estimated range of at least 4,200 nautical miles carrying a warhead of about one megaton. This is the longest range of any operational SLBM. In comparison, the latest Polaris missile, the A-3 variant, has a range of 2,500 nautical miles, while the later Poseidon, with a MIRV warhead, has a nominal range of some 2,000 to 2,500 miles.

Missile Progress

The significance of a Soviet SLBM with a range of 4,200 nautical miles is considerable. From the late 1940s, US naval strategists had planned to intercept Soviet submarines deploying into the oceans as they passed through the NATO-controlled straits at the exits of the Baltic Sea and the Black Sea; the narrow exits from the Sea of Japan, where the major Siberian port of Vladivostok is located; and the Greenland-Iceland-United Kingdom (GIUK) gap exit from Soviet Arctic ports. For the past decade essentially all Soviet nuclear submarines, including all with SLBMs, have been based in the Arctic and at Petropavlovsk in Siberia. The latter port has open access to the Pacific Ocean without passage through straits.

The Delta-class submarines with a 4,200-nautical-mile missile need not transit the GIUK gap to target American cities. Rather, the Deltas can launch SS-N-8 missiles from the relative security of Soviet coastal waters in the Arctic and strike targets throughout the United States except for portions of the southernmost states. A Pacific-based Delta, only a few miles off Petropavlovsk, can target United States territory in an arc running from southern California up through the Great Lakes.

Thus, Soviet ballistic missile submarines could effectively strike the United States without leaving Soviet coastal waters, where they can be easily defended by land-based aircraft and Navy coastal forces. This missile range should be considered in relation to certain geographic asymmetries that favor the Soviet Union. For example, Moscow is located more than 1,000 miles inland from the closest sea areas (the Norwegian and Barents Seas), while Washington is only 100 miles from the Atlantic



Newest of the operational Soviet SSBNs is the Delta class. This Delta I carries twelve SS-N-8 missiles.

coast. Similarly, much of the Soviet industrial base is located far inland, within and east of the Ural Mountains, while American industry is heavily concentrated along the coasts.

In addition to superior range, other technological advances now have been made in Soviet SLBMs. In 1975, the Soviets began flight tests of the SS-NX-17, the first Soviet SLBM with a solid propellant and a post-boost vehicle (PBV) to deploy multiple reentry vehicles (MRVs). Later that year, tests of still another new SLBM, the SS-NX-18, began. This missile, with more sophisticated guidance, is capable of carrying multiple independently targetable reentry vehicles (MIRVs). The SS-NX-17 appears to be a replacement for the SS-N-6 in the Yankee-class submarines and the SS-NX-18 as the successor to the SS-N-8 in the Delta classes.

The US Navy had first deployed solid-fuel missiles with the Polaris A-1 in 1960. MRVs were introduced with the Polaris A-3 in 1964, and MIRVs with the Poseidon in 1971.

Advanced Submarines

The Soviet SLBM force equaled the US Polaris/Poseidon force in numbers of missile tubes in 1974. The US force remained steady at 656 missiles, but Soviet construction of the Delta class continued at the rate of about six submarines a year.

After an estimated fourteen Delta I submarines were completed, an enlarged Delta II began emerging from the Soviet shipyards. This submarine is 500 feet long, displaces almost 10,000 tons, and has tubes for sixteen SS-N-8/18 missiles. Subsequently, a Delta III class has been identified. This submarine has been unofficially reported as having sixteen tubes for the SS-NX-18 or a still later missile.

Less clear is the status of a possibly later Soviet ballistic missile submarine, thought to be significantly larger than the Delta classes, which the Soviets have referred to as the "Typhoon." It is not definitely known to be under construction. However, the sustained Soviet SLBM effort of more than a decade, the continued increases in Soviet submarine construction capabilities, and the intensive missile development program all point to continued modernization and expansion of the SLBM force.

Emphasis on the SLBM force reflects the Soviet Navy's basic mission of the "battle against the shore." Admiral of the Fleet of the Soviet Union S. G. Gorshkov, the long-serving head of the Soviet Navy, has written that:

> In our day, a navy operating against the shore possessed the capability . . . of directly affecting the course and

SOVIET-US MISSILE-CARRYING SUBMARINE FORCE

Number	Class	IOC	Propulsion	Missiles
9	Golf I	1958	diesel	3 SS-N-4
13	Golf II*		diesel	3 SS-N-5
7	Hotel II*	1960	nuclear	3 SS-N-5
1	Hotel III*		nuclear	6 SS-N-8
34	Yankee	1968	nuclear	16 SS-N-6/17
14	Delta I	1973	nuclear	12 SS-N-8
12+	Delta II	1976	nuclear	16 SS-N-8
	Delta III		nuclear	16 SS-NX-18
5	*George Washington*	1960	nuclear	16 Polaris A-3
5	*Ethan Allen*	1961	nuclear	16 Polaris A-3
31	*Lafayette*	1963	nuclear	16 Poseidon

*Conversions from earlier versions of the same type

SOVIET-US SUBMARINE-LAUNCHED BALLISTIC MISSILES

Missile	IOC	Submarines	Fuel	Length (ft.)	Range (n.m.)	Warhead
SS-N-4 Sark	1958	Golf I	liquid	about 43	350	1 RV about 1 MT
SS-N-5 Serb	1963	Golf II, Hotel II	liquid	about 43	700	1 RV about 1 MT
SS-N-6 Mod 1	1968	Yankee	liquid	about 33	1,300	1 RV about 1 MT
SS-N-6 Mod 2	1973	Yankee	liquid	about 33	1,600	1 RV about 1 MT
SS-N-6 Mod 3	1973	Yankee	liquid	about 33	1,600	2–3 MRVs
SS-N-8	1973	Hotel III, Delta I/II	liquid	43	4,200	1 RV about 1 MT
SS-NX-17		Yankee	solid	about 35		MIRVs?
SS-NX-18		Delta	liquid	about 45	4,000+	3 MIRVs?
Polaris A-3	1964	*George Washington* *Ethan Allen*	solid	32	2,500	3 MRVs 200 KT each
Poseidon C-3	1971	*Lafayette*	solid	34	2,000–2,500	about 10 MIRVs 40 KT each
Trident I (C-4)	1980	*Ohio*	solid	34.5	about 4,000	about 10 MIRVs 100 KT each

Norman Polmar is an analyst specializing in aviation and maritime affairs. From 1966–77, he was editor of the US section of the annual, Jane's Fighting Ships, *and is the author of* World Combat Aircraft Directory *(Doubleday & Co.),* Strategic Weapons: An Introduction *(Crane, Russak & Co.), and* Guide to the Soviet Navy *(US Naval Institute Press). Mr. Polmar has visited the USSR as a guest of the Soviet Navy and of the Soviet Institute of US Studies.*

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even the outcome of the war. In this connection, naval operations against the shore have assumed dominant importance in naval warfare, and both the technical policy of building a navy and the development of the art of naval warfare have been subordinated to them.

Since January 1956, Admiral Gorshkov has been Commander in Chief of the Soviet Navy and a deputy minister of defense. These positions correspond roughly to those of US Chief of Naval Operations and Secretary of the Navy, respectively.)

This emphasis has given the Soviet Navy a current SLBM force of some ninety ballistic missile submarines carrying more than 950 missiles (*see table*). The Golf class (some of which are in the Baltic Sea) and Hotel class should be considered "theater" nuclear systems, with the lone Hotel III employed as a test submarine for the SS-N-8 and possibly SS-NX-18 missiles.

Still, these submarines can strike US and NATO targets in Europe in the same manner that the United States must allocate ICBMs and SLBMs to Soviet targets in Eastern Europe. And the Golfs have operated in the Caribbean, as have Shaddock cruise missile submarines. Also, some Golfs are reportedly being fitted with later missiles, probably the SS-N-6 or SS-N-8.

Of the total Soviet SLBM force, more than sixty are modern, nuclear-propelled ballistic missile submarines with approximately 870 missiles. This compares to a US force of forty-one submarines with 656 Polaris/Poseidon missiles *(see table).*

In 1980 at the earliest, the US Navy's first Trident ballistic missile submarine will become operational. This giant undersea craft, displacing more than 18,000 tons and 560 feet long, will carry twenty-four Trident I missiles with a range of some 4,000 nautical miles. (About ten of these submarines will be completed over a seven- or eight-year period.) Thus, when the first Trident is delivered, the US Navy will have forty-two ballistic missile submarines, assuming no retirements of older subs. At current construction rates, the Soviet Navy could then have on the order of seventy-five modern nuclear ballistic missile submarines, carrying more missiles, with greater ranges, and greater throw-weights than the US SLBM force. Only in numbers of reentry vehicles will the US SLBM force have a significant advantage. That advantage could be lost in the 1980s if the Soviets pursue MIRV development, in view of the greater throw-weight of their submarine missiles.

Operational Asymmetries

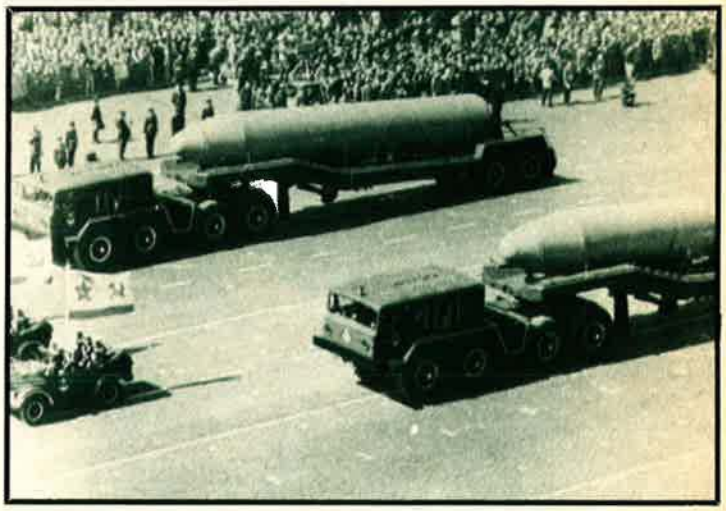
The Soviet SLBM force is operated quite differently from its US counterpart. All US missile submarines are manned by two full crews that alternate sixty-day deterrent patrols in forward areas (*i.e.,* within missile range of the USSR). While one crew (the Blue or Gold) is at sea, the other is on leave, in training, or in transit to and from forward submarine bases. After a sixty-day patrol the submarine comes alongside a tender for a fifteen-day "upkeep" and replenishment, and the Blue and Gold crews are rotated. A few other submarines are always in overhaul; hence, the at-sea rate of just over fifty percent or twenty-plus submarines.

The Soviets appear to maintain only a few of their modern ballistic missile submarines at sea, generally a few Yankees in the mid-Atlantic and a few in the mid-Pacific. This utilization rate is far below that of US submarines. A larger number could "surge" to sea in a crisis, for a limited time. Of course, the Delta classes, with very long-range SLBMs, need not steam very far to be able to target the entire United States.

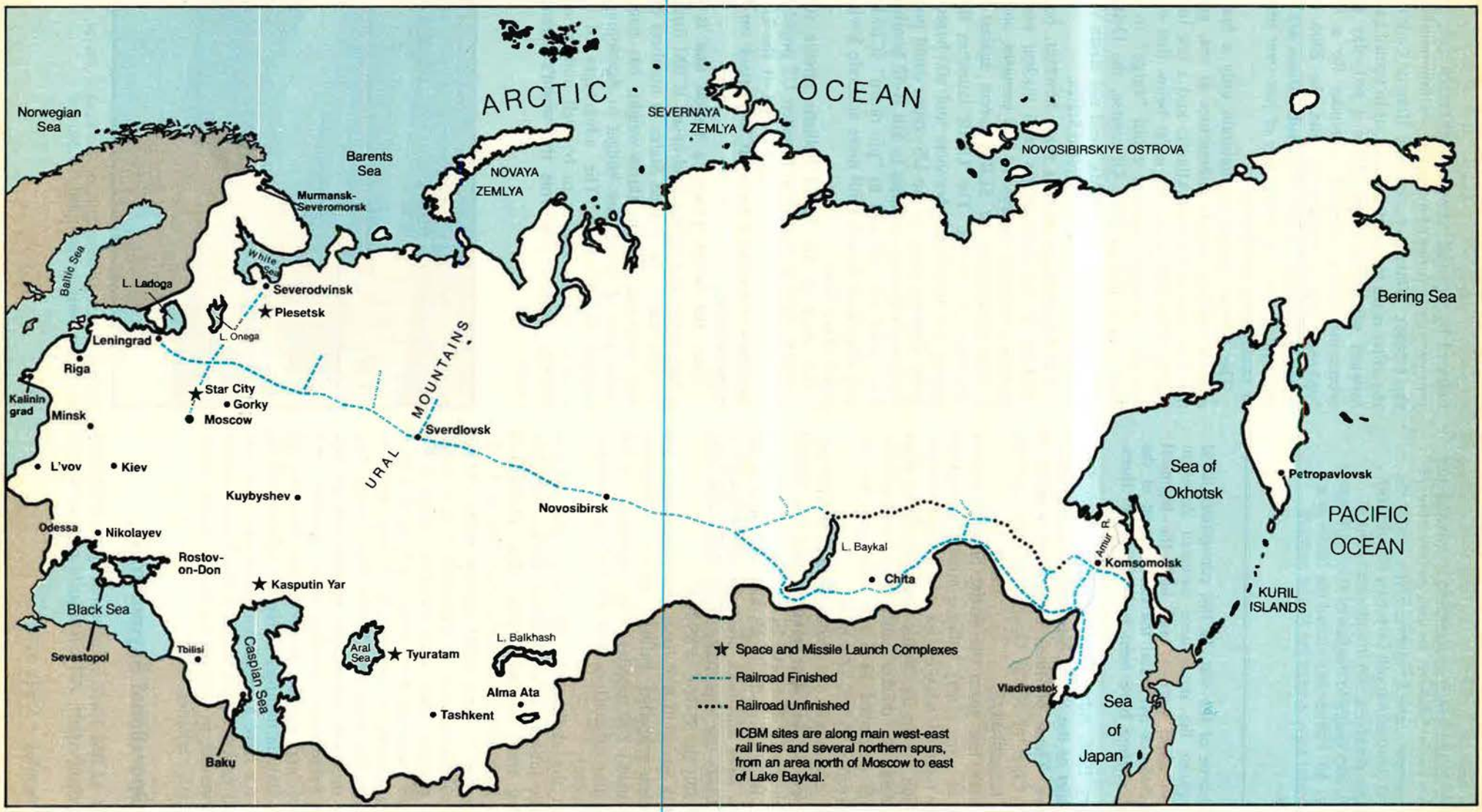
The longer-range missiles may, however, be partially withheld in the early stages of a nuclear exchange to provide a strategic reserve. In this scenario, one assumes a high survivability of SLBM forces against opposing antisubmarine forces. The USSR launches its ICBMs against US land-based bombers and silo-based ICBMs. Some Yankees close to the US coasts could possibly fire depressed-trajectory missiles to kill B-52 bombers before they could take off and to "pin down" ICBMs in silos and delay their launch until more accurate Soviet ICBMs could strike them.

But most of the Soviet ballistic missile submarines would be held in reserve to threaten US population centers and industry in a second round, if the US did not capitulate following a Soviet ICBM attack on US land-based missiles.

Thus, the Soviet Union, a nation that is primarily a land power and with a land-based ICBM force that far exceeds that of the United States in numbers of missiles and warheads, and in throw-weight, has committed a major part of its defense budget to developing a large, modern SLBM force. The advantages of sea-based weapon systems appear to be well understood by the Kremlin leaders, who rule the world's foremost land power. ■



SS-N-6 SLBMs parading through Red Square. Range, depending on modifications, is from 1,300 to 1,600 nm.


ARCTIC OCEAN
Norwegian Sea
Barents Sea
SEVERNAYA ZEMLYA
NOVOSIBIRSKIYE OSTROVA
NOVAYA ZEMLYA
Murmansk-Severomorsk
Baltic Sea
White Sea
L. Ladoga
Severodvinsk
Plesetsk
L. Onega
Leningrad
Riga
Kalinin grad
Minsk
Star City
Gorky
Moscow
URAL MOUNTAINS
Sverdlovsk
L'vov
Kiev
Kuybyshev
Novosibirsk
Odessa
Nikolayev
Rostov-on-Don
Kasputin Yar
Black Sea
Sevastopol
Tbilisi
Caspian Sea
Aral Sea
Tyuratam
L. Balkhash
Alma Ata
Tashkent
Baku
L. Baykal
Chita
Amur R.
Komsomolsk
Vladivostok
Sea of Okhotsk
Petropavlovsk
PACIFIC OCEAN
KURIL ISLANDS
Bering Sea
Sea of Japan
Space and Missile Launch Complexes
Railroad Finished
Railroad Unfinished
ICBM sites are along main west-east rail lines and several northern spurs, from an area north of Moscow to east of Lake Baykal.

Soviet Aerospace Almanac

All Soviet land-launched ballistic missiles are assigned to the Strategic Rocket Forces, which exceed the US ICBM force in numbers, throw-weight, and probably survivability. The Kremlin sees in its . . .

SOVIET ROCKET FORCES: MILITARY CAPABILITY, POLITICAL UTILITY

BY COLIN S. GRAY

The Strategic Rocket Forces, which have most fully absorbed the achievements of modern scientific-technological progress, comprise the basis for the combat might of the Soviet Armed Forces.

—Marshal A. A. Grechko
The Armed Forces of the Soviet State

NAPOLEON said that you can do anything with bayonets except sit on them. Contemporary critics of strategic weapon programs claim that you can do nothing with ICBMs *except* sit on them. Unfortunately, the Soviet Strategic Rocket Forces, SRF (*Raketnye Voiska Strategicheskogo Nazacheniya*), or Rocket Troops of Strategic Designation, under the command of Army General V. F. Tolubko, are evolving under the aegis of a fairly clear concept of military utility for political utility.

Some of the analysis and conclusions in this article may appear controversial at first glance. However, Soviet behavior strongly suggests that the Soviet Union is seeking strategic superiority (in vital, though not exclusive, part reposing in superior strategic weapon capability) which it deems politically useful.

Our experience of Soviet attitudes includes Soviet negotiating performance in SALT over eight years; the character, scale, and diversity of Soviet strategic weapon programs; our observations of Soviet strategic weapon research and development activity; stated Soviet strategic doctrine; our understanding of political-military relations in the Soviet Union; our knowledge of the standard practices of Soviet defense industry and how they relate to doctrine and policy; and the consequences for present and future Soviet policy of the Soviets' interpretation of their past. The thesis consistent with the evidence is that the Soviet Union is determined to attempt to secure strategic superiority.

The Soviet Union quite sensibly adheres to a balanced, combined arms, approach to politico-military problems. The SRF, for all its impressive technical achievements, derives much of its political clout from the combat capability of the other armed services. Thus, circumstances of threatened or actual escalation to strategic nuclear use should be determined by the relative competence of the Soviet Ground and Air Forces. In Soviet perspective, the SRF is not *a deterrent,* as opposed to a *war-fighting force.* Notwithstanding the thin and occasional evidence of deviant Soviet opinion, Soviet thinking on military power today does not draw the kind of implicit (and even sometimes explicit) distinction between *usable* and *unusable* weapons that permeates Western theorizing and policy. In the traditional and still massively dominant Soviet view, war waging, at all levels, is to be taken seriously. Deterrent effect flows from anticipated war-waging competence, and war, at any level, can and should be won.

There is strong evidence that the Soviet defense community approaches the military problems of the SRF much as it approaches the problems of the other armed services. The SRF is considered a war-fighting instrument. There is no Soviet equivalent of the Western concept that strategic weapons which have to be used have failed in their mission.

The SRF: Industrial Infrastructure

The creation of the SRF in 1959, its elevation to the rank of a separate service on May 7, 1960, and then to the position of senior armed service, all expressed Nikita Khrushchev's fascination with the military-technical revolution and his view that nuclear-missile forces would dominate future wars. The SRF has responsibility for all land-based ballistic missiles with ranges greater than 1,000 kilometers (620 miles). It is believed to have close to 390,000 active-duty military personnel, 50,000 civilians, and a ready reserve of some 520,000. General Tolubko, in common with the heads of the other armed services, is a deputy defense minister. However, the senior hierarchical standing of the SRF accords Tolubko the status of first among equals.

The principal defense-industrial connection of the SRF is with the innocuously titled Ministry of General Machinebuilding (headed by S. A. Afanas'yev), an industrial-bureaucratic empire created in 1965 largely to provide for the hardware needs of the SRF. The connection between the SRF and the Ministry of Medium Machinebuilding (headed by Y. P. Slavskiy)—the industrial-bureaucratic empire charged with nuclear-weapon

production—is believed to be scarcely less important.

In the Soviet Union, strategic ballistic missiles tend to be viewed as a form of super-artillery, and artillery is traditionally a weapon of great prestige in the Soviet Armed Forces. Whereas in the US Air Force, ICBMs are but a part, albeit a major part, of the most prestigious combat command (SAC), in the Soviet Union, the SRF is charged exclusively with providing appropriate strategic missile strength while manned bombers are assigned to Long Range Aviation—an element of the Soviet Air Forces. When we combine traditional Russian/Soviet attitudes toward preparing for and conducting war, and the fact that Soviet military strategy is almost exclusively a professional military responsibility, set in the context of the defense-hierarchical preeminence of the SRF and the unique Soviet style in military hardware development and procurement, it becomes apparent that the SRF's political influence, likely operational plans, and aspirations for future excellence cannot easily be understood in Western terms.

"...momentum in Soviet strategic (and other) weapon programs in part is dictated by the industrial structure and by economic planning...."

Typically, Western analysis and descriptions of the SRF's military capability plunge rapidly into somewhat contentious claims concerning the characteristics of particular weapon systems. These are important, and are addressed here, but this focus on individual end products tends to detract from our understanding of *the process* whereupon individual weapons are simply milestones. In a fashion wholly alien to American practice and experience, Soviet defense industry is required to be kept busy. The Ministry of General Machinebuilding does not face an annual crisis imposed by skeptical legislators.

The close-to "steady state" activity of Soviet defense industry invites several explanations. First, a centrally planned economy geared to five-year planning cycles is inherently inflexible. Second, unlike Western security communities, the Soviet Union is not subject to major fluctuations in estimates of the severity of external threat. This long-haul orientation stems both from Russian/Soviet historical experience (there is always another crisis, another war in which more military power is preferable to less military power), and from the ideology of the Communist Party of the Soviet Union (CPSU). Eras of tactical détente may come and go, but there can be no mutual accommodation of interests between the Soviet Union and the antagonistic social systems of the West. In other words, the performance, year in and year out, of the SRF and its defense-industrial allies reflects a stable Soviet assessment of external threat.

Soviet defense industry builds what it knows how to build—deficiencies and all. The generation of Soviet ICBMs now being deployed or placed in active storage—the SS-X-16, the SS-17, -18, and -19—reflects the capability of Soviet defense industry in 1978. They constitute the fourth generation in Soviet missilery, which Soviet officials know will be succeeded, in the early- to mid-1980s, by a fifth generation. This momentum in Soviet strategic (and other) weapon programs in part is dictated by the industrial structure and by economic planning with its norms and the structure of incentives/disincentives provided for factory managers, and in part by an intelligent incremental approach to weapon technology. The American arms-control community probably would benefit greatly by shifting from discussion of the real and imagined problems of strategic stability (an alien concept in Soviet understanding) to studies of the bureaucratic-industrial-economic planning infrastructure of the SRF.

The importance of appreciating this infrastructure is easily demonstrated. In 1969, at the height of the ABM debate in the United States, claims and counterclaims were advanced concerning the hard-target kill potential of the SS-9 ICBM, a third-generation Soviet strategic missile. What should have been emphasized, but was not, was the certainty that behind the growing inventory of SS-9s, -11s, and -13s, was a fourth generation of ICBMs (the SS-16s through -19s), and behind that a fifth generation to be deployed in the mid-1980s.

SALT and Soviet Strategic Doctrine

The impact of actual (SALT I) and imminent (SALT II) arms-control arrangements on SRF programs is an instructive field of enquiry. The Nixon Administration and now the Carter Administration have argued that the alternative to SALT is an "unrestrained arms race." But it appears that the Soviet defense industry already is working very close to capacity in the strategic weapons (and warheads) field, and that Soviet capacity for surge-production of this class of weapons is extremely limited, in good part because of Soviet deficiencies in the mass production of microelectronic equipment. The SALT I Interim Agreement on Strategic Offensive Forces permitted the Soviet Union to continue building nuclear-powered ballistic missile submarines at a rate not much different from that possible had the SALT process broken down. At the same time, the numerical freeze on ICBM *launchers* (the least useful category of hardware items to count next to throw-weight and missiles themselves) permitted any kind of qualitative improvements the SRF was ready to introduce.

SALT II promises to be equally cosmetic. The Soviet Union will retain its *unilateral* allowance of 308 "heavy" ICBMs, compared to zero for the United States; has been allowed to count the SS-19 as a "light" ICBM despite the fact that it has a throw-weight more than three times that of the SS-11 which, in American understanding, was the outside-limit for "light" ICBMs under SALT I; and may deploy up to 820 MIRVed ICBMs. The United States has failed totally to secure any worthwhile SALT constraints on the hard-target kill capability of the SRF.

Soviet missile throw-weight, accuracy, payload subdivision, and reliability may all be improved without incurring heavy trade-off penalties.

Prediction in strategic analysis is notoriously frail. However, Soviet practices with respect to the research, development, testing, and deployment of long-range ballistic missiles are so regular that the current and planned capabilities of the SRF may be described with fairly high confidence. The Soviet Union appears to have a stable strategic doctrine: Soviet Armed Forces are charged, preeminently, with the sensible military task of defending the Soviet homeland. The Soviet defense community seems to believe that perceptions of the East-West military balance have (or should have) an important impact upon peace and crisis-time diplomacy, and that those perceptions relate essentially to military employment options. The tasks of the SRF therefore include: the role of political counterweight to enhance the perceived political clout of the Soviet Union; the role of strategic counter-deterrent to dissuade enemies from escalating to strategic-nuclear use out of a local crisis; and the role providing for "escalation dominance" should strategic-nuclear use nonetheless be initiated. The weapon programs of the SRF are fully consistent with this interpretation.

The fourth generation SS-X-16 through -19 ICBM series constitutes a direct affront to all the major tenets of Western strategic and arms-control theory. As a package, these four ICBMs, with their several variants, carry the promise of: very serious hard-target kill potential (the SS-18 and -19); a very high megatonnage threat to soft targets (the SS-17 and perhaps -18); and a free-ranging land-mobility that would be extremely difficult to monitor by national technical means of verification (the SS-X-16, and its shorter range variant, the SS-20 IRBM).

Arms-control arrangements may come and go, as may changing emphases in Soviet declaratory doctrine, but the SRF inexorably improves its ability to fight and perhaps even to win a thermonuclear war. It is not very intelligent for Western analysts to debate the real weaknesses in the current Soviet ICBM deployment programs; it is clearly apparent that ICBM generations five and six are well in hand, whether or not there is a SALT II (or III). Because the SRF is not constrained by any Soviet analogue of Western strategic stability theory, technology development is governed solely by technical competence, industrial capacity, and military effectiveness.

The first, second, and probably even the third generations of Soviet ICBMs were characterized by very large rocket motors required to deliver the rather heavy warheads of a rather crude warhead technology. The technology is surely no longer so crude, yet the Soviet interest in high throw-weight persists in the SS-X-16 through -19 ICBMs. Whatever the original reasons may have been, the SRF seems to be persuaded that high missile throw-weight has useful military consequences. It permits large-yield warheads and, if need be, a dramatic number of MIRVs to saturate a "multiple aim point" basing system for American ICBMs, and ABM defenses.

"Whatever it may be that the Soviet Politburo has in mind, the SRF is on the brink of effecting a historic transformation in the Soviet-American strategic relationship."

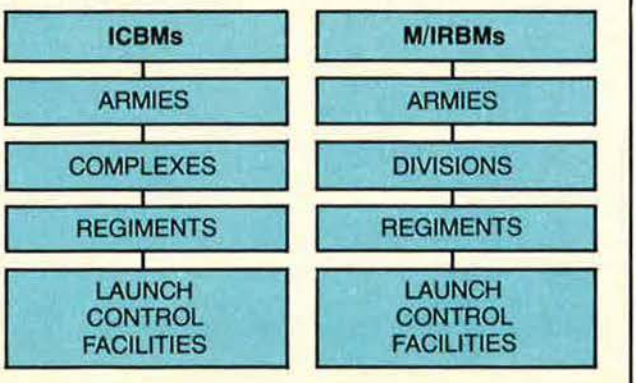
Force Levels

Deployed in a band stretching from the Moscow region to east of Lake Baikal with some northern spurs, particularly in the Urals, the SRF currently has an active inventory of close to 1,450 ICBMs. In addition, 600–650 M/IRBMs are deployed in the western USSR and close to the Chinese border. Both ICBMs and M/IRBMs are being modernized. SS-17s and -19s are replacing SS-11s; SS-18s are replacing SS-9s; while SS-20s are replacing the obsolescent SS-4s and -5s in the M/IRBM category. Although the SRF has ready, and probably stockpiled for deployment, the SS-X-16 ICBM, designed for land-mobile basing, the current emphasis is on deploying fourth-generation ICBMs in upgraded silos.

Under the terms of SALT II, it is very probable that the SRF will draw down its ICBM force by a couple of hundred launchers, but—pending some major American decision on the silo-threatening MX follow-on ICBM—it is very unlikely that the SRF will dip below about 1,200. At the present time, the SRF has no grounds for acute anxiety over the survivability of its silo-housed force. For all its virtues, Minuteman III does not pose a major hard-target counterforce threat to the SRF. In the absence of

THE STRATEGIC ROCKET FORCES: ORGANIZATION

The command structure of the SRF is divided cleanly between ICBM and M/IRBM forces. Overall, the Commander of the SRF disposes 9 armies—6 operational and 3 test. At the lowest organization level, the SRF are divided into 300 Launch Control Facilities.



such a threat, the Soviet incentive to maintain all its ICBM force in silos is very understandable.

Debates over Soviet motivations tend to be unproductive. In late 1976, Teams "A" and "B" made up of Central Intelligence Agency and outside analysts respectively, contended over the conclusions to be drawn about intentions. Such judgments have to be drawn, but they should be drawn neither from highly selective quotations from Soviet strategic literature, nor from very general assumptions derived from assessments of Soviet politico-strategic culture and style. Both of these can be important, but they lack the authority needed to persuade skeptics. *Facts* such as these are more important:

- On a fairly regular timetable, the SRF is testing and deploying successive generations of ICBMs and IRBMs.
- Each succeeding generation is characterized by a marked advantage over its predecessor in terms of prospective hard-target kill capability.
- Soviet expenditure on research and development for strategic forces rose noticeably following the signing of SALT I in 1972.
- The level of Soviet research and development devoted to ballistic missile defense technologies was far greater after signing the ABM Treaty of 1972 than it was before.

It is difficult to place a benign interpretation on these facts. If one wishes to claim that the programs of the SRF do not reflect any malign intentions, then they are the products of a rather mindless industrial-bureaucratic process that produces new weapon generations (or half-generations) every few years. In that case, the fact remains that the SRF has these improved weapons in hand for whatever political ends the leadership might find expedient. Moreover, any transient reduction in East-West tension has *no* long-range effect on SRF capabilities. In the absence of more persuasive subtle arguments, it is usually sensible to take seriously the most obvious explanation available. Any Western commentator who is not committed to the proposition that Soviet strategic thought is essentially identical with—or is tending toward—American stability theory should have little difficulty translating the apparent military capabilities of the SRF into strategic doctrinal desiderata.

Whatever it may be that the Soviet Politburo has in mind, the SRF is on the brink of effecting a historic transformation in the Soviet-American strategic relationship.

WEAPONS OF THE SOVIET STRATEGIC ROCKET FORCES

CATEGORY TYPE	RANGE (MILES)	WARHEAD YIELD	THROW-WEIGHT (000 LBS)	CEP (NM)	FIRST DEPLOYED	NO. DEPLOYED (END 1977)*
ICBM						
SS-7 Saddler	6,900	5 mt	3–4	1.5	1961	109
SS-8 Sasin	6,900	5 mt	3–4	1.0	1963	
SS-9 Scarp	7,500					
Mods 1, 2		18–25 mt	12–15	0.5	1965	238
Mod 4		3–5 mt (MIRV)				
SS-11 Sego	6,500					
Mod 1		1–2 mt	1.5	0.5	1966	830
Mod 3		3 x 100–300 kt	2.0	0.3–0.4	1973	
SS-13 Savage	5,000	1 mt	1.0	0.7	1968	60
SS-X-16	5,000+	n.a.	2.0	0.25–0.3		
SS-17	6,300+					
Mod 1		4 x 900 kt (MIRV)	6.0	0.3	1975	40
Mod 2		5+ mt (?)				
SS-18	6,300+					
Mod 1		18–25 mt	16–20	0.20–0.25	1975	50
Mod 2		5–8 x 2+ mt (MIRV)				
Mod 3		18–25 mt				
SS-19						
Mod 1	7,000+	6 x 1–2 mt (MIRV)	7.0	<0.20	1975	150
Mod 2	6,300+	5+ mt (?)				
IRBM						
SS-5 Skean	2,300	1 mt	1.0	1.5	1961	100
SS-20	3,500–4,000	3 x 100–300 kt (MIRV)	1.2	n.a.	1977	20+
MRBM						
SS-4 Sandal	1,200	1 mt	1.0	1.0	1959	500

** These numbers are very approximate and probably understate the inventory of SS-18s and -19s. The former are replacing the SS-9s, and the latter the SS-11s.*

Some 820 MIRVable SS-17s, -18s, and 19s, ranged against 550 Minuteman IIIs with upgraded accuracy and warhead yields doubled by the MK 12 warhead, should mean escalation dominance for the Soviet Union. The United States should be deterred from initiating any strategic nuclear action, because the Soviet Union—in "constrained" response—could neutralize, in a highly cost-effective way, the remainder of the American land-based missile force. The Carter Administration, in its rather negative consideration of MX ICBM issues, seems to be neglecting an essential criterion for the adequacy of the strategic force posture: that it be able to deter an attack on itself. Given current trends, the SRF should not be deterred from attacking the American land-based missile force—in a first or second strike—by 1982–83.

Technology Trends

The SRF has undergone dramatic changes in capability since the mid-1960s. Having learned a major lesson in tactical preparedness from Pearl Harbor, the US Strategic Air Command has prudently presumed that a surprise attack "out of the blue" is a permanent danger. Similarly, in best mirror-image fashion, the American defense community has assumed that Soviet strategic forces also are retained on a close-to-instant readiness basis. It is now common knowledge that, even aside from the technical problems (*e.g.*, of nonstorable liquid fuel) that beset first- and second-generation Soviet ICBMs, Soviet alert procedures—until quite recently—were very different from those of the US. Despite their massive objective inferiority, Soviet strategic forces were maintained until the later 1960s in such a low state of readiness as to suggest a high measure of confidence that there would be long advance warning of an American attack. Mr. Khrushchev and even Mr. Brezhnev, for a while, would have pressed "the button" only to find that nothing operational happened for a lengthy period. Notwithstanding its war-fighting doctrine, the Soviet Union did not have instantly war-ready strategic forces.

Over the past decade, Soviet strategic forces readiness appears to have improved very markedly. Certainly any remaining differences from the US in alert style cannot plausibly be attributed to a more relaxed Soviet attitude toward the likelihood of war. Soviet leaders appear to believe that the United States would never launch a massive strategic surprise attack "out of the blue."

Although the peacetime alert status of the SRF appears today more nearly to approach that of SAC than it did ten to fifteen years ago, the nuclear-powered ballistic missile submarine (SSBN) deployment practices of the Soviet Navy continue to offer a quite dramatic contrast to American style. *(See "The Soviet SLBM Force," p. 42.)* Typically, only a small fraction of Soviet SSBNs are out of port on patrol at any time, and—by and large—they deploy in home, or close-to-home, waters. Reasonably enough Admiral Gorshkov appears to believe that he will always be granted twenty-four to forty-eight hours to surge his SSBNs out of Severomorsk and other ports into the Barents Sea. It is difficult to quarrel with that judgment.

Fourth-generation Soviet ICBMs—the SS-X-16, -17, -18, and -19—have more throw-weight and are more accurate than the SS-9s, -11s, and -13s that they are replacing, or may replace (in the case of the SS-13); hence, Soviet ICBMs are becoming more capable of hard-target killing strikes. The precise technical achievements of the SRF, at any point in time, are not known to the American defense community. The accuracy, or CEP (circular error probable), of fourth-generation Soviet ICBMs is *believed* to vary between 0.2–0.3 nm (1,200 to 1,800 feet). All four new Soviet ICBMs have post-boost vehicles, or buses, that indicate a MIRV capability and a determination to increase accuracy. Also, this new generation, first deployed in 1975, has on-board computers which is an ominous development. However, notwithstanding the 100-plus Soviet ICBM test-firings each year (including many from operational launchers—something the United States has never done), our knowledge of Soviet ICBM CEPs remains tenuous.

"The American defense community will never know Soviet ICBM CEPs with high confidence...."

American estimates of Soviet CEPs are to some extent extrapolations from technology. Given the fact that the United States conducts relatively few ICBM test-firings each year, and never from operational silos (and obviously never over even-close-to-operational trajectories), it is understandable that there is some debate over the precise figures for the CEPs of US ICBMs. Any CEP estimates for particular Soviet ICBMs at a point in time are challengeable. What cannot be challenged is the quite evident Soviet determination to improve missile accuracy. Paul Nitze has argued that the Minuteman force enters a period of acute danger when Soviet ICBM CEPs attain values of 0.15–0.2 nm. The American defense community will never know Soviet ICBM CEPs with high confidence, but because of its many test firings, the SRF should have a lesser degree of uncertainty in its own estimates.

Throw-weight estimates are more certain than are CEP numbers, since missile volume is easier to observe than is accuracy. However, even throw-weight estimates are beset with numerous uncertainties. For example, were the Soviet Union to follow American developments in high-energy missile propellants, the effect on the throw-weight of Soviet ICBMs of a given volume might be dramatic.

Similarly, we make assumptions about Soviet ICBM warhead yields, but what do we really know about them? Thanks to the Partial Test Ban Treaty of 1963, the United States knows nothing certain about Soviet competence in nuclear-warhead design. This ignorance is illustrated dramatically in the various estimates offered for the yield of the MIRVs carried by the SS-17, Mod 1, and the SS-19, Mod 1. In the latter case, the published yield estimates vary between 200 kilotons and one to two megatons. Western knowledge of Soviet progress in warhead design is less than impressive. For an appreciation of the upper

level of threat, the American defense community asks itself, "What could our weapon laboratories do with the more than 7,000 pounds of throw-weight of the SS-19, or with the 16,000 to 20,000 pounds of the SS-18?" It is possible that the SS-19, Mod 1 carries six MIRVs in the 200- to 300-kiloton range, but it is not very plausible.

The continuing SRF interest in relatively high ICBM throw-weight is probably a sensible hedge against the potential operational degradation of ICBM CEP. Accuracy is far more important to hard-target kill capability than is warhead yield (the standard simplified counterforce formula is $k = Y^{2/3}/(CEP)^2$), but yield is close to a certain value, whereas CEP is not. CEP may be degraded by mobile basing, gravitational anomalies, and even local weather conditions if blunt, high-drag reentry vehicles are used.

"The Soviet ace in the hole, ultimately, does not repose in MIRVed ICBMs, but in a major civil defense program."

American defense analysts argue over Soviet ICBM accuracies and MIRV-warhead yields, but Soviet technical intentions really are beyond debate. The SALT record of 1969–78 shows, unambiguously, that the Soviet Union is not interested in reducing the silo-killing potential of its ICBM forces. To cite only very recent events, the Soviet Union rejected out of hand President Carter's March 1977 proposal that the Soviet "heavy" ICBM allowance be cut from 308 to 150, and that ICBM and SLBM tests be limited to no more than six a year. Over more than eight years of SALT, there has not been a single Soviet proposal that would have contributed markedly to the American understanding of strategic stability by reducing the first-strike bonus.

The SRF as a Political Instrument

There has not been an acute Soviet-American crisis since October 1962. Leading American participants in that event believed, at the time, that the strategic imbalance in the American favor was critically important to the successful outcome of the crisis. What would happen in an acute international crisis in the 1980s, given the expected state of the strategic balance? In the summer of 1974, Henry Kissinger asked, "What in the name of God is strategic superiority?" The Soviet SRF appear to be directed by a political intelligence that has few problems with Kissinger's question. Until the present, prospective American strategic nuclear action has played an essential background role in American and allied strategic thinking vis-à-vis theater needs. If local military events in Europe, the Middle East, or Northeast Asia went seriously wrong for the United States and its local allies, then there was always the option of escalating the action for an improved outcome at a higher level of violence. Unfortunately, the present and anticipated capabilities of the Soviet SRF have fractured this logical chain.

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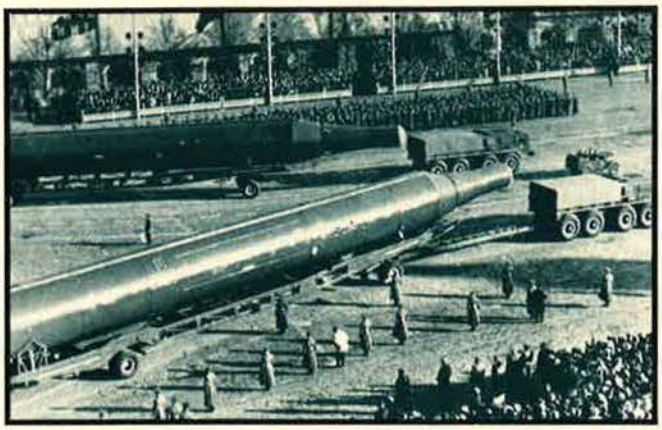
For the foreseeable future, it is more likely to be the NATO than the Warsaw Pact forces that confront imminent theater defeat. This possibility has been accommodated for more than a quarter-century by a NATO that has always looked up to the US strategic posture to provide the needed makeweight. The problem today, and even more for the 1980s, is that the SRF should function well as a strategic counter-deterrent. Soviet strategic programs are such that the American incentive to break out of a purely theater conflict in search of an improved outcome should be nonexistent. The SRF *may* not (and this is in contention at present) provide the Soviet Union with the means for winning World War III, but that is not how "strategic superiority" should be defined. For the Soviet Union, strategic superiority should be understood to mean the capability to deter the United States from initiating strategic nuclear employment, and the ability to match or surpass in effectiveness any American strategic options. The Soviet ace in the hole, ultimately, does not repose in MIRVed ICBMs, but in a major civil defense program. If the Politburo places considerable confidence in civil defense, it means that the Soviet Union could, *in extremis*, escalate and counterescalate against the United States in the belief, or serious hope, that Soviet society could take the expected damage and recover but American society could not.

The American defense community is not, in 1978, agreed upon the structure or the details of the dominant Soviet image of a future strategic war. For the past seven years, at least, the United States has been very interested in limited options to secure intra-war deterrence and war termination at the least possible level of damage. Announcement of the so-called "Schlesinger doctrine" in 1974, with its publicized emphasis on strategic strike options at the low end of the spectrum, energized a still-smouldering debate over the likely Soviet style in strategic force employment.

It is worth noting that all of the less than impressive evidence available on this subject suggests that the SRF are not at all prepared to match limited strategic option for limited strategic option. While admitting our very real ignorance, it still is sensible to take note of what appears to be the principal operational mission of the SRF. Specifically, in response to warning of an impending American strike, or in response to an American limited strategic option (LSO), the SRF should be expected to launch a massive strike against all of the American land-based strategic facilities—ICBM silos, bomber bases, SSBN facilities, and command and control targets. Un-



The SS-13 (top) was first displayed in 1965, but never deployed on a large scale. For a decade, the SS-9 (above) was the world's most powerful missile. It and the SS-11 are now being replaced by fourth-generation Soviet ICBMs.

fortunately, by the early 1980s, the SRF should have a very large incentive, in time of acute crisis, to exercise such an option. Assuming prior Soviet activation of the civil defense program, it is difficult to see how an American president could respond intelligently and effectively to such a Soviet counterforce strike. Using only a fraction of their throw-weight, the SRF should have eliminated the Minuteman-Titan force, inflicted considerable damage on the manned bomber/cruise missile carrier force, and complicated command and control of SSBNs.

The Soviet SRF should have political utility in the following ways. They should deter strong moves by the United States in response to a challenge, military action by the United States during a crisis, and escalation of a theater conflict to the intercontinental level.

The diplomatic meaning of SRF capabilities in peacetime was illustrated forcefully in March and April 1977. Hoist on its arms-control petard, the Carter Administration presented a comprehensive SALT proposal to the Soviet Union that would have cut noticeably into future Soviet counterforce capability. The Soviet Union rejected this offer peremptorily, essentially on the grounds that it was inequitable. It was inequitable not so much in the sense that the end results of the proposal would be unequal, but rather that the American strategic weapon programs did not begin to justify the kind of constraints that were asked of the Soviet Union. Arms-control negotiations with the Soviet Union are not protracted seminars in the meaning of stability; rather are they trading sessions critically dependent upon evidence of real programs. In 1977, to President Carter's chagrin, the Soviet Union believed in the American long-range cruise missile program, but it did not believe in the B-1 or the MX.

It is difficult to assess the prospective political clout of the SRF without specifying the character of American opposition. The keystone role of the Soviet SRF in the 1980s is related directly to the fact that they will not—on current American evidence—confront a US strategic force, in its land-based elements at least, that could deter attack on itself. The Soviet SRF—today and even more as we anticipate for the 1980s—should deny an American president any attractive escalation options from a local disaster. Because of Soviet civil defense and war-survival programs, traditional American ideas of unacceptable damage should be appropriate no longer.

The current and anticipated future capabilities of the SRF should mean that in the next acute Soviet-American crisis, there will be no obvious reason why the Soviet Union would be the first to "blink." Too many officials and commentators in the United States acquired their crisis-management education from the events of the late 1950s and the early 1960s. The SRF, supported by only a moderately competent civil defense program, should ensure that in the 1980s no Soviet leader will be required to accommodate under extreme pressure. ■

Soviet Aerospace Almanac

Soviet aerospace forces for defense of the homeland have nearly as many military personnel as the entire US Air Force, and eight times as many interceptors. They are organized as a separate service . . .

TROOPS OF NATIONAL AIR DEFENSE

BY WILLIAM F. SCOTT

MUTUAL Assured Destruction (MAD) is a strategic concept that is widely accepted in the United States. It is based on the premise that nuclear war between the Soviet Union and the US can best be deterred if each nation has the capability of destroying the other in the event of a nuclear exchange.

Proponents of MAD believed that the Anti-Ballistic Missile Treaty between the US and the Soviet Union, signed at Moscow on May 26, 1972, served to codify the concept. The treaty states:

> . . . the United States and the Soviet Union agree that each may have only two ABM deployment areas, so restricted and so located that they cannot provide a nationwide ABM defense or become the basis for developing one. *Each country thus leaves unchallenged the penetration capability of the other's retaliatory missile forces.* [Emphasis added.]

A 1974 Protocol to the treaty further limits each side to one site only.

There is no evidence that the Soviet leadership genuinely accepted the concept of Mutual Assured Destruction in 1972, or has accepted it since then. The USSR's long-range intentions regarding aerospace defense and war survival were implicitly stated in a 1976 book, *The Development of Antiaircraft Defense,* by Marshal of Aviation G. V. Zimin, a doctor of military science and Commandant of the Zhukov Military Academy of Air Defense. Four years after the ABM treaty was signed, he wrote:

> Airspace, along with dry land, has become the basic arena of combat actions. . . . The enormous destructive force of nuclear warheads *brings up the necessity of destroying every warhead, without exception, which penetrates into the interior of the country through the air or from space.*
>
> All these conditions place before air defense complicated and responsible tasks, the solution of which will be determined by the ability to repulse strikes not only of aerodynamic *but also of ballistic means of attack.* With this is tied the constant process of rearming and developing new combat equipment. . . .
>
> These very conditions evoke the need for *further perfection of civil defense,* the main task of which includes preparation of the population for protection from modern means of mass destruction and *assurance for the continuity of work of all branches of the economy in wartime.* [Emphasis added.]

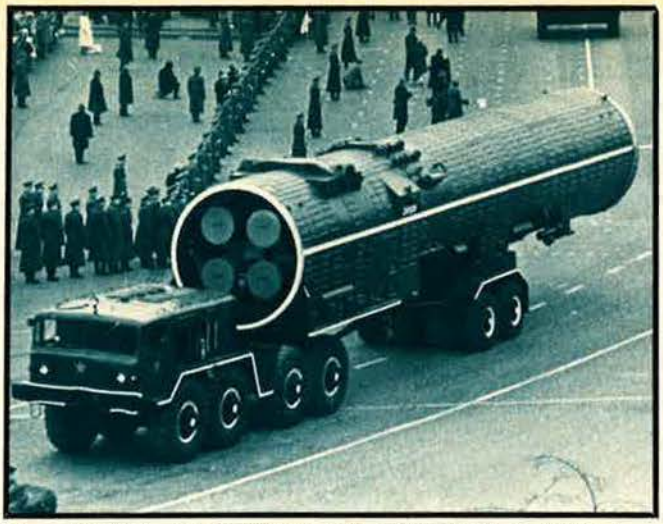
All Soviet military publications, Marshal Zimin's book included, are issued under control of the Main Political Administration of the Soviet Army and Navy—an organization with the rights of a department of the Central Committee of the Communist Party. It also is worth noting that an introduction to Marshal Zimin's book was written by Marshal of the Soviet Union P. F. Batitskiy, Commander in Chief of the Troops of National Air Defense.

Further evidence of the USSR's dedication to aerospace defense and war survival lies in the size and activities of its Troops of National Air Defense (*Voiska Protivovozdushnoi Oborony Strany*—popularly abbreviated as PVO Strany), the second largest of the five Soviet military services. More than 500,000 military personnel are assigned to PVO Strany, which has two major air defense districts (Moscow and Baku) and numerous air defense "formations" throughout the country. At all levels, close coordination is maintained with civil defense units. (By way of contrast, the US Aerospace Defense Command has fewer than 25,000 military personnel assigned (*see box*).

PVO Strany is divided into five different aerospace defense components: manned interceptors, surface-to-air missiles (SAMs), radar and communications, antirocket missiles, and antispace weapons. Some analysts confuse components of PVO Strany with the troops of air defense of the Ground Forces *(voiska protivovozdushnoi oborony Sukhoputniykh Voisk),* one of the four major branches of the Soviet Ground Forces (*see also "Air Defense of Soviet Ground Forces," p. 78*).

Early Development

Origins of the Troops of National Air Defense stem from World War I, when air observation, warning, and



The antiballistic missile (ABM), dubbed "Galosh" by NATO, is displayed in Moscow during an October Revolution parade.

communications systems (VNOS) were established. A PVO section *(otdel)* was formed in the Red Army in 1927 and raised to a directorate (*upravelniye*) in 1930. At the beginning of World War II, air defense troops were subordinated to the commanders of troops in the military districts and fleets. The first Troops of National Air Defense (PVO Strany) were formed in November 1941. Components of PVO were antiaircraft artillery (ZA), interceptor aviation (IA), and air observation, warning, and communications (VNOS). In the immediate postwar period, the air defense function was placed under the Commander of Artillery of the Soviet Army.

In 1948, when the US Strategic Air Command was two years old, Soviet air defense responsibilities were assigned to a newly created service, the Troops of National PVO. Although independent, this service at first did not have the same stature as the Ground Forces, Air Forces, and Navy. This situation changed in May 1954 when Marshal of the Soviet Union L. A. Govorov was designated as the Commander in Chief of the Troops of National PVO, as well as a deputy minister of defense.

The Kremlin leadership gave this new service high priority. The MiG-15s, followed by the MiG-17s and -19s (which the Soviets called their first supersonic interceptor), were produced primarily as interceptors.

A remarkable feat in design, development, and production was achieved with the SA-1, which was the world's first surface-to-air missile system deployed in mass. By 1955, hundreds of these missiles were on herringbone launch sites surrounding Moscow in three concentric rings. This deployment, accomplished in two years, would have been a major effort for the total armed forces of any nation in so short a period and must have cost billions of rubles.

Organization

The actual organization of the Soviet Troops of National PVO is not known with certainty. The composition of the Military Council of this service reflects to a large extent PVO's organizational structure (*see organization chart, p. 91*).

As of January 1, 1978, the Troops of National Air Defense (PVO Strany) were commanded by a Marshal of the Soviet Union, with a Marshal of Aviation as First Deputy Commander in Chief. There are ten additional deputy commanders in chief, for activities such as armaments, rear services, military schools, and combat training. Three of the deputies serve as commanders of the three primary components of PVO Strany: fighter aviation, radio technical troops, and zenith rocket (SAM) troops. Positions of three other deputies are not identified. One of these may be responsible for antimissile defense, another for antispace defense, and the third for air defense matters in the Eastern European nations of the Warsaw Pact Forces, which joined the Soviet national air defense structure in 1969.

In the event of war, coordination among Warsaw Pact air defense units, Frontal Aviation under front commanders, and Ground Forces air defense troops could become exceedingly difficult. Based on Soviet writings about wartime responsibilities of the Headquarters of the Supreme High Command (STAVKA), a STAVKA representative with command authority would probably be sent to coordinate all air defense and Frontal Aviation matters in a given region.

SOVIET/US AEROSPACE DEFENSE FORCES, 1973–77

	Manned Interceptors		Strategic Surface-to-Air Missiles		ABM Missile Launchers		Military Personnel	
Year	USSR	US[a]	USSR	US[b]	USSR	US	USSR	US[d]
1973	2,900	585	10,000	481[c]	64	0	500,000	34,109
1974	2,650	532	9,800	261	64	0	500,000	33,438
1975	2,550	374	12,000	0	64	0	500,000	30,500
1976	2,650	331	10,000	0	64	0	550,000	29,350
1977	2,650	331	12,000	0	64	0	550,000	24,595

All figures except those for US personnel are from The Military Balance *(1973–74 through 1977–78 editions), published by The International Institute for Strategic Studies, London.*

[a] *Includes both Regular and Air National Guard units.*

[b] *Includes both Regular and Army National Guard units.*

[c] *US Army Nike-Hercules only subsequent to phaseout of USAF Bomarc-B units in 1972.*

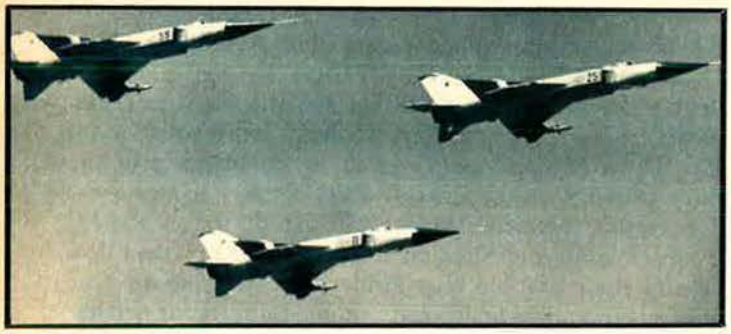
[d] *USAF Aerospace Defense Command only. Does not include Army personnel assigned to Nike-Hercules units and to the now-defunct Army Air Defense Command.*

Manned Interceptors of PVO Strany

The high priority given to aircraft for PVO Strany continues in the 1970s. One of the best-known aircraft in the world today, the MiG-21, with its high rate of climb and good handling characteristics, was designed as an interceptor and fighter. Later models of the MiG-21 were modified for specific purposes, such as ground support.

The MiG-23 Flogger also has an interceptor role and some models have been assigned to PVO Strany. Later versions, such as the Flogger-D, are modified for a ground attack role.

Much has been written in the United States about the MiG-25 Foxbat. First designated the E-266, this aircraft set its first world speed record in 1965. Other records held are an absolute altitude record of 123,523 feet and speed of 1,852 mph over a 500-kilometer circuit. (Records for speed in a straight line and over a 1,000-kilometer closed course are held by the USAF SR-71A—2,193 mph and 2,092 mph respectively.) With an operating altitude of more than 80,000 feet, the MiG-25 probably was designed to intercept the USAF B-70, which never went into production.



Su-15 Flagon-A interceptors, part of the Soviet Union's air defenses, pass over Moscow in an aerial review.

Another modern interceptor in the PVO Strany inventory is the Su-15 Flagon. This twin-jet all-weather interceptor is an excellent companion for the higher performing MiG-25. Older aircraft, such as the Yak-28P Firebar, also remain in the Soviet interceptor forces.

The manned aircraft of the Troops of National PVO work in close conjunction with surface-to-air missile systems. Pilots of air defense aircraft fly according to very specific instructions from ground controllers. As long as radar units function and communications are maintained, Soviet interceptor pilots can be expected to do a good job.

It is highly unlikely that the Soviets have curtailed the design, development, and production of new manned interceptors. In all probability the successor to the MiG-25 is being tested today.

Surface-to-Air Missiles (SAMs)

As the SA-1 was being deployed in the early 1950s, a more advanced system, the SA-2, was in production. First deployments of this new SAM were noted in 1956 and 1957. Western experts expected widespread deployments would take several years, but by 1958, SA-2 sites were numbered in the hundreds—a deployment speed that had been completely unanticipated in Washington.

At the time of its initial deployment, the SA-2 did not have a good low-altitude capability. Accordingly, the SA-3 was designed to fill the gap. Experience gained with the SA-2 in Southeast Asia during the 1960s, combined with a number of modifications in guidance, however, brought about a low-altitude capability much greater than had been expected in the original design, and, as a result, the SA-3 was never widely used.

The SA-5 was the next SAM system deployed by the Troops of National PVO. Although this system appeared in the mid-1960s, its true performance and purpose are still unknown to the West. The SA-5 and associated radars formed what is known as the "Tallin Line." With its slant range of approximately 150 miles, two-stage solid propellant, and possible terminal propulsion for its warhead, the SA-5 is considered by a number of Western analysts to have the dual mission of attacking both manned aircraft and ballistic missile reentry vehicles.

The argument about the SA-5's ABM capability still continues. Former Secretary of Defense Melvin Laird said in late 1977 that the Soviets were testing the weapon as an ABM—a direct violation of the SALT I agreement.

Mobile missiles, such as the SA-4 Ganef, SA-6 Gainful, SA-7 Grail, SA-8 Gecko, and SA-9 Gaskin are assigned to the troops of air defense of the Ground Forces and *not* to PVO Strany. Soviet production of new SAM systems for national air defense is certain to continue. Development of a SAM system to combat cruise missiles probably is under way now.

Radio-Technical Troops

The effectiveness of PVO Strany's surface-to-air missiles and manned interceptors depends on the radio-technical troops who man radar and communications sites around the Soviet Union. The Soviet radar-communications net is the most dense of any major world power. Considerable quantities of American radars were provided the Soviet Union during World War II through the 1944 US Lend-Lease Act. As late as the 1960s, many of these radars still were deployed. It is standard Soviet practice never to throw away any military equipment. As new radars appear, the old ones form a backup system.

Barlocks and other early warning radars were deployed to Southeast Asia where Soviet technicians learned modern radar counter-countermeasures techniques against US Air Force and Navy aircraft. American scientists were surprised at the capability of these Soviet radars which were more than ten years old when sent to North Vietnam.

Thousands of radar sites blanket the Soviet Union,

William F. Scott, a West Point graduate, was a bomber pilot during World War II. Subsequently, he served as an Air University faculty member, an exchange officer with the State Department, and twice as US air attaché in Moscow. Since his retirement as a colonel in 1972, he has visited the USSR and met with leading Soviet theoreticians. He holds a doctorate in Soviet studies and now is a lecturer at Georgetown University and a consultant on Soviet affairs. He has been a frequent contributor to this magazine.

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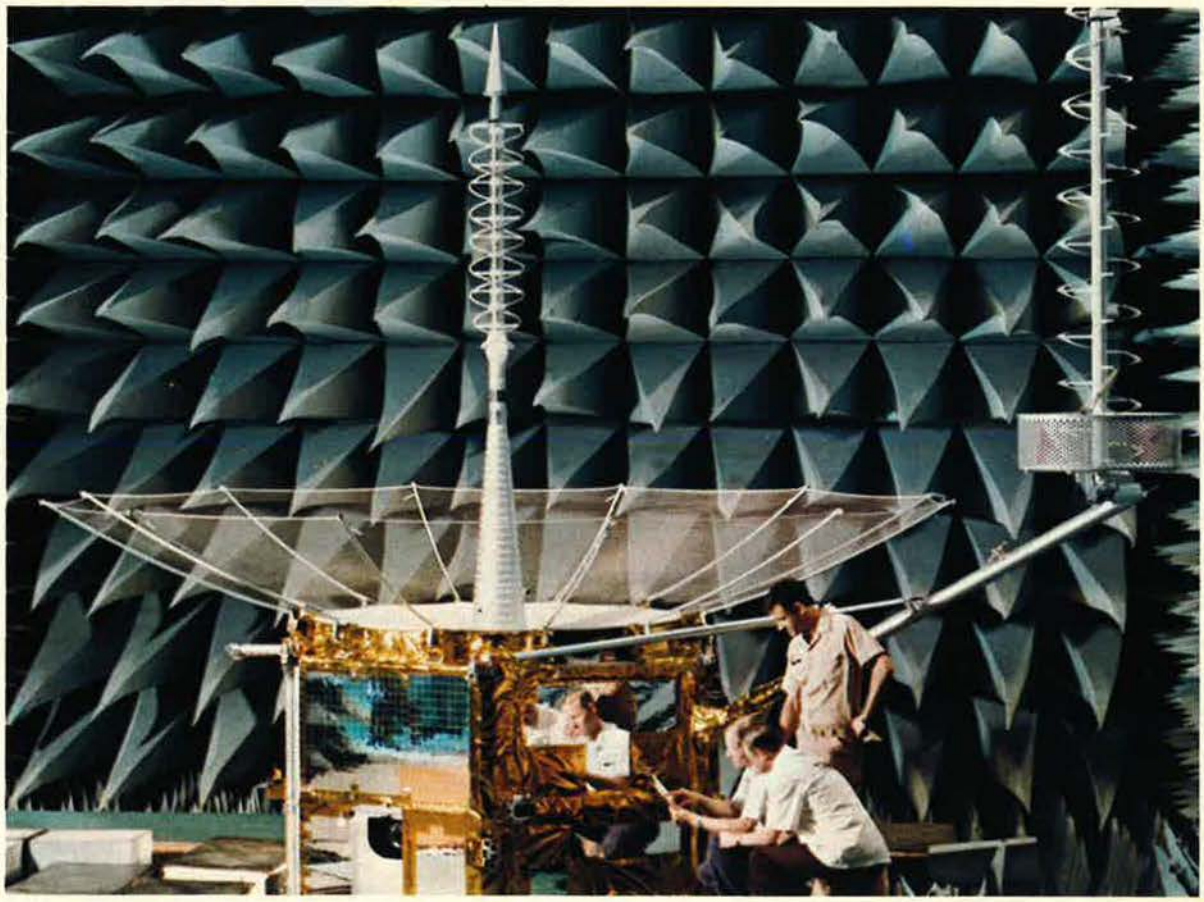

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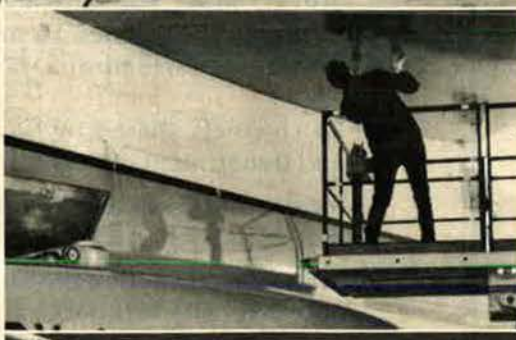

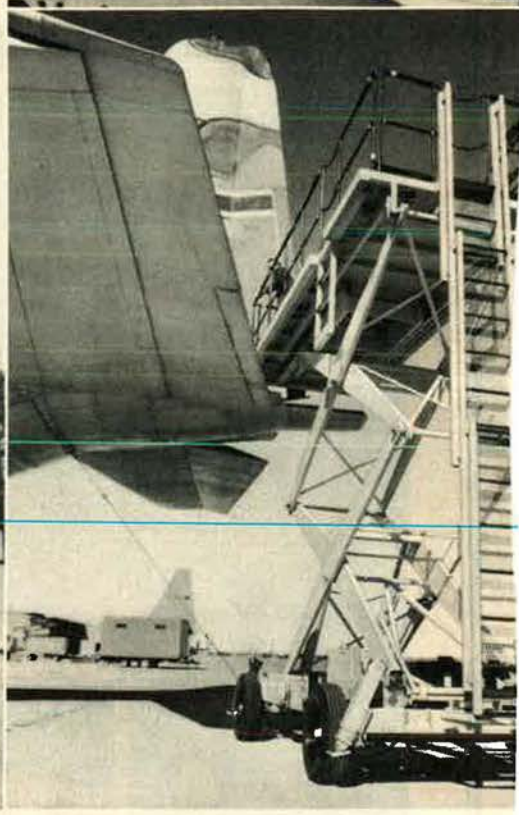

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SA-2 Guideline with Fan Song radar is one of a number of antiaircraft missiles deployed in the USSR and the Pact area.

with early warning equipment, height-finding radars, and associated communications gear generally in the same location. If one radar site is destroyed, other sites in the area could provide continuous coverage.

Antirocket Defense (*Protivo Raketnaya Oborona* [PRO])

Work on an antiballistic missile defense was undertaken at the same time the first offensive missiles were being tested. As the Soviets deployed units of their Strategic Rocket Forces in the early 1960s, they also tried to construct ABM systems around Moscow and Leningrad. Something went wrong with this early attempt and the effort was abandoned. An ABM, the Galosh, was paraded through Red Square in 1963, primarily to impress foreign attachés. At the same time, huge radars were visible from the two main roads leading from Moscow to the West—one to Leningrad and on to Helsinki, the other through Minsk to Brest Litovsk and Warsaw. The Kremlin leadership apparently wanted to make sure their antiballistic missile efforts were known to the outside world.

An official Soviet military dictionary in the mid-1960s provided the following definition of this element of PVO:

> PRO (antirocket defense)—a component part of PVO, designated for detecting, intercepting, and destroying enemy ballistic rockets in the trajectory of their flights and creating jamming for them. PRO fulfills its mission with the help of antirocket and special jamming equipment.

By the mid-1960s, Soviet spokesmen declared that antimissile systems would become the primary component of PVO Strany. Designers of the Soviet ABM systems, however, had not taken into account the possibility of multiple independently targetable reentry vehicles (MIRVs), which United States scientists had developed in light of Soviet claims for their missile defense system. Moreover, the United States was ready to deploy its own ABM system, "Safeguard," in response to Soviet developments.

MIRVs had made the Soviet ABM, in which the Soviet leadership had placed such great claims, virtually obsolete. There was little purpose in its further deployment, a fact which placed the Soviet leaders, by their own military tenets, in a difficult position. As Marshal Sokolovskiy had explained in *Military Strategy,* ". . . the side which first creates an antimissile defense will have a most important strategic advantage which would allow the threatening of war, or its unleashing, without danger from the enemy's retaliatory strikes." It looked as if the United States would have the first effective ABM system.

The battle that the Soviets had lost in the scientific and technical arena was recouped by skillful negotiations. The Politburo accepted an invitation from Washington to discuss limitations on strategic arms. Concerned with the war in Southeast Asia and unaware of the Soviets' technological deadend in ABM weaponry, Washington failed to follow up its ABM advantage. In fact, one group in the United States, not understanding Soviet military strategy and Soviet concern about the failure of its ABM system, even asserted that the United States scored a victory in the ABM agreement that followed. Any close observer of Soviet defense policies, however, should not be surprised by Melvin Laird's disclosure in 1977 that Moscow's efforts to develop an ABM system are continuing, despite the provisions of SALT I.

Antispace Defense (*Protivo Kosmicheskaya Oborona* [PKO])

Soviet efforts to develop an antispace defense system probably date from the late 1950s, when the United States launched its first satellite. In the 1960s, Soviet antispace concepts and organizational subordination of space defense systems were described as follows:

> PKO (antispace defense)—a component part of air defense (PVO), designed for destroying the enemy's cosmic means of fighting, which are being used for military purposes (in the capacity of a carrier of nuclear

weapons, for carrying out reconnaissance, and so forth) in their flight orbits. Special spaceships, satellite fighters, and other flying apparatuses are the basic means of PKO.

After international agreements banning space-based weapons of mass destruction were concluded in 1967, Soviet writers stopped discussing their own antispace work. At the same time, the Soviet leadership apparently directed that a major effort be made to convince the public that the US was preparing for space warfare, a theme taken up by defense intellectuals at the Soviet research institutes. During the late 1960s, articles in *Military Thought,* the restricted journal of the Soviet General Staff, were particularly vitriolic. The Kremlin's purpose may have been, in part, to justify its antisatellite effort that had been under way for several years.

Soviet leaders have always been extremely sensitive to penetration by any means of the wall of secrecy they have erected around the USSR. Even during détente, the space-based "national technical means of verification" authorized by SALT I have bothered the Soviet leadership. Moscow agreed to such means only to lessen US insistence on on-site inspection. The Kremlin has far less need for on-site inspection in the United States, where Soviet citizens serving in the United Nations can travel freely around the country. In contrast, approximately 325 of the 400 largest Russian cities are closed to foreigners.

The Soviets' principal concern over US space activities doubtless is focused on spaceborne defensive and military support systems. The United States is heavily dependent on satellites for early warning of attack, reconnaissance, and communications. Although disclosure in the mid-1970s of Soviet antisatellite test flights came as no surprise, it has caused considerable reaction in the West. "Thinking about the unthinkable" must now include the possibility of the loss or blinding of satellites that are vital to US deterrent or war-fighting capabilities.

PVO Strany Educational System

The specialized education and training of PVO Strany officers reflect the USSR's commitment to air defense. Most of the career officers are products of four- and five-year "higher military schools" granting both degrees and commissions. The schools—fourteen in all and representing different specialties—are somewhat similar to US military academies and operate exclusively for PVO Strany components (*see box*). Logistical and other specialized support (engineering, communications, chemical defense) is furnished by separate agencies centralized under the Ministry of Defense and hence not taught in PVO Strany's higher military schools.

At age twenty-eight, promising career officers attend either the Govorov Military Engineer Radiotechnical Academy of Air Defense in Kharkov or the Zhukov Military Command Academy of Air Defense in Kalinin. These schools—both three years long—combine elements of both US staff and command and war colleges. Select senior officers attend the Academy of the General Staff, which corresponds roughly to the US National War College.

* * *

In the Soviet hierarchy of military services, the Troops of National Air Defense rank third—below Strategic Rocket Forces and Ground Forces, above Air Forces and Navy. There is a striking contrast between the resources the USSR and the US allocate to aerospace defense. But the Kremlin views their Troops of National Air Defense, along with the Troops of Civil Defense, as major factors in ensuring survival of the Soviet state. Even in this era of SALT, Soviet military doctrine still "requires that the Armed Forces, the country, the whole Soviet people be prepared for the eventuality of a nuclear war." The concept of mutual assured destruction is not a consideration in the Politburo's military planning. ■

SCHOOLS OF THE TROOPS OF NATIONAL AIR DEFENSE

Surface-to-Air Missile Troops

Gor'kiy Higher Zenith Rocket Command School of Air Defense

Opochka Higher Zenith Rocket Command School of Air Defense

Ordzhonikidze Higher Zenith Rocket Command School of Air Defense

Engels Higher Zenith Rocket Command School of Air Defense

Yaroslavl' Higher Zenith Rocket Command School of Air Defense

Minsk Higher Engineering Zenith Rocket School of Air Defense

Radio Engineering Troops

Krasnoyarsk Higher Command School of Radioelectronics of Air Defense

Pushkin Higher Command School of Radioelectronics of Air Defense

Vil'nius Higher Command School of Radioelectronics of Air Defense

Zhitomir Higher Command School of Radioelectronics of Air Defense

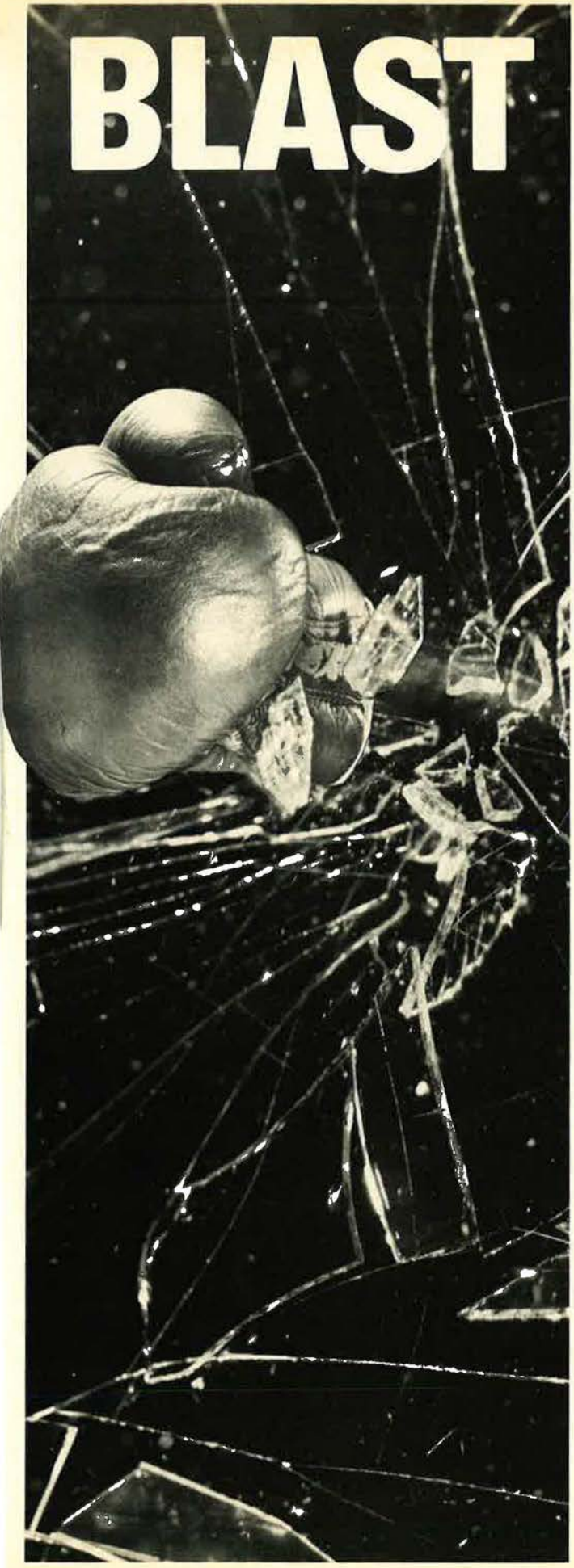
Kiev Higher Engineering Radiotechnical School of Air Defense

Fighter Aviation

Armavir Higher Military Aviation School for Pilots of Air Defense

Stavropol' Higher Military Aviation School for Pilots and Navigators of Air Defense

Daugavpils Higher Aviation Engineering School for Air Defense



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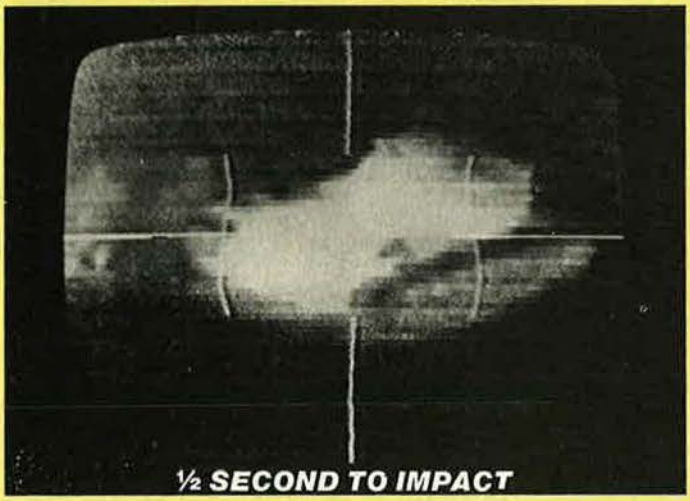

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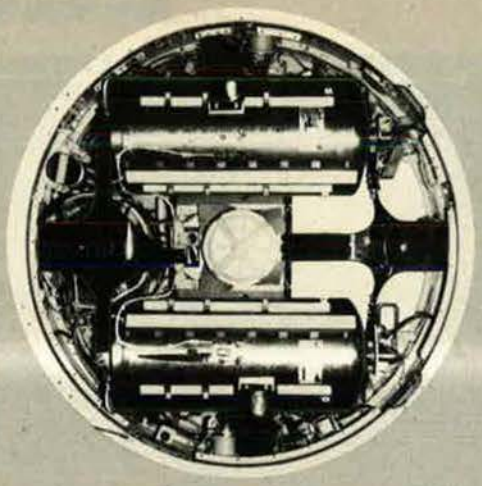

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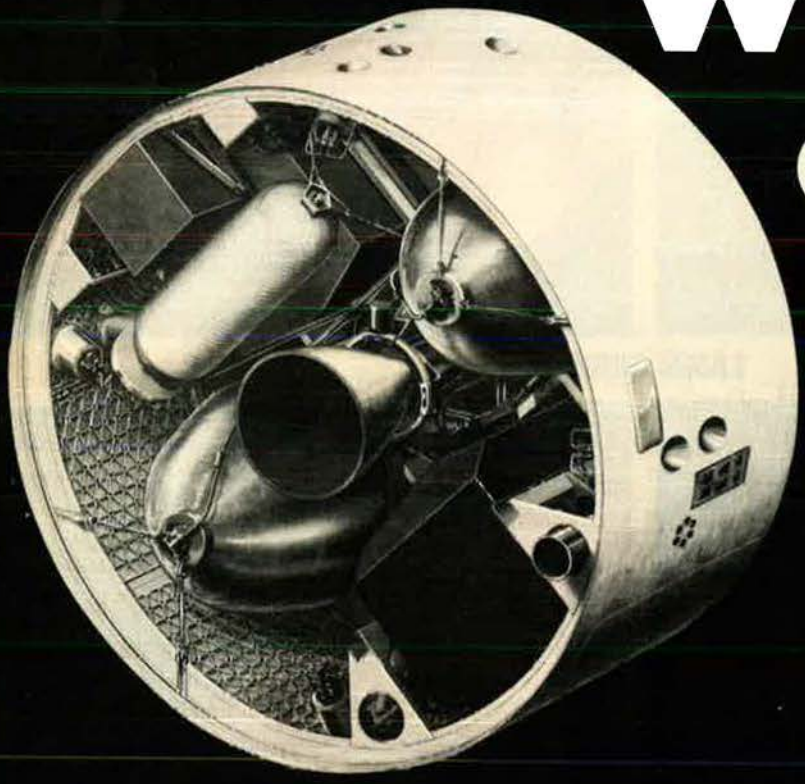

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Soviet Aerospace Almanac

In the 1976 Soviet Aerospace Almanac issue, the author described the organization and mission of the Soviet Navy's air arm. Here is a supplemental report on the new carriers and land-based aircraft of . . .

SOVIET NAVAL AVIATION

BY NORMAN POLMAR

IT HAS now become evident that the Soviet Union is committed to constructing a number of large aircraft carriers of the *Kiev* class, or of improved and probably larger ships.

The *Kiev* herself, the first Soviet "aircraft carrier," has recently returned to the Black Sea-Mediterranean theater after almost a year and a half in the Soviet Northern Fleet. Return of the 925-foot, 37,000-ton ship to the Med again raises the question of why the Soviet Union is building these "flattops"—the largest and most expensive warships ever constructed in the USSR.

Several theories of her purpose have been advanced by Western intelligence analysts: an antisubmarine ship; an escort ship for Soviet ballistic missile submarines; a multipurpose or "attack" carrier on the Western style; or a "sea-control" ship for operation in distant areas the Soviets could not reach with land-based air, such as the Indian Ocean or South Pacific.

The assignment of the *Kiev* to the Northern Fleet in Arctic waters from August 1976 until December 1977 gave credence to analysts who believed the *Kiev* has a primary role of protecting Soviet SLBM submarines from Western antisubmarine forces. However, there are no Soviet SLBM submarines based in the Black Sea, and none believed to operate in the Mediterranean. Thus, the questions, and debate, will continue.

The Soviets call the *Kiev* a large antisubmarine cruiser (*bolshoy protivolodochny kreyser*), but that does not necessarily indicate her main purpose. Neither can this be ascertained from her weapons and sensors. The *Kiev* has a heavy armament of antiaircraft, antiship, and antisubmarine missiles; antisubmarine warfare (ASW) rockets; multipurpose guns; and torpedo tubes that give her the firepower of the most powerful missile cruiser afloat. In addition, she carries a mix of some thirty-five Yak-36 Forger V/STOL aircraft and Ka-25 Hormone helicopters.

Most of the Hormones so far seen on the *Kiev* are "A" models, configured for ASW with dipping sonars, expendable sonobuoys, and radar, as well as an internal weapons bay for homing torpedoes or depth charges (possibly nuclear). However, some are of the "B" variant for over-the-horizon targeting of the ship's SS-N-12 long-range, antiship cruise missiles. Interestingly, as US disarmament experts debated the development of long-range cruise missiles, the *Kiev* became the ninth Soviet surface warship to carry the Shaddock-type missile, which, in the antiship version, has a range of some 250 nautical miles, and probably double that in the land-attack variant. (Sixteen diesel and twenty-nine nuclear submarines also carry Shaddock-type missiles.)

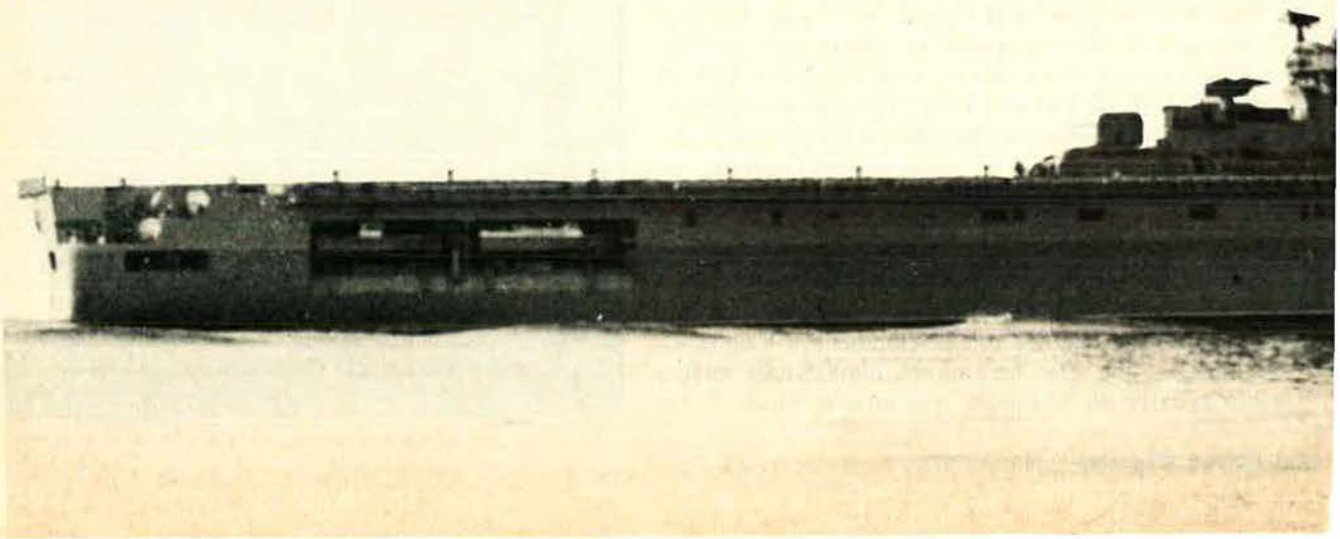
The exact role of the Yak-36 Forger also is not clear. The Forger-A (single-seat) and Forger-B (two-seat) aircraft have been observed in VTOL operations only, but may be capable of short landings and takeoffs as well, and may have transonic speed. Underwing pylons appear capable of carrying air-to-air, antiship, air-to-ground, or even antisubmarine weapons.

Thus, even if the *Kiev* and her embarked aircraft are specialized antisubmarine or submarine-escort ships, their multipurpose armament and possible aircraft mixes provide the Soviet leadership with a variety of operational options. Indeed, several different V/STOL aircraft are known to be under development in the USSR, and the recent transfer of Fitter-C aircraft to the Soviet Naval Aviation (SNA) (*Morskaya Aviatsiya*) indicates a possible close air support or attack role for the Navy. The Fitter-C is a variable-geometry wing, Mach 2-plus (clean) aircraft that can carry almost 8,000 pounds of ordnance. Those that German sources have identified in the Baltic may be for the support of Soviet naval infantry (marine) operations against West Germany and Denmark. Still, this is a new role for SNA, and one that similarly could be projected for the Forger or follow-on V/STOL aircraft flying from the *Kiev* and her sister ships.

Soviet Naval Aircraft at a Glance

Number	Type	NATO Code Name
325	missile attack	Badger, Backfire
50	medium bombers	Badger, Blinder
100	reconnaissance	Badger, Bear-D
several	electronic warfare	Badger, Cub-C
150	antisubmarine	Bear-F, May, Mail
50	fighter-attack	Forger, Fitter-C
350	helicopters	Hormone, Haze, Hound
80	tankers	Badger
150	transports and trainers	

The Soviet Navy uses land-based Tu-16 Badger bombers (above) for a variety of missions. Ka-25 Hormone ASW helicopters (right) are operated from Soviet cruisers, helicopter carriers, and the Kiev.



The Shipbuilding Program

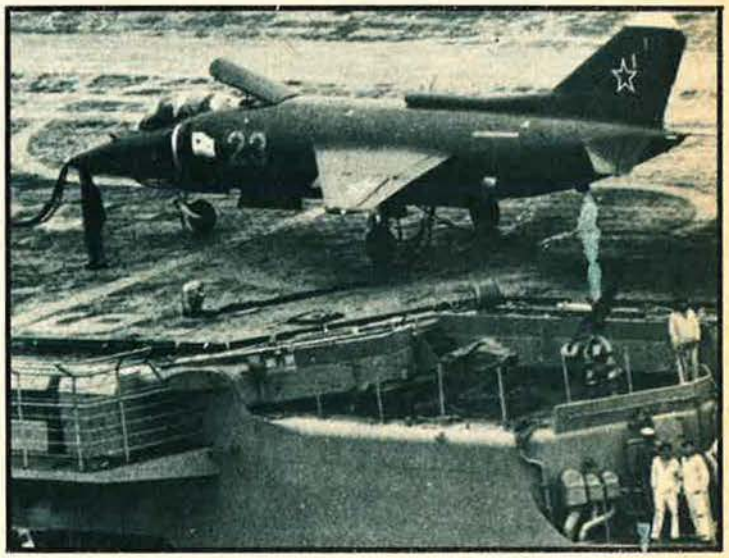
The second carrier of this class, the *Minsk,* is now being completed, and a third carrier—reportedly named *Kursk*—is under construction. Most Western intelligence analysts predict that the Soviets will build additional ships of this or an improved, larger class. A US Navy report of carrier design stated: "It is anticipated that after operational experience with the early *Kiev*-class ships the Soviet Union will develop still larger carriers to gain the benefits that accrue to larger ship design (*e.g.,* the greater aircraft, aviation fuel, and aviation ordnance capabilities)."

This is not to predict, however, that the Soviets will produce ships as large as the 94,000-ton, nuclear-propelled carriers of the *Nimitz* class, the US Navy's latest design. Soviet design practices, mission requirements, and shipyard capabilities are different. Also, the *Nimitz* is configured for conventional aircraft operations, with arresting wires and catapults. The research and development, operational experience, and training for this type of carrier operations would be too expensive and take the Soviets too long, in view of the potential of near-future V/STOL aircraft.

Rather, the later *Kievs* and the next Soviet carrier class probably will be V/STOL ships, and possibly even be capable of supporting an operational version of one of the various ground-effect vehicles now being tested by the Soviets. This technology offers certain advantages of both aircraft and air-cushion vehicles.

The Soviets can be expected to produce other aircraft carriers at the rate of one ship every three years using only the sprawling Nosenko shipyard, near the Black Sea. At least one other Soviet shipyard, at Leningrad, is believed capable of building ships of this type.

The existing carrier building rate should not affect the construction rates for other types of warships. For the past decade, Soviet shipyards have produced an average



At top, a long-range Tu-95 Bear-D Navy reconnaissance bomber. Right, a Yak-36 Forger-A on the flight deck of the Kiev. *Below, the* Kiev *cruising in the Mediterranean.*

Though not designed for intensive air operations, the Kiev *can carry up to thirty-six V/STOL fighters and ASW/electronics helicopters.*

of two missile cruisers and two small missile destroyers per year, plus numerous lesser surface warships, ten nuclear-propelled submarines, and a small number of advanced conventionally propelled subs.

This rather extensive warship building effort, coupled with a large and aggressive merchant ship and fishing craft program, demonstrates the Soviet leadership's interest in exploiting the seas for Soviet political, military, and economic purposes. At the same time, as noted in other articles in this issue, the Soviet air and missile arms have not been neglected, nor have the Soviet ground forces. But the high cost of naval ships in time, rubles, and industrial resources must be interpreted as evidence that the Kremlin leaders have a special interest in sea-based weapons.

New Aircraft

Beyond aircraft carriers, other aspects of Soviet Naval Aviation have not been neglected. The Navy continues to operate more than 1,250 aircraft (*see box, p. 67*).

The most significant developments during the past few years with respect to aircraft are the Forger and Fitter-C acquisition, the introduction of an "F" variant of the ubiquitous turboprop Bear for ASW operations, and the Backfire. The swingwing Backfire continues to enter SNA, with some estimates indicating SNA is assigned the majority of those being produced.

In the antiship strike role, the Backfire can carry two antiship missiles on flights far out over the Atlantic, Pacific, or even Indian Oceans, presenting a considerable threat to Western naval and merchant shipping. Indeed, the range and supersonic dash speed of the Backfire, coupled with standoff missiles having conventional or nuclear warheads, can be considered the major Soviet threat to the US surface fleet. Only the F-14 Tomcat with its long-range Phoenix/AWG-9 intercept system, and the planned Aegis shipboard radar/missile system are generally considered as having a viable capability against the Backfire. However, only seven of the Navy's thirteen carriers have F-14 squadrons (twenty-four aircraft per ship), and the first Aegis-armed destroyer will not be completed until 1982 *at the earliest.*

Beyond its antiship capabilities, the Backfire has the likely potential for special missions such as quick, accurate strikes against European ports or airfields to destroy US sealift/airlift reinforcement options, and even air intercept of transport aircraft flying across the North Atlantic during a NATO conflict.

The introduction of these new aircraft into SNA and the massive carrier construction effort make Soviet Naval Aviation a vital factor in assessing Soviet aerospace capabilities. ■

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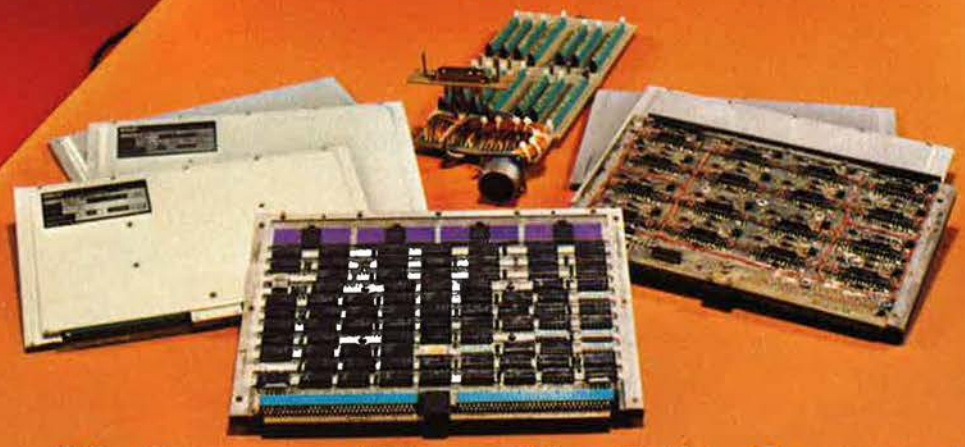

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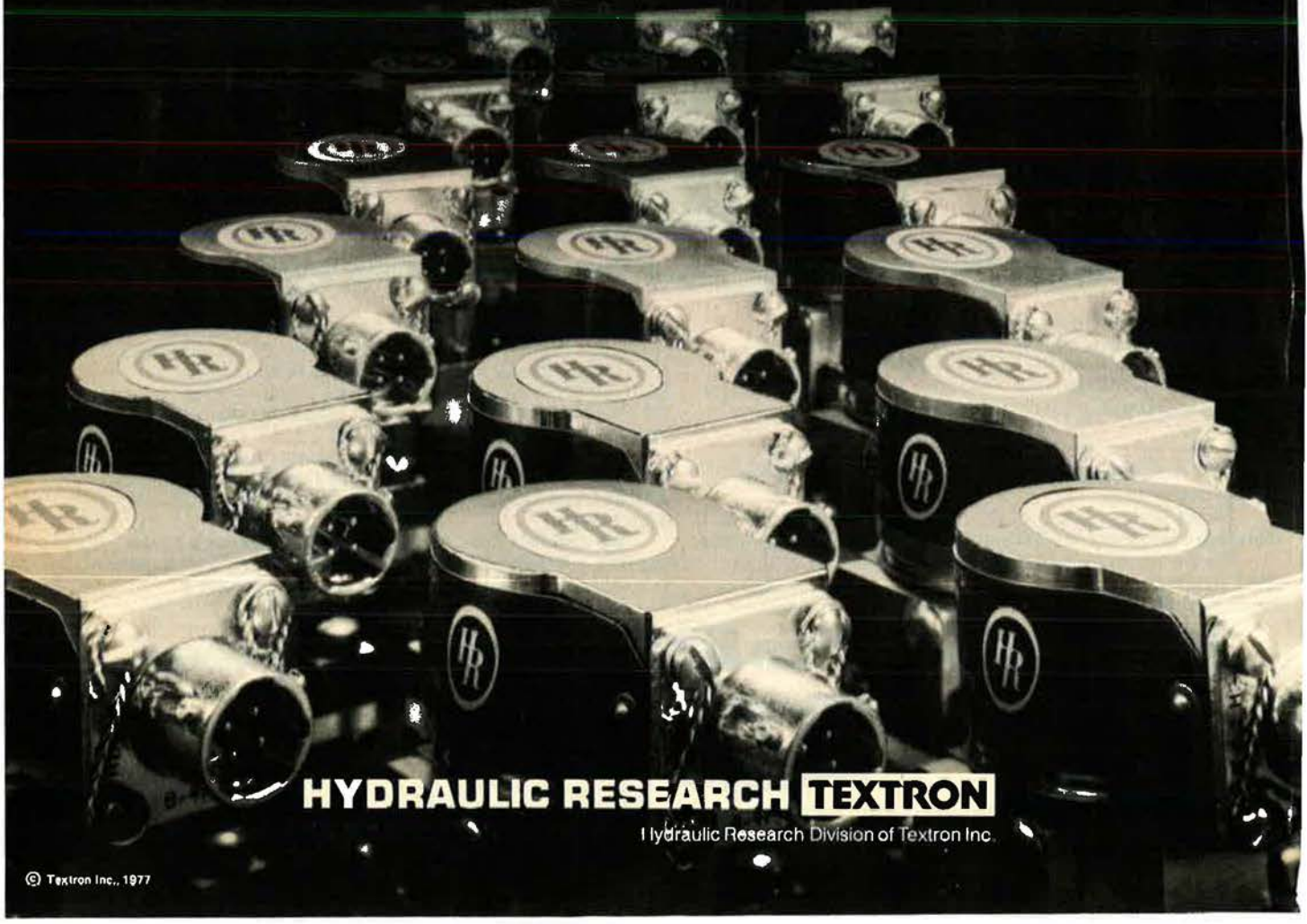

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Soviet Aerospace Almanac

During its twentieth year of spaceflight, the USSR again had about four times as many launches as the US. There were improvements in several continuing programs and a few surprises among . . .

SOVIET SPACE ACTIVITIES IN 1977

BY CHARLES S. SHELDON II

THE YEAR 1977 marked the twentieth anniversary of Sputnik-1. During the two decades since that event, the Soviet space program has maintained a fairly consistent growth trend to its present high level of activity. For the last several years, the Soviet Union has made about four times as many launches to orbit as the United States. The Soviet program is dominated by its military cast, although the much smaller number of civilian-purpose missions exceeds such flights by the US National Aeronautics and Space Administration.

Quantitative comparisons between the two dominant space-active nations are reasonably accurate indications of the level of effort and general capability to perform successful launches to particular orbits. Much more difficult are judgments as to the quality of results and effectiveness of particular programs. It is reasonable to conclude that in several respects the United States program has been more successful than the Soviet one. But, because of the broad capability the USSR has demonstrated it can maintain, this should not lead to complacency. Also, there is a tendency to assume that programs not conducted "our" way are necessarily inferior. Such judgments would be dangerous. The real question is: Do the Soviet methods give them useful results that satisfy their purpose? For the most part, they probably do, since the Soviets continue to assign a high priority to their space effort, and they are capable of reaching selected objectives.

Ground-Support and Launch Vehicles

During 1977, there was no very marked change in the logistics base of the Soviet space program. Plesetsk, the Arctic launch site north of Moscow, which most closely parallels in purpose the US Western Test Range launch facilities at Vandenberg AFB, Calif., conducted sixty-nine successful orbital flights. Tyuratam in Kazakhstan, equivalent to the Florida launch facilities of the Eastern Test Range at Cape Canaveral, Fla., made twenty-seven such flights, and Kapustin Yar on the lower Volga (like a combination Wallops Island, Va., and White Sands, N. M.) launched two orbital flights.

Information on research, development, and manufacturing facilities is hard to come by. Visitors to Star City near Moscow see signs of added construction within the grounds of this training center for cosmonauts.

Worldwide tracking and communication with spacecraft outside the Soviet Union is provided by well-equipped ships with large parabolic antennas, scientific and technical staffs, and much electronic gear. The existing three large tracking ships, named respectively for former space leader Korolev and for dead cosmonauts Komarov and Gagarin, were joined in 1977 by the Volkov, first of four new support ships also to be named for dead cosmonauts.

During 1977, the "A"-class launch vehicle (used for flights ranging from Sputnik-1 through Soyuz-26) was used successfully fifty-four times—thirty-eight from Plesetsk and the balance from Tyuratam. The "C"-class vehicle, a smaller, all-purpose launcher, was used successfully twenty-eight times—twenty-six from Plesetsk and two from Kapustin Yar. The "F"-class vehicle, derived from the powerful SS-9 ICBM and used strictly for military missions, was launched seven times from Tyuratam. The "D" vehicle, also called Proton, and the largest of currently available launchers, was used four times at Tyuratam. The smallest of the launchers, the "B"-class, was used twice at Plesetsk. Finally, at Plesetsk, three more launches were made at a new inclination into orbital patterns not matching any known mission. Tentatively, this suggests something different in the way of launchers, either totally new or a variant of one of the existing vehicles.

Activity Levels by Program

It is much harder to provide a sure count of the number of payloads orbited than of the number of launches because of definitional problems and incomplete reporting; the former tend to require adjustment over some months following original launch. A given launch may carry more than one payload, which explains why there may have been as many as 125 payloads from the ninety-eight launches of 1977. Deducing missions of each payload has to be speculative in many cases; the Soviet announcement of a launch, while giving date and orbit attained, usually does not include the purpose of the flight.

Military Observation

Large payloads in low circular orbit which are typically recalled to earth after about fourteen days make up

the most important single part of the military observation program. An improved version is in flight development and can stay up thirty days, which in turn probably requires a new method for returning some data, such as carrying extra capsules. This technique was used twice in the space station program, the Soviets announced. Of the thirty-three observation flights during the year, two were specifically announced as earth resources flights. These differ from the US Landsats, which operate for years, returning all data by radio, while the Soviet version lands with its film after two weeks.

Science

This may be the second largest category at perhaps fourteen payloads, although only three were specifically identified as scientific, and all these carried at least some non-Soviet experiments (Sneg-3, Prognoz-6, and Interkosmos-17). There were three Kosmos flights of unidentified purpose that did not fit known military patterns, but which were similar to past scientific flights. Additionally, there may have been as many as eight piggybacks, usually on military observation flights, but this estimate, based on past patterns, exceeds the count of such announced supplementals actually reported so far by the British Royal Aircraft Establishment, which is a principal publisher of such data.

Store-Dump Communications

Two single payloads and eight additional multiple payloads put up by a single launch vehicle for a total of ten match the orbits of flights in other years that seemed most likely to be used either to pick up, tape record, and later play back messages, or to be used for real-time message transfer in a particular theater.

Navigation and Geodesy

Some nine flights were in this category, operating like the US Transit program on 150 and 400 megacycles. Of these, two did not fit the regular pattern of orbital placement and may have been geodetic satellites, based upon past analysis.

Regular Communications

A total of eight named flights included six Molniya payloads distributed among the -1, -2, and -3 categories (some civil and some military), for the most part serving as replacements for failed payloads already in orbit. These eccentric orbit flights, inclined at about sixty-three degrees to the equator, were joined by Raduga-3 and Ekran-2, both in geostationary orbit, a class of mission the USSR has had to work harder and longer to achieve than has the United States.

Electronic Ferret

There were eight payloads, put up in regular orbital patterns by either the "C" or "A" vehicles. These payloads were largely replacements of earlier flights that previous analysis of orbital characteristics and behavior suggests are ferrets.

Inspection/Destruction Program

This program included seven flights—three targets and four interceptors. While not now illegal, the flights have caused the greatest public concern of any made during the year because of their potentially destabilizing influence on arms-control arrangements between the Soviet Union and the United States. Two of the targets were in eccentric orbits, one between 1,000 and 2,000 kilometers' altitude, the other between 150 and 900 kilometers, while the third target was at about 1,000 kilometers in circular orbit. Reports on the degree of success in interception and destruction are equivocal and come from usually unnamed spokesmen or sources in the US Department of Defense.

So far, no intercepts have involved flights above about 2,000 kilometers, so that interference with early warning or communications satellites has yet to be demonstrated as a capability of such weapons. However, should a decision be made to interfere with lower flying satellites of another space-launching nation, the Soviet capability now exists.

DISTRIBUTION OF SOVIET SPACE PAYLOADS BY PUTATIVE PROGRAM 1957–1977

Possible Mission	*1977*	*(1957–1977) Cumulative*
Military Recoverable Observation	33	395
Communications	18	238
Earth Orbital Science	14	133
Minor Military Mission (which could include some environmental monitoring, radar calibration, or electronic ferreting)	5	108
Navigation and Geodesy	9	63
Electronic Ferreting	8	57
Weather Reporting	4	45
Earth Orbital, Man- or Biology-Related	2	39
Earth Orbital, Manned	4	37
Unmanned Lunar Related	0	34
Venus Related	0	23
Ocean Surveillance	3	19
Fractional Orbital Bombardment	0	18
Mars Related	0	16
Inspector/Destructor	4	15
Targets for Inspection	3	14
Early Warning	3	11
Engineering Test	3	9
Lunar, Man- or Biology-Related	0	8
Orbital Launch Platform	12	161
TOTAL	125	1,443

Minor Military Missions

Some five flights are in the category of an unspecified minor military mission, put up by the "B"- or "C"-class small launch vehicles. These were probably replacements of earlier payloads, used for environmental monitoring, radar calibration, or component testing.

Weather Satellites

There were four Meteor satellites, divided between the -1 and -2 classes, and one of the flights was for the first time placed in a retrograde, sun-synchronous orbit, a pattern favored for many years by similar US satellites, but new to the Soviet program.

Manned Flights

In February 1977, Soyuz-24 carried two cosmonauts on an eighteen-day flight to the Salyut-5 military space station. In late September, the Salyut-6 mostly civilian station was placed in orbit. Military stations fly in a lower orbit, presumably carrying high-resolution camera systems, using all-military crews, and transmitting in modes similar to other known military flights. Civilian stations fly higher, have more readily interpretable open communications, and have a mixed crew of military pilot and civilian technician or scientist. In October, Soyuz-25 was launched, made a rendezvous with Salyut-6, but docking was not completed, and the crew came home two days after launch to receive minimal honors. Another launch, Soyuz-26, was still docked to the Salyut-6 station at the end of the year. (In January 1978, the Soviets achieved an unprecedented double docking with the flight of Soyuz-27, whose crew returned to earth in Soyuz-26 after a short stay. *See also "Aerospace World," p. 20.*)

HISTORICAL TABLE OF SUCCESSFUL LAUNCHES TO EARTH ORBIT OR ESCAPE

Year	United States	Soviet Union
1957	0	2
1958	5	1
1959	10	3
1960	16	3
1961	29	6
1962	52	20
1963	38	17
1964	57	30
1965	63	48
1966	73	44
1967	57	66
1968	45	74
1969	40	70
1970	29	81
1971	31	83
1972	31	74
1973	23	86
1974	22	81
1975	28	89
1976	26	99
1977	24	98
TOTALS	*699	1,075

* *US launches include four by Italy for the United States*

Ocean Surveillance

The flights to develop surveillance of ocean shipping continued in the pattern of earlier years, using the "F"-class vehicle, one payload—judging by its orbital placement—apparently for ferreting, and the others making a pair, presumably using active radar to provide an all-weather capability. The operational application is incomplete, however, as these radar payloads operate for only weeks or a few months at best before they shut down, leaving most of the year uncovered by any such capability.

Early Warning System

While in an earlier year one Soviet flight placed in geosynchronous orbit may have served an early warning purpose, the more typical pattern followed was that of the three flights in 1977 that went into eccentric, inclined orbits as if they were Molniya communications flights but with Kosmos designators. They were not failed Molniyas because they were not put into the ground-trace pattern of the other Molniyas that have a fixed orbital relationship to each other. The deduced mission of these flights is early warning.

Possible Vehicle Tests

As mentioned earlier, three flights from Plesetsk cannot be described with any certainty as to mission. Kosmos-921 was in circular orbit at roughly 700 kilometers and seventy-six degrees inclination. Kosmos-956 was at a similar inclination, but the orbit varied between about 150 and 900 kilometers' altitude. Kosmos-972, at the same inclination, was placed in an orbit between about 700 and 1,200 kilometers' altitude. The one obvious common factor is the shared seventy-six degrees' inclination that is unique to these flights, and raises the possibility of a new vehicle.

Other Man-Related or Biological Flights

Kosmos-936 was a recoverable satellite that carried biological experiments, including some supplied by the United States, as part of a continuing program of some years' standing.

Kosmos-929 is of special interest, and may be related to the Kosmos-881 and -882 pair placed in orbit the year before. Both launches used the large Proton or "D" vehicle. In 1976, observers were intrigued by the pair that apparently were recovered at the end of the first revolution. In 1977, another strange flight occurred, namely Kosmos-929. In contrast to Kosmos-881 and -882, launched on a single vehicle, the new flight was announced as a single payload, but observers worldwide discovered there were two sets of telemetry which alternated every thirty minutes on the same frequency channel. This probable double payload operating as a single vehicle was placed in orbit in mid-July 1977 at between 300 and 200 kilometers' altitude, and remained active at the end of the year. In December, it was maneuvered to a higher altitude. Until some new program is unveiled one can do little more than speculate as to the purpose of these tests. Orbital placement and telemetry would seem to associate both launches with the manned program.

Orbital Launch Platforms

Finally, twelve Soviet flights during the year employed the orbital launch platform technique as an intermediate step to placing payloads in their final orbits. By some reckonings, these platforms can be counted as a form of payload, rather than just as debris; they are separate and distinct from the upper-stage rockets that also are abandoned in low earth orbit.

New Developments and Trends

Most of the specific new developments that attract public attention have been dealt with in the preceding section of this review. In summary, the most interesting and novel developments have been the first retrograde orbit used for the Meteor weather satellite, the not-yet-understand-

able purpose of Kosmos-929 and whether it is tied to the also strange pair of the year before, and, finally, the three new flights at seventy-six degrees' inclination. Do these last represent a new vehicle combination, and what might prompt their introduction at this time? If an earlier vehicle is being used, why have three flights with different altitudes been flown at a new inclination? It may take some time to answer these questions.

But the development of the year that has received the most public attention is nothing new; rather it is a continuation of the tests of the year before—launching targets, against which Soviet interceptors practice. US concern over this activity is natural, considering the potential for trouble. It comes during a period when new negotiations are under way with the USSR to limit activities that could be pointed toward destruction of the "national technological means" for policing arms agreements.

Outlook for the Future

The Soviet space program continues at a very high level, though 1977 fell one short of the number of successful flights conducted the year before. Both years represent the highest space activity of any country in any year. This is true despite one anomaly in 1977: In November there was only one launch. During that month, there was a twenty-seven-day pause with no evidence of any launches, a period of inactivity unheard of in recent years. No explanation has been offered by Soviet space officials, but the number of launches in other months was so high as to all but wipe out the November decline.

Many organizations will be watching with concern the further development of the Soviet space intercept capability, and perhaps bilateral agreement will bring these activities to an end.

Overall, there is no reason to expect that the Soviet space program will be cut back. The biggest question cannot be answered satisfactorily today: Will the 1979 arrival of the American reusable space transportation system be matched by a corresponding Soviet capability? If it is, space activity in both nations may move to a new, higher plane of quantity and significance for both military and civilian ends. If the United States alone has a Space Shuttle in existence, then the two major space programs may begin to diverge, and the US program may become the stronger and more active of the two. These possibilities are not lost upon Soviet authorities, and the respective states of advanced technology in each country may be in for a time of testing. ■

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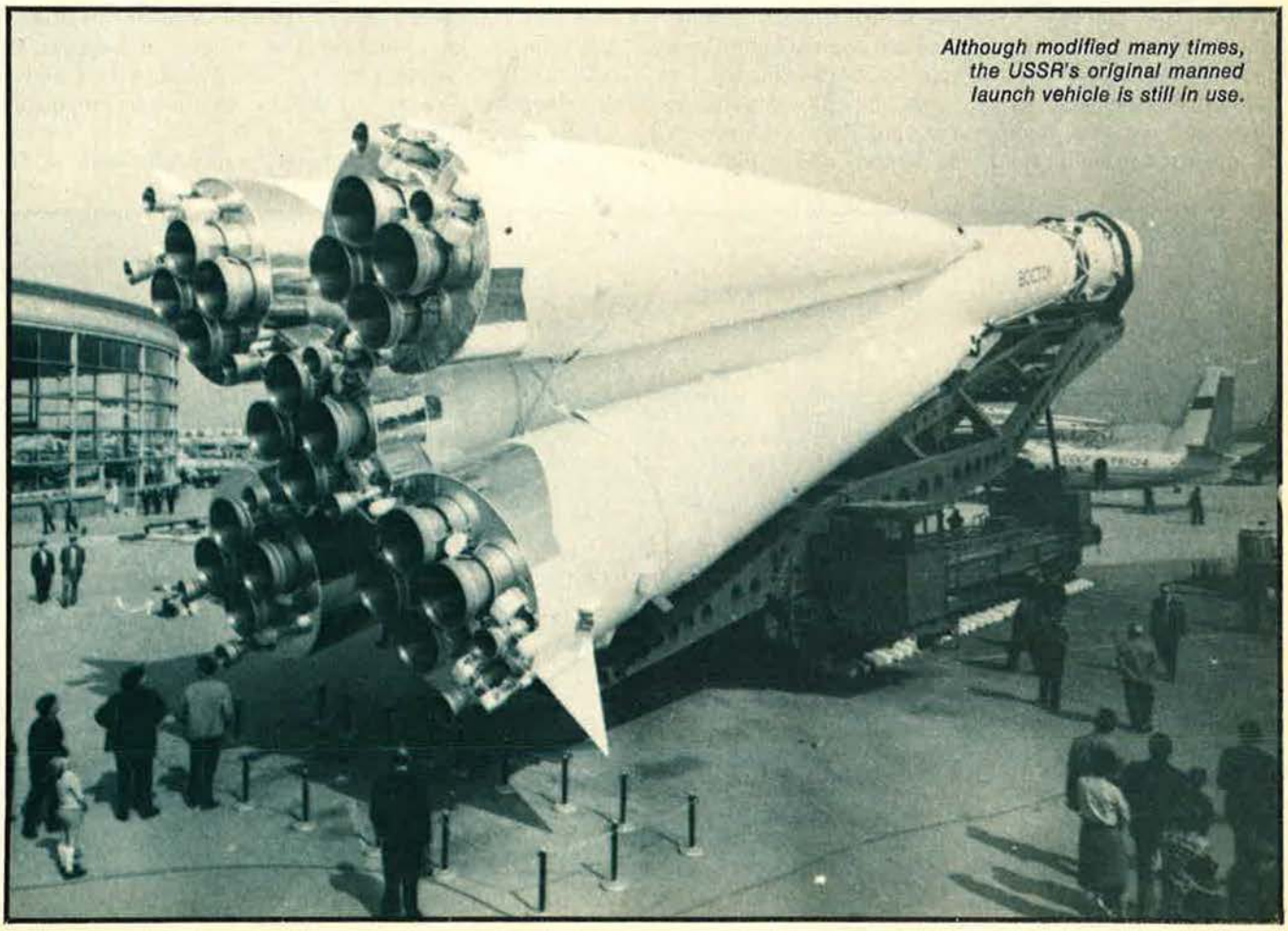


Although modified many times, the USSR's original manned launch vehicle is still in use.

Mobile AA systems of the Soviet Ground Forces support their concept of the offensive, free Frontal Aviation to exploit its improved operational capabilities, and create new problems for US/NATO tactical air forces.

AIR DEFENSE OF SOVIET GROUND FORCES

BY COL. DANIEL K. MALONE, USA

IN 1970, a book entitled *Nastuplenye (The Offensive),* written by Soviet Col. A. A. Siderenko, was published in Moscow. It described Soviet tactical-operational doctrine and spelled out the roles of air and ground forces and of nuclear weapons in a war against NATO. Colonel Siderenko's book was translated into English as the lead-off in the US Air Force series "Soviet Military Thought."

Siderenko described armored assaults across a broad front, spearheaded by independently maneuvering columns advancing 100 kilometers a day, maintaining wide gaps between the columns to avoid destruction by NATO's nuclear weapons, rapidly crossing radioactive fallout zones in their radiation-protected vehicles, exploiting the gaps created by the Red Army's own nuclear weapons, and bypassing the vast floods, fires, and destruction created by nuclear detonations. All else was to be subordinated to exploiting the confusion of the gigantic battlefield and maintaining the tempo of the attack.

It is doubtful, however, that, at the time of writing, the dispersed columns described by Siderenko could have avoided defeat in detail, especially by NATO airpower in either nuclear or nonnuclear conditions. Soviet Ground Forces did not then have adequate means of air defense. That deficiency has since been remedied by advances in Soviet technology and the continuing production of air defense systems.

It may be that the author, as well as other Soviet military analysts, knew such weapons soon would appear. As early as 1966, another book, *Tank Battalion in Combat,* described the role of "air defense means" accompanying a battalion in march column.

The ZSU 23-4 self-propelled, radar-directed, 4,000-

The SA-4 Ganef has the longest range of any PVO SV system—about seventy km. It can be airlifted by the An-22 transport.

PVO SV AIR DEFENSE SYSTEMS

GUNS	Associated Radars	Rounds per Minute	Effective Range
wed:			
.5-mm single, dual, quad KPV	n/a	600 per barrel	1,400 meters
-mm dual ZU-23	n/a	800-1,000 per barrel	2,500 meters
-mm S-60	PUAZO (gun director) and radars	120	6,000 meters
lf-Propelled:			
-mm ZSU 23-4	On-board radar with optical backup	1,200	3,000 meters
-mm ZSU 57-2	Similar to S-60	240	4,000 meters

MISSILES	Associated Radars	Altitude	Slant Range
A-2 Guideline	Fan Song E	24.4 km	45 km
A-4 Ganef	Surveillance radar plus Pat Hand for control	24-28 km	70 km
A-6 Gainful	Straight Flush	low-medium	35 km
A-7 Strela	IR homing	3,050 meters	3.5 km
A-8 Gecko	Self-contained acquisition and control	6,100 meters	10-15 km
A-9 Gaskin	IR homing	low	7 km

In a combined-arms offensive, Soviet Ground Forces units executing blitzkrieg movements would be lavishly equipped with a wide variety of antiaircraft guns and missiles.

round-per-minute gun system was publicly displayed in 1965 while the authors of *Tank Battalion* probably were still writing. A scant year after publication, the SA-6 Gainful, a track vehicle-mounted SAM system, paraded across Moscow's Red Square.

Within five years after *The Offensive* was published, the Soviets were so certain of success with follow-on systems to defend their Ground Forces that they exported the SA-6 and ZSU 23-4 to the Mideast, publicly paraded the newer SA-8 and SA-9, and installed an improved SA-7 on new mobile carriers. Both books demonstrate that Soviet open-press doctrinal sources offer the reader valid, accurate, and often predictive information.

These highly mobile tactical air defense systems—and others to be described later—are assigned to a major branch of the Soviet Ground Forces, the troops of air defense of the Ground Forces (*voiska protivovozdushnoi oborony Sukhoputniykh Voisk*, abbreviated as PVO SV). They are not a part of Soviet Troops of National Air Defense (PVO Strany), described in the article beginning on p. 56, but are formed into units subordinate to Ground Forces regiments and divisions.

The air defense systems now operated by PVO SV present a direct and serious challenge to our own NATO doctrinal requirements. Equally challenging, these systems, together with dramatic improvements in Soviet tactical aircraft, have enabled the Soviets to reduce the air defense role of Frontal Aviation—the tactical element of the Soviet Air Forces—and increase the emphasis on its ground support functions.

In the last six years, Soviet technology incorporated in third-generation tactical aircraft has quadrupled both their payloads and payload/range capabilities. Frontal Aviation is now able to carry out the ground support role spelled out in *The Offensive*, while the Ground Forces' organic air defense weapons have become the principal means of defending Soviet troops in the field from air attack.

Though it may not have been entirely accurate in 1970, what Colonel Siderenko wrote in *The Offensive* is true today:

> The means of troop air defense have now become qualitatively different. Their basis is the antiaircraft missile and antiaircraft artillery complexes which coordinate with the rocket-carrying fighter-interceptors. . . .
>
> As a result of the successes attained in the development of aviation, its combat capabilities and especially the power of its strikes increased sharply. . . .
>
> The most important [mission of Frontal Aviation] is the destruction of the enemy's means of nuclear attack.

The principal air defense systems that have made this transformation in Soviet offensive tactics possible include the ground-to-air missiles and antiaircraft guns described briefly in the paragraphs that follow. Additional technical information may be found in the "Gallery of Soviet Aerospace Weapons," which begins on p. 93.

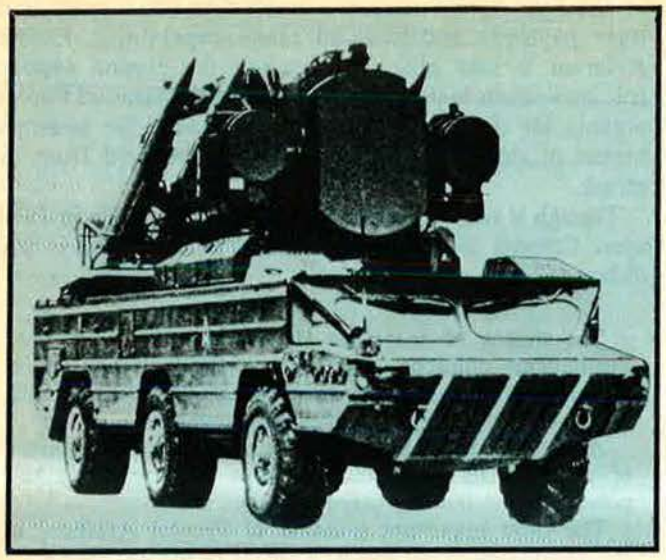
The SA-6, designed for the leading echelons of an offensive, mounts launcher and radar/control systems on separate tracked vehicles. Linking them by radio, rather than by the extensive cabling of the US HAWK, may surrender some precision, but matches response time and mobility to the tempo demanded by the Soviet concept of an offensive.

The latest PVO SV addition, the SA-8 Gecko, reaches a step beyond, mounting missiles, radars, and guidance on a single vehicle. Paraded through Red Square in 1975, the SA-8's wheel-based design indicates proportional steering, operator adjustable tire pressure to aid maneuver in mud and snow, a high road speed, and amphibian capability. The SA-8 is believed able to fire two missiles under independent control.

The SA-9 Gaskin, displayed the same year, provides a high mobility intermediary between the ZSU 23-4 Shilka and the SA-6 and SA-8. The SA-9 packs four probably upgraded SA-7s on a powered turret fitted to the BRDM-2 armored car. Internally adjustable tire pressures, plus auxiliary wheels that can be lowered for extra traction or crossing obstacles, give high land mobility. Hydrojet propulsion and filtration of the crew space to exclude radioactive dust enables the SA-9 to cross rivers and zones of radiation along with the forward columns of tanks and troop carriers. Mounting SA-9 on the BRDM—which is used as scout car, antitank missile launch vehicle, and for radiological-chemical reconnaissance—extends standardization in the vehicle fleet, provides maneuverability for SAM defense, and keeps open a hot production base for mobilization expansion of all the BRDM's applications.

Evolution of Soviet Tactical Air Defense

While the Soviet Armed Forces have not been involved in combat of any significant scale since World War II, it would be foolish to underestimate their expertise in air



The SA-8 Gecko appears to be designed for high acceleration and maneuverability, rather than range.

defense. The development of Soviet concepts, doctrine, and tactics goes back at least to the early years of World War II, and their air defense technicians have had extensive recent experience in Southeast Asia and the Mideast.

Two lines of development of Soviet air defense systems —mobility and deployment in mass—spring from scrupulously studied World War II experience. As early as 1941, according to the bible of Soviet military thought, *Voyennaya Strategia (Military Strategy)*, all means of air defense—machine guns, AA artillery, and interceptor aircraft—were combined into a single PVO organization to optimize the system of control.

The purpose of unifying PVO was to provide for "rapidly concentrating power and means of [air defense] along the main axes with the objective of covering the forces [*voysk*] and more important objectives on the territory of the country [*strany*]."

In the years after World War II, the spread of nuclear weapons; the consequent severe increase in the threat to armored troop formations; the ground element's growing need for fast, independent operation; and the high level of production of air defense weaponry led in 1958 to a formal division of responsibilities into air defense of the country (PVO Strany) and air defense of the Ground Forces (PVO SV).

Air defense engagements involving Soviet equipment that American airmen have witnessed or experienced during recent years form an excellent bridge from past to present to future Soviet theater air defense weapons and tactics.

Over North Vietnam, US aircraft were pitted against a full range of single, dual, and quad ZPU 14.5-mm machine guns, 23-mm single- and dual-mount cannon, and the S-60 57-mm, seventy-round-per-minute gun—a post-World War II development employing radar and fire-control directors and delivering effective fire out to 6,000 meters. These guns will remain in Soviet/Warsaw Pact service for a long time to come.

The field mobile SA-2 Guideline, backbone of North Vietnam's missile air defense, employed Fan Song A through D radars. The current Fan Song E used in conjunction with the extensive SA-2 net of Warsaw Pact PVO SV incorporates electronic counter-countermeasures (ECCM) features that could overcome some of the electronic measures used by US airmen against the older models.

The guns and SA-2s that the USSR supplied North Vietnam represented the 1950–60 era perfection of air defense art when speed and maneuverability of jet aircraft plus electronic countermeasures (ECM) were capturing the technological lead. Concern for technical secrecy did not deter the Soviets from providing these weapons in traditional mass. More than 6,000 large-caliber AA guns ringed Hanoi, about half of them radar controlled. That was approximately three times as many guns as defended Berlin at the peak of the World War II Allied bombardment. Some twenty-six SA-2 battalions manning about 156 launchers engaged US B-52s in Linebacker II, the final December 1972 air offensive.

The 1973 Mideast war witnessed the first engagements exemplifying the PVO tactics described by Siderenko in *The Offensive*. That war also saw the largest armored battle since the World War II battle of Kursk, where 13,200 tanks and self-propelled guns were employed.

Egypt's PVO must certainly have represented Soviet practice. The Soviets staffed and operated a PVO District in Egypt, incorporating 250 SA-2 Guidelines, twenty-two SA-3 Goas, and many SA-6s, all at least partially manned by Soviet advisors. Soviets piloted 100 MiG-21Js and an additional MiG-23 squadron comprising the aviation element of the District, whose commander was no less than Soviet Colonel General Okunev, detached from duties as commander of the Moscow PVO District to head Egypt's air defenses. SA-6s, ZSU 23-4s, AA artillery, and machine guns were densely distributed among all Arabic ground forces that opposed the Israelis.

In the Mideast war, the SA-3 Goa, low-altitude complement to the SA-2, supplemented the other systems in an overlapping of PVO Strany and PVO SV, a likely model for future replication.

SA-2s and SA-3s pushing along behind the armored columns helped usher in the new dimension of mechanized

Mounted on a modified PT-76 tank chassis, the ZSU 23-4 Shilka can be aimed and fired on the move.

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warfare achieved by Arabic forces. But it was the ZSU 23-4 Shilka and the SA-6 Gainful moving with the forward echelons that drew the headlines.

Although surprised by the effectiveness of the SA-6s, most US analysts were not particularly startled by SA-6 technology, but many were incredulous about the performance of the Soviet-built antiaircraft guns. Guns, after all, are very old. But mounting gun-control radars on the same chassis as fast-firing guns was a whole new ball game. The ZSU 23-4 Shilka is credited with about one-third of all Israeli aircraft losses, as well as with filling the low-altitude envelope where missiles are not effective.

The ability to move with the leading tank elements, to slam through underbrush and mud, and to be sufficiently armored to survive in close enemy contact gives guns an advantage up front over more fragile missiles. Moreover, pilots will find it difficult to distinguish the modern *flak-panzer* from its accompanying tanks.

Both the Vietnam and Middle East experiences ring the same tocsin loud and clear: The air defense battle is a battle of attrition. Who wins and who loses is determined by what runs out first—missiles and bullets or airplanes.

The December 1972 B-52 attacks on military targets in the Hanoi area involved about 1,000 sorties in eleven days. Despite the naval blockade and cutting rail lines to China, enough SA-2s had been amassed by the North Vietnamese to salvo up to 100 missiles at a time. US ECM could not cope with these massed attacks, though the "wizard war" was waged by the enemy with the older Fan Song radars. B-52 losses peaked at six on the third and fourth days.

The shoulder-fired, heat-seeking SA-7 Strela (NATO Grail) is effective against low and slow planes and helicopters.

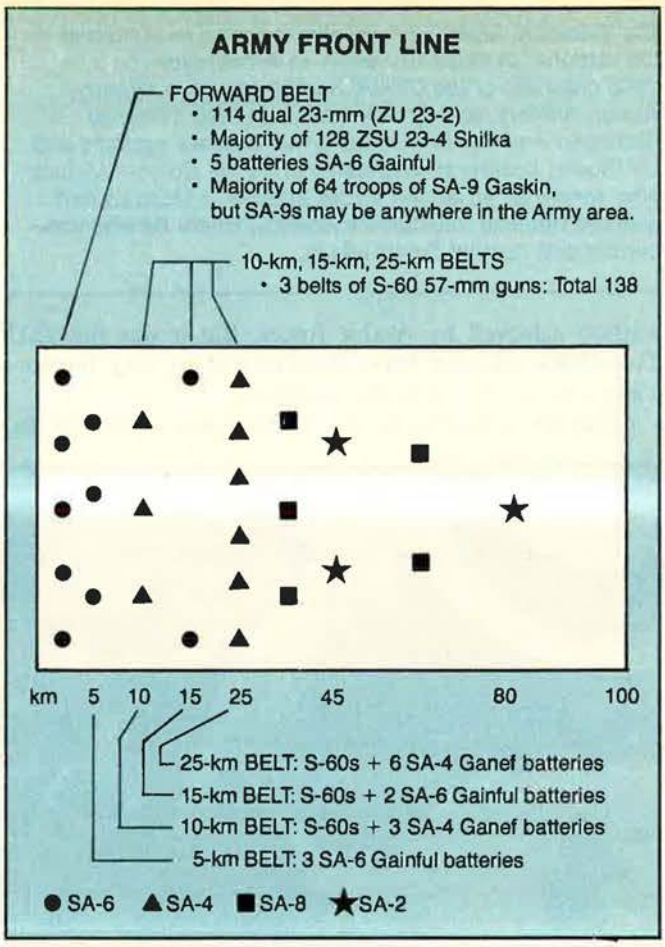
Changing tactics and using fighter-bomber and Wild Weasel SAM suppression began to take effect. By the fifth day, no B-52s were lost and only random B-52 losses occurred thereafter. By December 28, the battle of attrition was won; NVA radars could no longer track targets, and the B-52s flew at will.

The Mideast war saw deployment of up to 10,000 SAMs and AAA guns, most of them newer designs. Israeli

ECM did not work against the newer equipment. The Israelis tried attrition and lost about 100 airplanes, most in the first three days. ZSU 23-4 Shilkas destroyed so many of the Israeli A-4s, which were attempting to repeat the 1967 war's low-level attacks on Egyptian airfields, that the Israelis abandoned the raids after three days, without destroying a single Egyptian aircraft on the ground. SAMs and AAA kept the upper hand until combined Israeli infantry and armor attacks swept the Suez west bank of Egyptian air defense, after which political pressures brought the conflict to an end.

Soviet theory, doctrine, and weapons deployment, as seen in Vietnam and the Mideast, are keyed to conducting an offensive as a battle of attrition, in which they expect their superior mass to be pivotal. Should the Warsaw Pact attack NATO, the avalanche of tanks and mechanized formations, defended against NATO air forces by PVO SV systems, would be paralleled by coordinated Pact fighter-bomber strikes against NATO nuclear delivery means and by interceptors of Frontal Aviation seeking out NATO aircraft beyond the range of PVO SV's surface-to-air missiles.

NATO air forces may face the dilemma of either defending against intruding aircraft or having to attack the armored formations to avoid excessive loss of territory while NATO reinforces. Are there enough NATO planes to win the battle of attrition in the air? And, how do you successfully attack armored formations equipped with an array of guns and missiles so expanded numerically and improved technically?



PVO SV Organization for Combat

Organizational diagrams of PVO SV SAMs and guns, and of backup aircraft, provide less understanding of Soviet doctrine than does an examination of how many and where ground systems are deployed and how Frontal Aviation would be used. The weapons deployments described below can be considered the "permanent party" of PVO SV ground systems in a typical high-readiness-category Soviet Army, comprised of three or four divisions. Frontal Aviation fits organizationally into the next echelon above Army—the Front, a wartime grouping of three or more Armies. The Front Commander employs the aircraft as best fits operational-tactical requirements of his Armies.

SA-7 Strela gunners are part of each motorized rifle company and possibly each tank company. They ride the company commander's BMP (Infantry Fighting Vehicle) or follow on foot if the riflemen themselves maneuver dismounted. Some 5,000 SA-7s are believed to have been fired in the Mideast war, downing only three Israeli aircraft (certain) and seven (possible), contrasted to a ratio of one helicopter downed for every three SA-7s fired in Vietnam. However, the SA-7s threatened enough damage to keep aircraft at higher altitude or to drive them away.

ZSU 23-4 Shilkas follow 400 meters behind the forward companies of tanks or BMPs, though they may deploy in column behind the battalion flank deemed most susceptible to air attack. They divide front and rear if the protected battalion itself forms column. Intervehicular ZSU 23-4 distances will be 150 to 200 meters to avoid mutual damage when engaging low-altitude aircraft. Ammunition trucks—a necessity when firing 4,000 rounds a minute and a luxury aircraft cannot bring along—follow at about 1.5–2 kilometers. Each tank and motorized rifle regiment evidently includes a battery of three platoons of two Shilkas each.

The first echelon of fire control seems to be the battery commander's vehicle of the ZSU 23-4 battery. The vehicle passes early warning and fire command information to the platoons, obtained in turn from the command vehicle of the supporting SA-9 Gaskin troop and its electronic support measures van. At least in East German forces, the SA-9 element, when not moving, controls firing to tactically coordinate Shilka and Gaskin, undoubtedly drawing on the Straight Flush radar of the SA-6 echelon, and the ZSU 23-4s on-board radar for targets. When moving, each AA mount is largely on its own. Sixty-four troops (batteries) of the SA-9 Gaskin support the typical combined arms or tank Army, each regiment having its own organic troop.

Of the ten SA-6 Gainful batteries, five are deployed in the forward belt, three at about the five-kilometer belt, and the remaining two in a third belt about ten kilometers further to the rear (*see chart*).

Five batteries of SA-8 Gecko, the newest mobile antiaircraft missilery fielded anywhere, are initially intended for deployment twenty to thirty kilometers deep, defending reserve and logistics centers out to ranges of ten to twelve kilometers. From its design and apparent function, we may expect the SA-8 to become a division-level

weapon as production permits, replacing S-60 or SA-6 regiments.

Nine SA-4 Ganef batteries fill the gaps between the SA-6s, three Ganefs moving with attacking forces at about the ten-kilometer belt, and the rest at about twenty-five kilometers. With four solid-propellant boosters, a ramjet sustainer, and extended range radar, the SA-4 batteries will play a role well ahead of the forward edge of the battle area (FEBA) both for detecting attacking aircraft and acquiring targets for the other systems.

Three SA-2 Guideline batteries totaling eighteen launchers provide the high- to medium-altitude missile segment of each army's defense; two at about forty-five kilometers and the third about eighty kilometers behind the FEBA.

AAA guns rounding out the air defense umbrella include some 114 dual ZU 23-2s, mostly deployed along the front, and twenty-three batteries totaling 138 radar-directed S-60 57-mm guns arrayed in belts at ten, fifteen, and twenty-five kilometers. One S-60 regiment is organic to each division. A variety of automatic weapons can be expected throughout the operational zone.

In addition to the weapons organizationally committed to Soviet Ground Forces, experience would indicate that additional SAMs from PVO Strany would begin to overlap the Army's rear boundary. MiG-21 and MiG-23 aircraft from Frontal Aviation would likewise receive reinforcement from the PVO Strany interceptor force, when and if the latter were releasable.

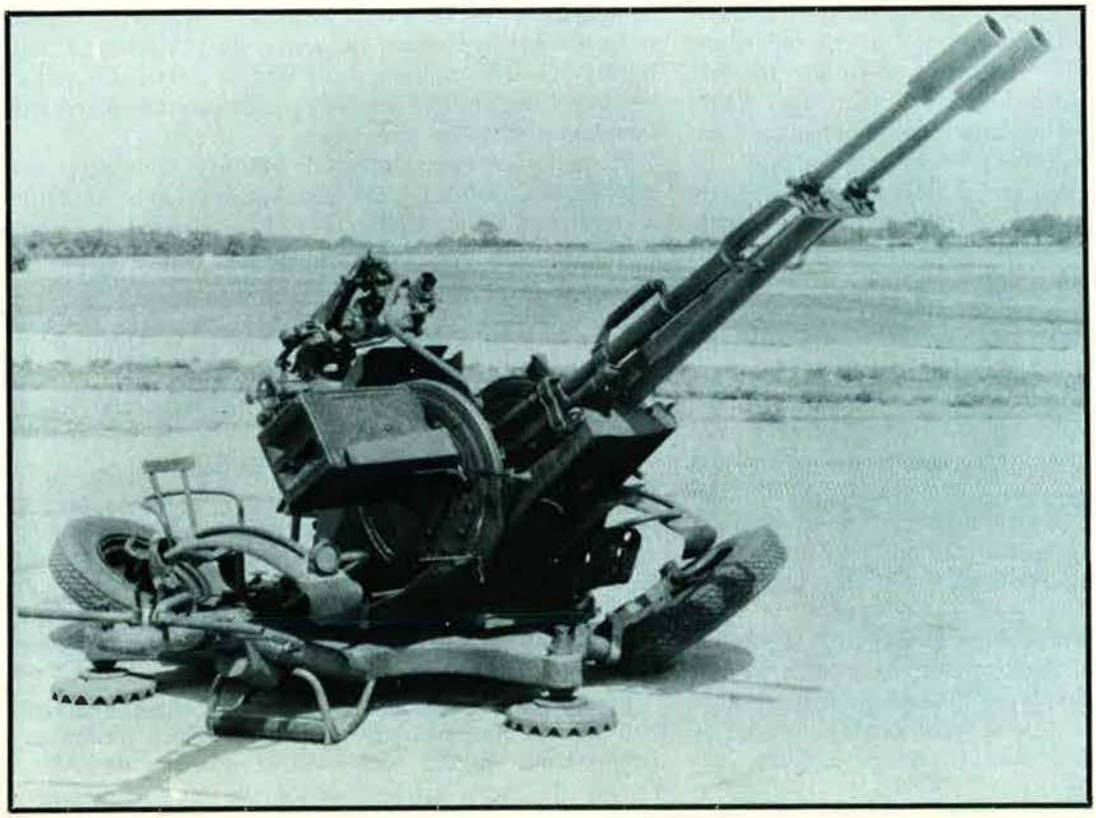
Command and Control

Not much has been written about PVO command and control of airplanes, flak, missiles, and helicopters. The Soviet Institute of Military History's study of the battle of Kursk, as well as the authoritative *Military Strategy,* praise centralized PVO control as much as they laud central control by the Communist Party.

Some remarks in *The Offensive* hint at a crack in the PVO monolith: "Considering the increased role of aviation and the nature of the struggle against the air enemy, under modern conditions troop air defense is given especially great significance. It will be organized through complex use in close coordination of the various PVO means. . . . In addition, every unit and element must be capable of fighting the air enemy under any conditions, regardless of whether they are in the zone of air defense cover of the senior commander or not. Armed conflict on the scale of all troop elements represents a uniform and simultaneous process of struggle against the ground and air enemy. Consequently, the grouping of PVO forces and means designed to repulse enemy air attacks comprises an inalienable part of the troop combat formation of any scale." The problem likely is as perplexing to Soviet doctrinal analysts as to our own.

* * *

Soviet design bureaus have produced drastic changes in aircraft and air defense warfare systems, and Soviet defense industries have matched technology with mass production. Whether or not we have answers to the new level of effectiveness of PVO SV weaponry depends on many factors. As with most technological vs. bureaucratic confrontations, the necessary surgery often is postponed by aspirin-strength palliatives until the case becomes severe. Faced with so major a shift in the art of mobile air defense of armored columns, the first issue is not answers, but whether our military schools and colleges are asking the right questions and challenging the old assumptions. Certainly air defense technology will not render aircraft obsolete. But new tactics, new doctrine, new procedures, and perhaps new weapons are needed, and quickly. ■



Employed in large numbers by all Pact forces is the ZU 23-2, which was surprisingly effective in Vietnam.

Soviet Aerospace Almanac

Soviet Armed Forces are manned by a relatively small cadre of professional officers and NCOs, and about 4,500,000 conscripts who have had considerable preservice training in preparation for . . .

UNIVERSAL MILITARY TRAINING IN THE USSR

BY HARRIET FAST SCOTT

SOMETIME this month, notices will appear all over the Soviet Union announcing the call-up of all males who will have turned eighteen by July 1. In September, the Defense Ministry will post another order calling up those who will reach eighteen by January 1, 1979. This twice-annual call-up is part of the Soviet military conscription that has existed in one form or another during the Soviet Union's sixty-year existence.

The Soviet Armed Forces consist of a relatively small cadre of regular officers, warrant officers, and "extended-duty" soldiers and sergeants, along with a constantly changing force of several million young men in training.

The number of officers is estimated to be between 600,000 and 1,000,000. The number of warrant officers and extended-duty servicemen is between 250,000 and 400,000. This permanent cadre is responsible for maintaining a combat-ready military force, and at the same time for training "almost all" Soviet males—to use the late Marshal Grechko's expression—and then discharging them into the Reserves. The Party leadership has said that any future world war will likely be nuclear and will "demand multimillion-man armies." This demand can be met only through the mobilization of millions of trained men.

This year, in response to the Defense Minister's order, approximately 2,600,000 young men born in 1960 will report to the local military office, called the military commissariat (*voyenkom*). Half this number reports in April and May, and the rest in November and December.

They will be examined by a call-up commission headed by the local military commissar, with representatives from the local Party organization, trade unions, the militia, and medical agencies. The military commissariat will have all of the conscript's records, including education, preliminary military training, and any specialist training he might have been given after he first registered for military call-up at age seventeen.

The call-up commission assigns each man to a service, branch, or arm. Physical characteristics have some bearing on assignment. For example, to qualify for flying duties, the eighteen-year-old must be between five feet two inches and six feet tall, weigh less than 176 pounds, and have legs at least thirty inches long.

Of major importance to the individual at the time of call-up is the fact that the call-up commission also designates noncommissioned officer candidates. These candidates are sent directly to sergeants school for approximately six months of training. For the remainder of their eighteen months in service these young men will be in charge of other eighteen- and nineteen-year-olds—the bulk of the Soviet Armed Forces.

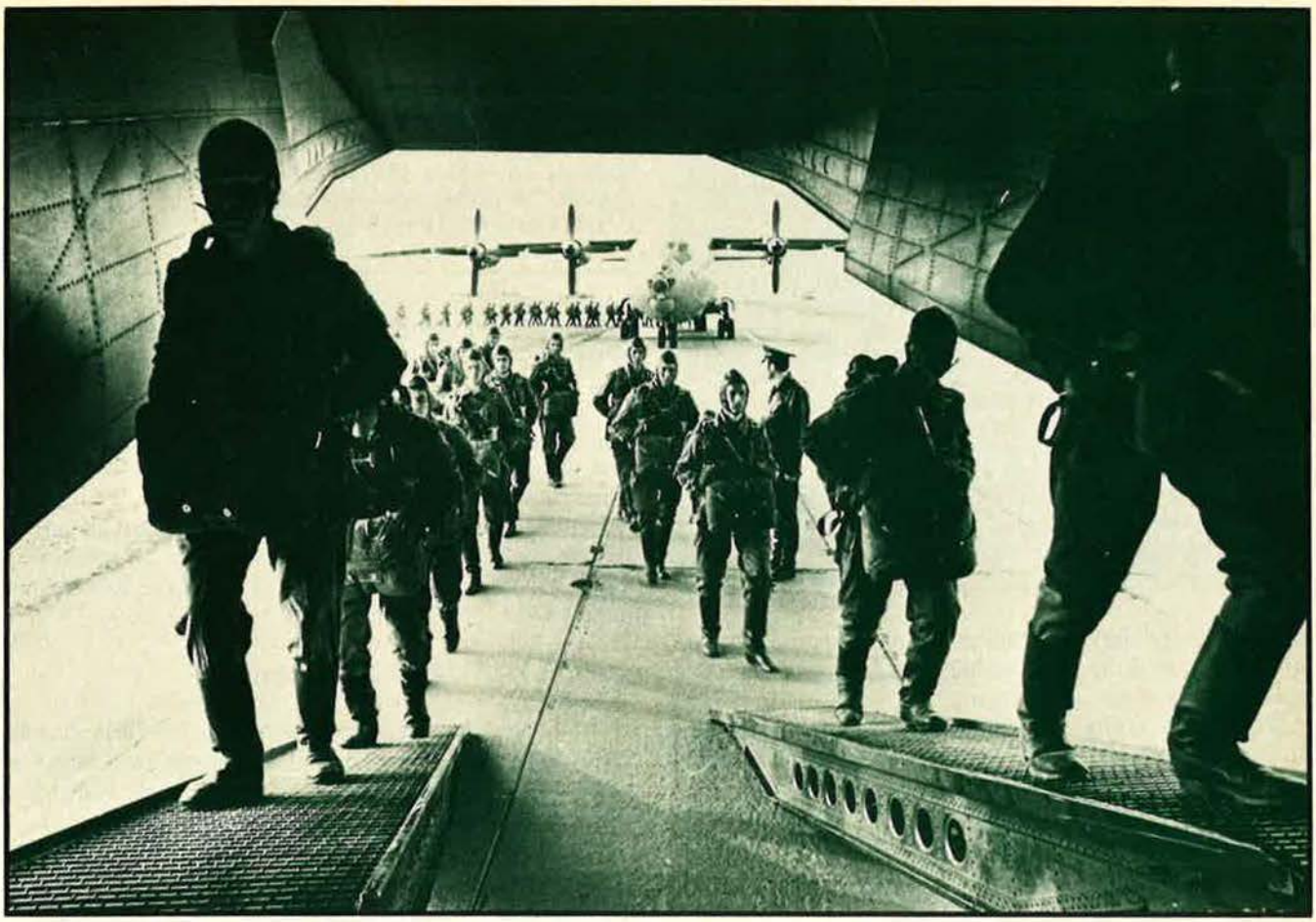
Changing Patterns of Conscription

Conscription for the Red Army was decreed May 29, 1918, but nationwide military obligation was not introduced until September 1925, after the military reforms. Military obligation for all males aged nineteen to forty consisted of two years of Beginning Military Training, followed by five years of active duty starting at age twenty-one. This training was based on a territorial militia system of intermittent service or cadre service mixed with long leaves of one to three years.

A new Law on Universal Military Obligation was adopted September 1, 1939, almost two years before Hitler invaded the Soviet Union. This law required an annual call-up in September and October of all nineteen-year-olds except those receiving secondary education. After World War II, compulsory military service was three years for the Air Forces, Ground Forces, Troops of National Air Defense, and Strategic Rocket Forces, and four years for the seagoing components of both the Navy and Border Guards.

In 1967, the Law on Universal Military Obligation was rewritten. The age of induction was lowered to eighteen for all males. Two call-ups each year replaced the single, annual call-up. Service was set at two years and, for those serving at sea, three years. Initially, those with higher education had to serve only one year, but this was raised in 1977 to two years for those serving at sea and eighteen months for all others.

Even before World War II, the Soviet Union had a system of Beginning Military Training in which youths were taught basic military skills before entering the Armed Forces. To help compensate for the 1967 reduction in



Soviet conscripts have some military training before call-up. The military-related DOSAAF even gives parachute training.

length of service, Beginning Military Training was made compulsory for all males on reaching age fifteen. This training is given in the ninth and tenth grades. Though given in the schools, the Defense Ministry is responsible for instruction. Much of the training is conducted by Reserve officers. For those not in school, military study centers are established at factories or at other places of work. Instruction also is given at specially equipped schools by DOSAAF, the Voluntary Society for Cooperation with the Army, Aviation, and Fleet.

Some youths are designated for specialist training when they register with the military commissariat at seventeen, one year before they are due to be called up to active military duty. This training is given at professional technical schools or by DOSAAF.

The 1967 law also set a time limit on deferments. Those who are ill, or who for family or compassionate reasons have their call-up deferred, are exempt on reaching age twenty-seven. Those who are deferred to continue their education are excused on reaching age twenty-seven. There are limited-service positions for those not physically fit for combat-type duty.

Up to fifteen percent of young Soviet men may be permanently excused for physical reasons. Another five percent may have invalid parents or other reasons for deferment, and never serve. In all, about twenty percent will be fully excused from military service. This means that every six months about 1,000,000 youths will be entering the Soviet Armed Forces, and approximately the same number will be discharged into the Reserves. In 1978, about 4,000,000 conscripts will be serving in the Soviet Armed Forces, which include the Border Guards of the KGB and the Internal Security Troops of the MVD, though the latter two are not under the Ministry of Defense.

Although the rigors of military life are many, the average Soviet citizen sees them as necessary to defend the country and complains very little. After all, he and his peers are all in the same boat.

The Call-Up Center

Soon after being reviewed by the call-up commission, those without deferments or physical disabilities are notified to report to a collection center. The "young soldier," as all conscripts are called until they formally take their oath, is now on active duty in the Armed Forces of the USSR.

At the collection center he is issued a uniform and boots, a set of underwear, a towel, a spoon, a mug, and toilet articles. These are kept in a small suitcase or bag, together with documents from the call-up commission. He gets a short haircut and turns in his civilian clothes, which are sent home for the duration.

The young soldier turns in his internal passport, if he has one, to the military commissariat and is issued a military card. (Present plans call for internal passports, without which most travel and permission to live in cities is impossible, to be given to all citizens by 1981.) At the collection center, the young soldier gets his first taste of

SOVIET MILITARY OATH OF ALLEGIANCE

I, a citizen of the Union of Soviet Socialist Republics, on entering the ranks of the Armed Forces, take the oath and solemnly swear to be an honorable, brave, disciplined, vigilant soldier, strictly to preserve military and state secrets, unquestioningly to observe military regulations and orders of commanders and chiefs.

I swear conscientiously to learn military affairs, in every way to protect military and public property and to the last breath to be dedicated to my People, my Soviet Motherland, and Soviet Government.

I am always ready on the order of the Soviet Government to go to the defense of my Motherland—the Union of Soviet Socialist Republics, and, as a soldier of the Armed Forces, I swear to defend it bravely, skillfully with pride and honor, not shrinking from shedding my blood or even from sacrificing my life for the achievement of full victory over the enemies.

If I break this, my solemn oath, then let me be struck by the severe punishment of Soviet law and by the general hatred and scorn of the workers.

active military duty. He wakes up on schedule, eats on schedule, and drills on schedule. He gets more medical examinations, shots, and lectures.

Soon travel groups are formed to take the young soldiers to their units. According to Soviet accounts, the train platform overflows with local Party and city officials, parents, relatives, wives, and girl friends. The band plays loudly and off they go.

Life in the Military

On reaching his military unit, the young soldier is assigned to a separate platoon where the fundamentals he has learned in Beginning Military Training are reviewed.

He is issued three uniforms (dress, service, field) and fatigues. The barracks where he will live has a large sleeping room, a room to shine shoes and press uniforms, and a shower and shaving room. Each conscript is given one large bar of household soap each month to use on his weekly visit to a communal steam bath—a Russian custom suited to the cold climate. Soldiers must wash their feet each night before going to bed.

Meals are served three times a day with the interval between meals not to exceed seven hours. The basic diet provides about 3,700 calories a day, and "norms" providing additional calories are calculated for abnormal environments and some kinds of work. Each serviceman is given the norm set for his type of work. Thus, those located at radar posts high in the mountains, or on flying crews, or in aviation ground crews of the engineer-technical service, get special high calorie diets, as do soldiers over six feet two inches tall.

There are forty different dietary norms operating today in the Soviet Armed Forces, according to the Chief of the Central Food Directorate. Each soldier's food allowance is given in carefully measured helpings; those entitled to higher caloric norms may have a fourth meal each day.

After several weeks, but no later than two months, the whole unit attends a ceremony where the young soldiers take the military oath of allegiance. This is done with great solemnity and is considered a holiday for the unit. Often a symbolic place is selected for the ceremony to make a lasting impression on the new privates: Red Square in Moscow or the battlefield memorial at Volgograd (Stalingrad).

The serviceman generally will spend his entire two years in the same unit. He will get no leave during this time, except for emergencies or as a reward for unusual achievement.

Candidates for sergeant attend a school that is run by the regiment. Specialists go to classes up to six months for additional training or are assigned to on-the-job training in the unit.

Pay and Benefits

Young men leaving a job at a factory or a farm, or who are on a scholarship at school, are given two weeks of their civilian job pay as a bonus when they are called into service.

The monthly pay for privates, according to unofficial reports, is three rubles. Pay rates for the Soviet soldier and sergeant, however, are not published. Specialists get higher pay than others of the same rank. Additional pay also is given for exceptionally hard or dangerous work, including flying. Medical personnel get fifteen percent higher pay. Soldiers and sergeants with second-class, first-class, or master's rating get extra pay as long as they hold a position for which that rating has been established. Bonuses, based on rank, are given at the end of service when servicemen are transferred into the Reserves. If the

A TYPICAL DAY FOR THE SOVIET SOLDIER

Activity	Time	Duration
1. Reveille	0600–0605	5 minutes
2. Exercise	0610–0630	20 minutes
3. Barracks time	0630–0650	20 minutes
4. Morning inspection	0650–0720	30 minutes
5. Breakfast	0725–0755	30 minutes
6. Training (six 50-minute periods)	0800–1350	
7. Dinner	1400–1440	40 minutes
8. After dinner time	1440–1510	30 minutes
9. Weapon and equipment maintenance	1510–1530	20 minutes
10. (a) political-education time (Mon. and Thurs.)	1530–1830	3 hours
(b) Equipment maintenance (Tues. and Fri.)		
(c) Sports (Wed. and Sat.)		
11. Barracks time (self-study or homework)	1830–1940	70 minutes
12. Supper	1940–2010	30 minutes
13. Personal time	2010–2140	90 minutes
14. Evening walk	2140–2155	15 minutes
15. Taps	2200	

Harriet Fast Scott lived in the USSR for four years while her husband, Col. William F. Scott, was US air attaché in Moscow. She has since traveled extensively in Russia and has written several books and many articles on Soviet military affairs and civil defense. Now living in Washington, she is an Adjunct Professor, University of Miami, and a consultant on Soviet affairs. This year, Westview Press will publish The Armed Forces of the USSR, *coauthored by Mrs. Scott and her husband.*

serviceman is returning to a distant area, the bonus is doubled.

If the conscript is married and has children, and his family lives in a city or town, his wife gets fifteen rubles a month for one child and twenty-two rubles for two or more children. A wife living in a rural area will get 7.5 rubles for one child and twelve rubles for two or more children. Wives of conscripts will be given special assistance in finding work, and places are provided in nurseries for children, if requested.

When released into the Reserves after two years, servicemen have certain privileges. Within one month they must be given jobs compatible with their specialty and experience. Those who were students have a right to return to the same course from which they were called. Servicemen have the right to keep their housing or position on the housing list while in service. Servicemen do not pay taxes, and they have free mailing privileges.

Servicemen are encouraged to offer suggestions for improving efficiency. Special commissions examine all suggestions and, if accepted, make awards that can be large. A suggestion that results in a saving of more than 100,000 rubles a year can earn an award of as much as 5,000 rubles. There are lesser forms of encouragement and rewards such as citation at a parade, a two-day pass, or ten-day leave, or a decoration.

The backbone of Soviet military training is the proficiency rating for specialists. Third-, second-, and first-class ratings may be earned in that order by servicemen who are taking part directly in servicing armaments or military equipment, or training.

Soldiers who have finished either a course conducted by their unit or a school for specialists and who earn "good" or "excellent" scores on a test become third-class specialists. Those who receive a "satisfactory" score must get further on-the-job training. Some are given only on-the-job training, and then take the examination. Their scores must be at least "good" to get a third-class rating.

Examinations are given at the end of the winter or summer study period. Those who pass are awarded certificates and badges. Those who fail to qualify may take the test again in five months.

Second-class, first-class, and master specialists must reconfirm ratings each year. Higher ratings cannot be given in less than six months after the previous rating. Those who seek higher ratings must do well in both military and political training.

Commanders authorized to award ratings may also take them away for failure to take care of equipment or as punishment. Unsatisfactory ratings drop the specialist one grade. Tests to regain lost ratings may be taken after five months. All other things being equal, the serviceman with the higher class rating gets promoted first. For those who wish to enter officer commissioning schools, first-class and masters' ratings earn preferential treatment.

Soviet Discipline

Discipline is very strict. For treason, *i.e.,* acts resulting in damage to state independence, territorial integrity, or the military might of the USSR; defection; espionage;

Highly technical services such as Troops of National Air Defense have a larger percentage of extended duty enlisted personnel than the less technical branches, but still are assigned many conscripts for training.

giving state or military secrets to foreign states; refusal to return from abroad; hostile acts against the USSR; and plots to seize power, punishment is ten to fifteen years' loss of freedom with confiscation of property and sometimes with exile from two to five years. The sentence for extreme acts of treason can be execution and confiscation of property.

For crimes against military order—insubordination, nonperformance of orders, AWOL, desertion, divulging military secrets—servicemen are punished according to military law. For instance, insubordination may be punished by one to five years' loss of freedom; group insubordination, three to ten years; insubordination in wartime or in combat, from five to ten years up to the death penalty. The penalty for AWOL in peacetime can range from three months' to two years' assignment to a disciplinary battalion. Time served in a disciplinary battalion does not count toward national service obligation.

Reenlistment Policy

Several months before the end of his service obligation, the conscript may decide to stay on for additional duty. Certain positions can only be filled by extended-duty servicemen. Commanders encourage their best men to apply for these positions for two-, four-, or six-year enlistments. Reservists can also volunteer for active duty up to age thirty-five. Some specialist positions are handled by contract, usually for four years. These may be signed up for before the regular two-year service obligation is completed.

The regimental or equivalent level commander selects candidates for extended service. A board makes the final choice. Generally, men are expected to continue after reenlistment in the same unit.

On being accepted for extended service, privates are promoted to privates first class. Sergeants, who have held their rank for six months and whose position calls for higher rank, are also promoted.

Servicemen also may volunteer to become warrant officers. This rank was introduced in 1971 to replace extended servicemen. In 1973, the law was amended to include both extended servicemen and warrant officers. Candidates for warrant officer, if accepted, are sent to school for one or two years. Those with an equivalent civilian education in a military specialty may be given a warrant at once. The initial period of service for warrant officers is five years, with subsequent three- or five-year periods to age forty-five. A warrant officer can serve five additional years in special cases. Extended-duty servicemen can serve to age fifty.

* * *

Two years may seem a short time to produce a well-trained airman or soldier. However, premilitary training must be taken into account.

The Soviet citizen begins receiving military-related training from the age of seven, first as a member of the Octobrists, where patriotism and group discipline are taught, and later with the Pioneers, where instruction is given in rifle marksmanship and other military skills.

Nationwide military sports games are used to teach military skills to teenagers. The Zarnitsa games, for youths eleven to fifteen, include competitions in overcoming mock minefields and radioactive areas. The Orlenok games, for youths sixteen to eighteen, feature more advanced military exercises, including simulated nuclear attack drills.

Also, two years of Beginning Military Training is required of all boys in high school. For those who have dropped out of school, DOSAAF provides training in military and military-related skills.

Undoubtedly there are many weaknesses in the Soviet conscript military force. But as the Party leadership gives priority to research, development, and the production of weapon systems—such as the SS-20 and Backfire bomber—it gives equivalent attention to ensuring the combat readiness of its military personnel. The question is how effective—or ineffective—is the Soviet conscript force compared to the volunteer force of the United States. That is the context in which the vulnerabilities and strengths of the Soviet Armed Forces must be examined. ■

WOMEN IN THE SOVIET ARMED FORCES

Some 800,000 Soviet women served in the Soviet Armed Forces during World War II. Eighty-six of them were awarded the highest decoration of the Soviet government—Hero of the Soviet Union. The women served as snipers, pilots, communications specialists, machine gunners, tank drivers, on air crews, and in the medical service.

Valentina Nikolayeva-Tereshkova remains the only woman so far to have gone into space. She is a colonel in the Soviet Air Forces.

The first law related to women in the Armed Forces was enacted in 1925. The present law, adopted in 1967, establishes the role of women in service today. Women nineteen to forty years old who have medical or other special training may be put on the military rolls in peacetime and called up for practice assemblies. They may also volunteer for active duty. In wartime, they might be called into the Armed Forces to carry out auxiliary and special duties.

Women who volunteer as soldiers, sailors, sergeants, or petty officers must be between nineteen and thirty, have at least eighth grade education, and be unmarried and without children. They may volunteer for two, four, or six years and continue to serve until age fifty. The Ministry of Defense established the positions to be filled by women. They have the same rights as extended-duty servicemen, and may wear civilian clothing off duty. When released into the Reserves, women go into the second category (enlisted personnel) until they are forty years old.

Women also serve as officers, although very little mention of them can be found in the press. Many women are teachers at higher military schools and military academies, especially in departments of foreign languages and mathematics. Women officers who are put on the military rolls serve in officer Reserves of the third order until age fifty. They may be called up for a two-month practice assembly one time, and, as for all Reservists, for ten-day inspection assemblies.

The exact number of women in service today is not known. Some sources suggest 10,000 as a minimum. Whatever their number, girls in ninth grade learn the rudiments of military affairs along with the boys. Women also are very active in DOSAAF, the paramilitary sports society. Valentina Zakoretskaya recently set a world record when she made her 6,000th parachute jump. Alone or with a group, Zakoretskaya has set more than fifty world records, say Soviet sources. In time of need, there are few military jobs Soviet women could not fill.

—H.F.S.

The USSR's armed forces—particularly the aerospace forces—are organized differently from those of the US. Both combat and principal support services are headed by officers who are also Deputy Ministers of Defense.

ORGANIZATION OF SOVIET ARMED FORCES

Soviet armed forces are organized in five separate services: Strategic Rocket Forces, Ground Forces, Troops of National Air Defense (PVO), 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 services do not include Troops of Civil Defense, Border Guards (KGB), Troops of the Ministry of Internal Affairs (MVD), rear service logistical support, construction troops, or other support organizations. A further precaution: The Soviets sometimes refer to all their services as the "Soviet Army," even including their Navy.

The Ministry of Defense and the **General Staff** provide centralized command over all military services. Immediately subordinate to the Minister of Defense, who is roughly comparable in authority to both the US Secretary of Defense and the Chairman of the JCS, comes the Chief of the Warsaw Pact Forces, followed by the Chief of the General Staff, who heads a staff similar to that of prewar Germany. *(See accompanying charts.)*

The Strategic Rocket Forces, established in 1959, operate all land-based ballistic missiles with ranges greater than 1,000 km. While the SRF is extensively publicized by the Soviet news media, little is known about it 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 Military Balance,* published annually by The International Institute for Strategic Studies, London *(see December '77 issue of* AIR FORCE *Magazine)* credits the Strategic Rocket Forces with 375,000 military personnel. Strength figures for the services that follow are from *The Military Balance 1977/78.*

The Ground Forces, numerically the largest of the five services, are divided into four major branches: Motorized-rifle, tanks, rockets and artillery, and troop air defense. (The last must not be confused with Troops of National Air Defense.) Airborne forces, while closely allied with the Ground Forces, are a special branch directly subordinate to the High Command. Ground Forces air defense equipment includes mobile surface-to-air missiles and antiaircraft artillery. Tanks, armored personnel carriers, self-propelled artillery, and personal equipment all are designed for a CBR environment. The Soviet Ground Forces are well equipped for combat either with or without nuclear, chemical, and biological weapons. Ground Forces personnel number about 1,825,000.

The Troops of National Air Defense (PVO Strany) was separated from Ground Forces in 1948. Its three major components are antiaircraft defense, antimissile defense (PRO), and antispace defense (PKO). Its fighter-interceptors, SAMs (for example, the SA-3 and SA-5), combined with its huge radar network, exceed NORAD's capabilities several times over. PVO has some 550,000 troops.

While the **Soviet Air Forces,** with approximately 475,000 personnel, does not include ICBMs or air defense aircraft and missiles, it does include three major components: Frontal Aviation, Long-Range Aviation, and Military Transport Aviation.

Frontal Aviation is comparable to the USAF's Tactical Air Command. Its aircraft are assigned to military districts within the USSR, somewhat analogous to US joint commands, and to four "Groups of Forces" in Eastern Europe. Operational control over joint commands remains with the General Staff. However, the Air Forces commander in chief has major responsibilities for Frontal Aviation, which is charged with maintaining battlefield air superiority and working with the Ground Forces.

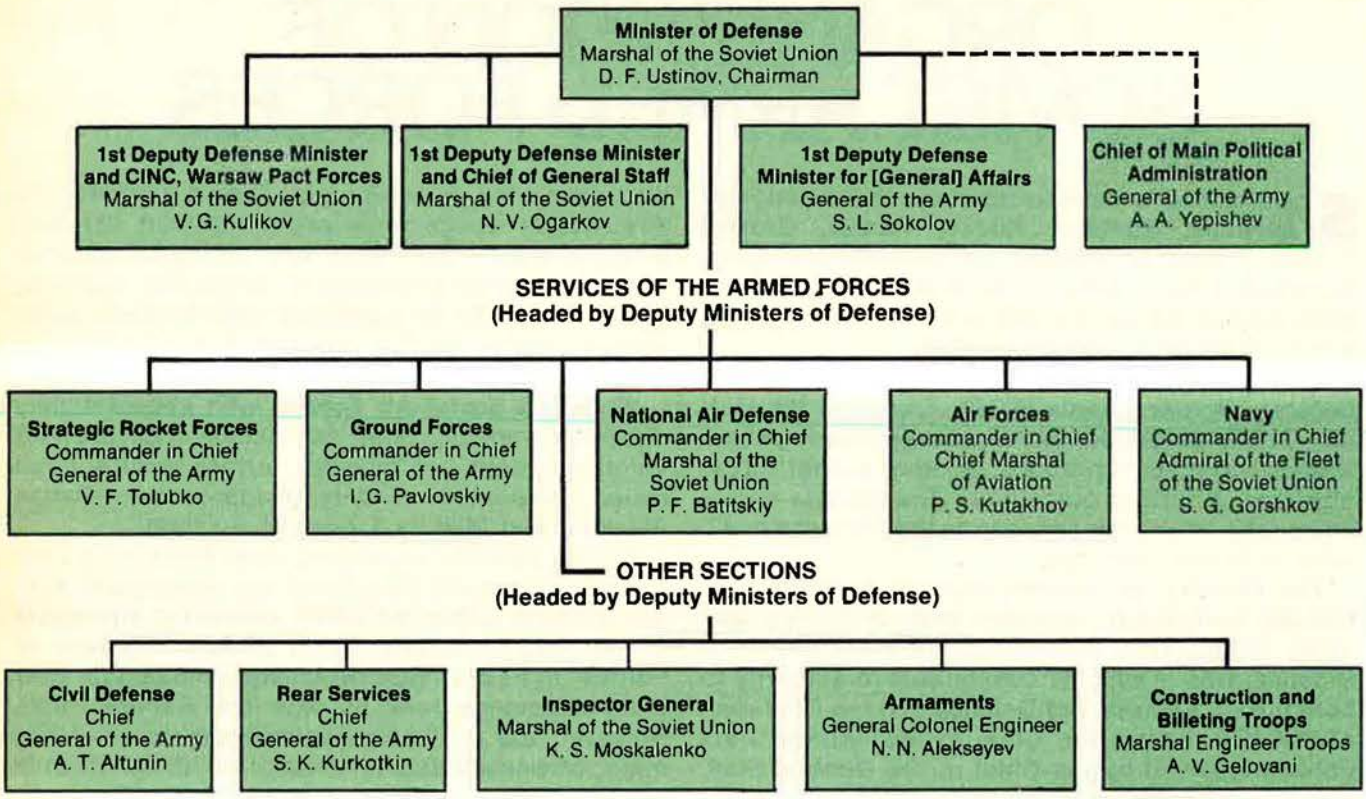
Long-Range Aviation has both long-range (Bear, Bison, and Backfire) and medium-range (Badger and Blinder) bombers. Backfire and Blinder are supersonic, but the bulk of the bomber force is still subsonic. Capable of air-to-air refueling by LRA's small tanker force, the bombers can carry either nuclear or conventional weapons, including air-to-surface missiles. This component of the Soviet Air Forces is comparable to USAF's Strategic Air Command, less SAC's ICBMs.

Transport Aviation includes both fixed-wing airlift and helicopters, although some helicopters are also assigned to the Navy. The transport aircraft of the Soviet airline, Aeroflot, must also be included in this component, essentially as a full-time reserve.

The Soviet Navy is now a maritime superpower. With the first aircraft carrier, the *Kiev,* having put to sea, Soviet Naval Aviation has a mix of helicopters and fixed-wing V/STOL aircraft. Naval Aviation also has strike and reconnaissance fighters, a limited transport force, bombers, and surveillance aircraft. Navy personnel strength is about 450,000, including 50,000 in Naval Aviation.

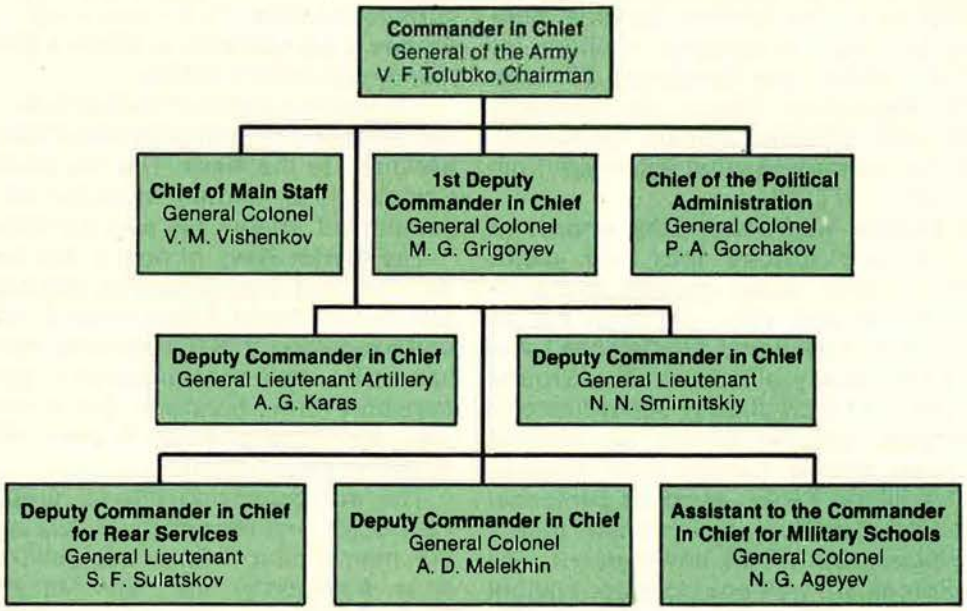
The accompanying charts, prepared by Harriet Fast Scott, and current as of February 1, 1978, show the membership of the top military organization. It is noteworthy that the Minister of Defense, Dmitriy Ustinov, although he holds the rank of Marshal of the Soviet Union, is the first essentially civilian Defense Minister since 1925, when Leon Trotskiy was removed. ■

MEMBERS OF THE MAIN MILITARY COUNCIL OF THE MINISTRY OF DEFENSE



—COMPILED BY HARRIET FAST SCOTT

MEMBERS OF THE MILITARY COUNCIL OF COMMAND AND STAFF OF THE STRATEGIC ROCKET FORCES



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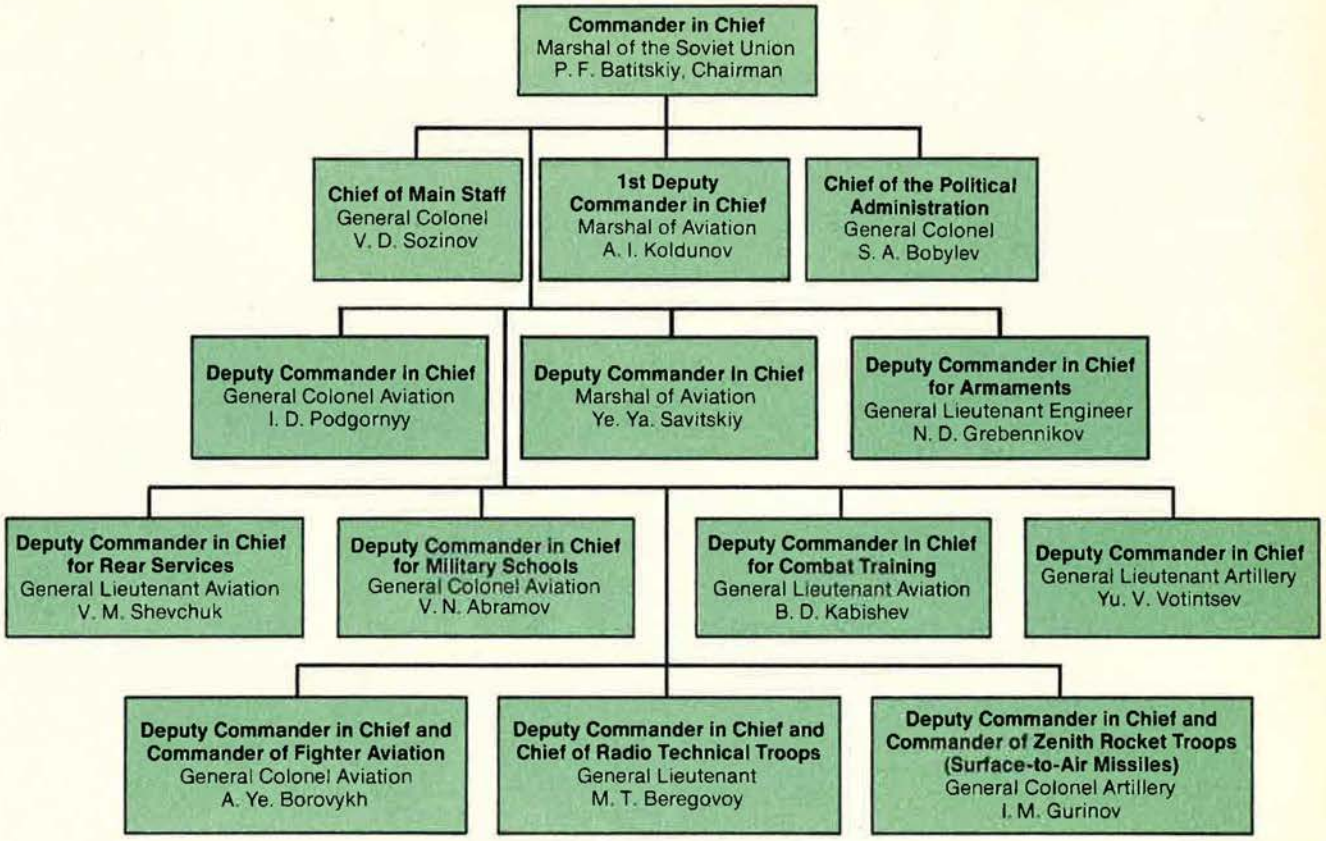
MEMBERS OF THE MILITARY COUNCIL OF COMMAND AND STAFF OF NATIONAL AEROSPACE DEFENSE FORCES



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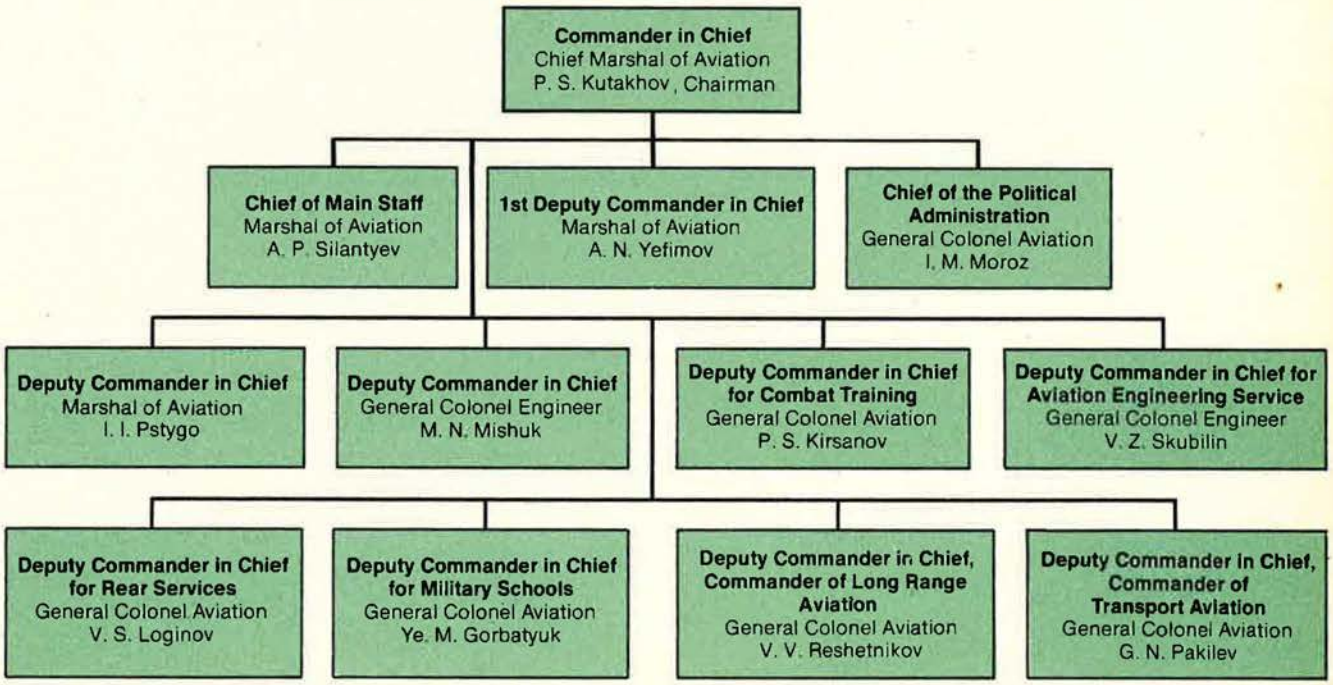
MEMBERS OF THE MILITARY COUNCIL OF COMMAND AND STAFF OF THE SOVIET AIR FORCES



—COMPILED BY HARRIET FAST SCOTT

Blinding force. The U.S. Air Force EF-111.

To defeat an enemy, first you have to reach him—undetected. The EF-111, the world's most powerful airborne ECM system, overwhelms and blinds ground radars to incoming aircraft.

And even if multiple, hostile radars switch to a variety of frequencies, the EF-111's broad range of jamming capabilities can handle them immediately.

Adaptable—the EF-111's system is designed to convert quickly and economically to new electronic threats. Compatible—its speed and maneuverability complement any strike aircraft. And versatile—it's ready for standoff, close air support or escort missions. The EF-111 will be the most advanced electronic warfare aircraft to join the U.S. Air Force Tactical Air Command.

GRUMMAN AEROSPACE CORPORATION

Soviet Aerospace Almanac

GALLERY OF SOVIET AEROSPACE WEAPONS

Again this year, the Gallery has been prepared exclusively for AIR FORCE Magazine by John W. R. Taylor, the British authority on aerospace systems. Completely revised, it contains much new information on Soviet planes and missiles. Some specifications are necessarily estimated or approximate. British spelling and usage have been retained throughout.

BY JOHN W. R. TAYLOR
Editor, *Jane's All the World's Aircraft*

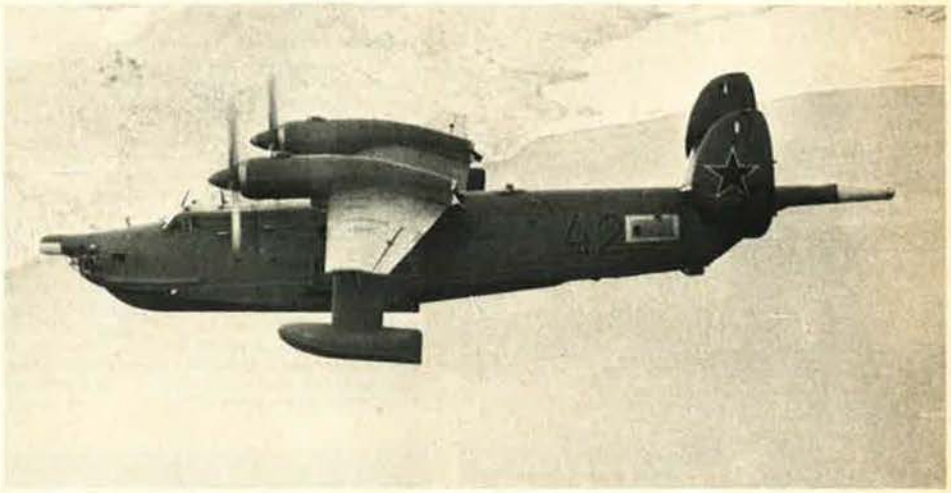
Bombers and Maritime

Beriev M-12 (NATO 'Mail')

Of all the nations which operated maritime patrol flying-boats in the second World War, only the Soviet Union and Japan retain aircraft of this type in first-line service. Georgi Beriev's M-12 was evolved from the piston-engined Be-6 in the late fifties, to take advantage of the lightweight power offered by turboprop engines, and of the latest ideas in high length-to-beam hull ratios. The type was first displayed publicly in the 1961 Aviation Day flypast at Tushino Airport, Moscow. Three years later M-12s were used for the first of a long series of record attempts, as a result of which they now hold all 36 officially-recognised international records for turboprop-powered flying-boats and amphibians. Payloads of up to 10 tonnes were carried during some speed and height record flights.

The operational M-12 amphibian is deployed primarily at shore bases of the Soviet Northern and Black Sea Fleets, but was flown also from Egypt, over the Mediterranean, during the Soviet presence in that country. An estimated 90 of 100 built remain in service; their equipment includes radar in a nose 'thimble' and an MAD (magnetic anomaly detection) tail-sting.

Power Plant: two Ivchenko AI-20D turboprop engines; each 4,000 shp.
Dimensions: span 97 ft 6 in, length 107 ft 11¼ in, height 22 ft 11½ in, wing area 1,030 sq ft.
Weight: gross 65,035 lb.
Performance: max speed 379 mph, service ceiling 37,000 ft, max range 2,485 miles.
Accommodation: crew of five.
Armament: variety of weapons and stores for maritime search and attack carried in internal bay aft of step in bottom of hull, and on four pylons under outer wings.

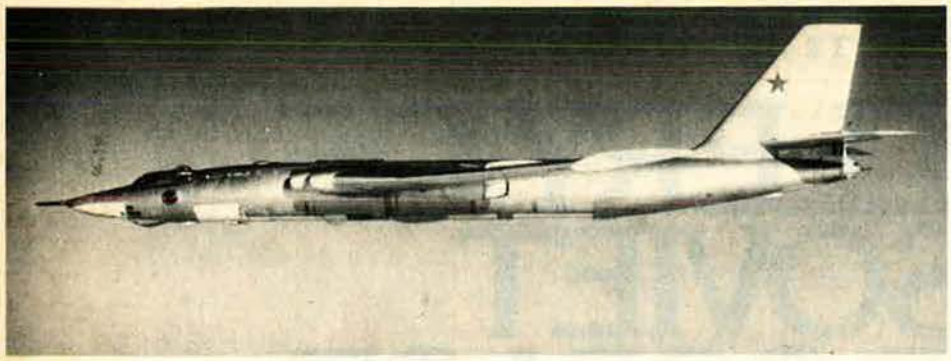


Beriev M-12 (NATO 'Mail')

Ilyushin Il-38 (NATO 'May')

Standard shore-based anti-submarine/maritime patrol aircraft of the Soviet Naval Air Force, the Il-38 was evolved from the Il-18 airliner in the same way that its US counterpart, the P-3 Orion, was based on the Electra transport. The lengthened fuselage retains few cabin windows. Added equipment includes a large radome under the forward fuselage and an MAD tail-sting, with an internal weapon bay aft of the radome. To cater for the effect of the internal changes and stores on the CG position, the wing had to be moved forward. No defensive armament is fitted. About 60 Il-38s are operational with naval units that patrol the Atlantic and Mediterranean. Export deliveries began last year, when the Indian Navy took delivery of the first of an initial batch of four ordered for INAS 315 at Dabolim, Goa.

Ilyushin Il-38 (NATO 'May') (Royal Air Force)



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

Tupolev Tu-16 (NATO 'Badger-D') (HMS Ark Royal)

Power Plant: four Ivchenko AI-20 turboprop engines; each 4,250 ehp.
Dimensions: span 122 ft 8½ in, length 129 ft 10 in, height 33 ft 4 in.
Performance: max cruising speed 400 mph at 27,000 ft, max range 4,500 miles.
Accommodation: crew of twelve.

Myasishchev M-4 (NATO 'Bison')

Although 35 of these Soviet contemporaries of the USAF B-52 are still nominally a component of Dalnaya Aviatsiya, the long-range air force, the M-4's main role is now as an in-flight refuelling tanker. About 45 of the original strategic bombers (NATO 'Bison-A') have each been fitted with an internal hose-reel unit for probe and drogue refuelling, and are deployed primarily in support of the 'Backfire' force. Maritime reconnaissance units continue to operate small numbers of the 'Bison-B' and 'Bison-C' versions. *(Data for 'Bison-A' strategic bomber follow.)*

Power Plant: four Mikulin AM-3D turbojet engines; each 19,180 lb st.
Dimensions: span 165 ft 7½ in, length 154 ft 10 in.
Weight: gross 350,000 lb.
Performance: max speed 560 mph at 36,000 ft, service ceiling 45,000 ft, range 7,000 miles at 520 mph with 10,000 lb of bombs.
Armament: ten 23 mm guns in twin-gun turrets above fuselage fore and aft of wing, under fuselage fore and aft of weapon-bays, and in tail. Three weapon-bays in centre fuselage.

Tupolev Tu-16 (NATO 'Badger')

After more than two decades of service, the Soviet Union's first production sweptwing bomber continues to form key equipment of both Dalnaya Aviatsiya and the Soviet Naval Air Force. About 300 are deployed with medium-range units of the strategic nuclear force, supported by a few Tu-16 in-flight refuelling tankers, using a unique wingtip-to-wingtip transfer technique, and more than 100 reconnaissance and ECM variants. Naval units have nearly 300 Tu-16s carrying air-to-surface missiles, 80 tankers, and 70 reconnaissance and ECM models. Reporting names by which these aircraft are known to NATO are as follows:

Badger-A. Basic strategic jet bomber, of which 54 took part in an Aviation Day flypast over Moscow in July 1955. Crew of seven. Glazed nose, with small undernose radome. Armed with seven 23 mm guns. About 310 still operational, a few as tankers for flight refuelling. Nine supplied to Iraq. About 75 operational with Chinese air force, mostly built in China.

Badger-C. Anti-shipping version, first shown in 1961 Aviation Day flypast, with 'Kipper' winged missile carried under fuselage. Wide nose radome, in place of glazing and nose gun of 'Badger-A'.

Badger-D. Maritime/electronic reconnaissance version. Nose like that of 'Badger-C'. Larger undernose radome. Three blister fairings in tandem under centre fuselage.

Badger-E. Similar to 'Badger-A' but with cameras in bomb-bay.

Badger-F. Basically similar to 'Badger-E' but with electronic intelligence pod on pylon under each wing.

Badger-G. Similar to 'Badger-A' but fitted with underwing pylons for two rocket-powered air-to-surface missiles (NATO 'Kelt'). One photographed by pilot of Japanese F-86F in 1977, about 50 miles north of Noto Peninsula, carrying a new missile (NATO 'Kingfish') on port underwing pylon. Majority serve with anti-shipping squadrons of the Soviet Naval Air Force; others are included in the 25 'Badgers' supplied to Egypt as replacements for aircraft lost in the Yom Kippur War of October 1973. *(Data for 'Badger-A' follow.)*

Power Plant: two Mikulin AM-3M turbojet engines; each 20,950 lb st.
Dimensions: span 110 ft 0 in, length 120 ft 0 in, height 35 ft 6 in, wing area 1,820 sq ft.
Weight: gross 150,000 lb.
Performance: max speed 587 mph at 35,000 ft, service ceiling 42,650 ft, range 3,975 miles at 480 mph with 6,600 lb of bombs.
Armament: seven 23 mm guns; in twin-gun turrets above front fuselage, under rear fuselage, and in tail, with single gun on starboard side of nose. Up to 19,800 lb of bombs in internal weapons-bay.

Tupolev Tu-22 (NATO 'Blinder')

First operational Soviet supersonic bomber, the Tu-22 was intended to spearhead the strategic attack force, carrying a 37 ft long air-to-surface missile (NATO 'Kitchen') semi-submerged in its weapons-bay. Western observers at the 1961 Aviation Day display in Moscow, where the aircraft was first shown in public, overestimated its performance and potential. In fact, the Tu-22 proved incapable of fulfilling a strategic role. Production was limited to around 250 aircraft; about 65 were transferred to the Naval Air Force, which continues to use nearly 50 for maritime reconnaissance and to help protect the sea approaches to the Soviet Union, from bases in the Southern Ukraine and Estonia. In addition to the main versions listed below, a missile-armed long-range interceptor variant has been reported, as a potential replacement for the Tu-28P.

Blinder-A. Basic reconnaissance bomber, with fuselage weapons-bay for free-fall bombs. About 140 'Blinder-As' and 'Blinder-Bs' are operational with Dalnaya Aviatsiya, some for reconnaissance; 12 have been supplied to the Libyan air force.

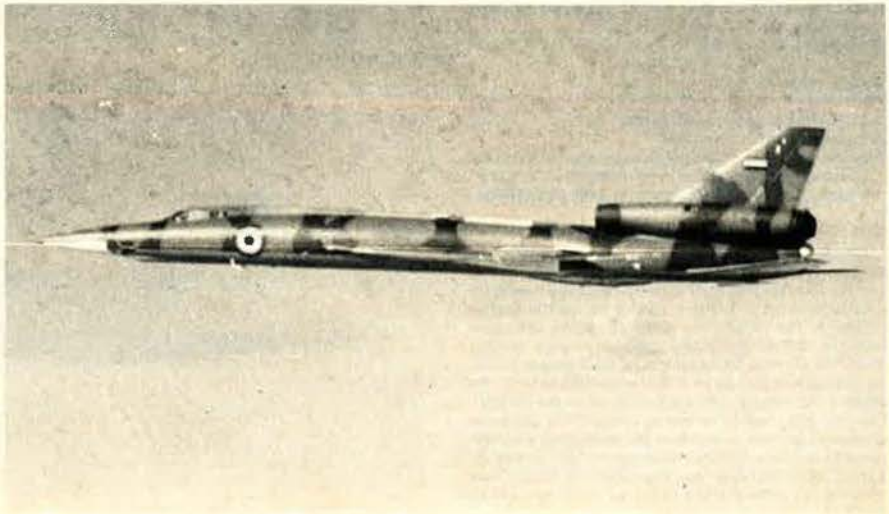
Blinder-B. Similar to 'Blinder-A' but able to carry air-to-surface missile (NATO 'Kitchen') semi-recessed in underfuselage. Larger radar and partially-retractable flight refuelling probe on nose.

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.

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

Power Plant: two unidentified turbojet engines in pods above rear fuselage, on each side of tail-fin; each estimated at 27,000 lb st with afterburning. Lip of each in-

Tupolev Tu-22 (NATO 'Blinder-A') of Libyan Air Force (US Navy)



take is extended forward for take-off, creating annular slot through which additional air is ingested.

Dimensions: span 90 ft 10½ in, length 132 ft 11½ in, height 17 ft 0 in.

Weight: gross 185,000 lb.

Performance: max speed Mach 1.4 at 40,000 ft, service ceiling 60,000 ft, range 1,400 miles.

Accommodation: three crew, in tandem.

Armament: single gun in radar-directed tail mounting. Other weapons as described for individual versions.

Tupolev Tu-95 (NATO 'Bear')

To the surprise of western observers, this unique four-turboprop aircraft proved so superior to the jet-engined Myasishchev M-4 that it became the primary long-range strategic bomber of Dalnaya Aviatsiya for 20 years, until the advent of 'Backfire'. It is encountered periodically by USAF interceptors over international waters, off the US east coast, during transits between Murmansk and Cuba, and elint missions from Cuba. All six major versions identified by NATO reporting names continue in service, as follows:

Bear-A. Basic long-range strategic bomber, first flown in the late Summer of 1954. Chin radome. Internal stowage for two nuclear or a variety of conventional free-fall weapons. Defensive armament of six 23 mm guns.

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. About 100 'Bear-As' and 'Bs' remain in service with the long-range bomber force. A few 'Bs' operate in maritime reconnaissance role with Naval Air Force, with large flight refuelling nose probe, and, sometimes, a streamlined blister fairing on the starboard side of the rear fuselage. Some 'Bears' are equipped to carry 'Kitchen' air-to-surface missiles.

Bear-C. Maritime patrol version, first observed near NATO ships in 1964. Differs from 'Bear-B' in having a streamlined blister fairing on each side of its rear fuselage.

Bear-D. Identified during harassment of US Coast Guard icebreakers in the Soviet Arctic in 1967, this was the first version fitted with X-band radar in large blister fairing under centre fuselage, for reconnaissance and important anti-shipping missile role. Tasks include pinpointing of targets for missile launch crews on board ships and aircraft which are themselves too distant to ensure precise missile aiming and guidance. Glazed nose like 'Bear-A', with undernose radome and superimposed refuelling probe. Rear fuselage blisters as on 'Bear-C'. Added fairings at tips of tailplane. I-band tail-warning radar in enlarged fairing at base of rudder. About 45 serve with Soviet Naval Air Force.

Bear-E. Maritime reconnaissance bomber. Generally as 'Bear-A' but with rear fuselage blister fairings and refuelling probe as on 'Bear-C'. Six or seven camera windows in bomb-bay doors.

Bear-F. Much-refined maritime version, identified in 1973. Smaller X-band radar fairing, further forward than that of 'Bear-D'. Large blister fairings absent from rear fuselage. Lengthened fuselage forward of wings, with shallow undernose radome on some aircraft only. Enlarged fairings aft of inboard engine nacelles to improve aerodynamics. Armament reduced to two guns, in tail mounting. Two stores bays in rear fuselage, one replacing ventral gun turret. Bulged nose-wheel doors, over larger or low-pressure tyres. About 15 operational in early 1978. *(Data for 'Bear-A' follow.)*

Power Plant: four Kuznetsov NK-12MV turboprop engines; each 14,795 ehp.

Dimensions: span 159 ft 0 in, length 155 ft 10 in, height 39 ft 9 in.

Weight: gross 340,000 lb.

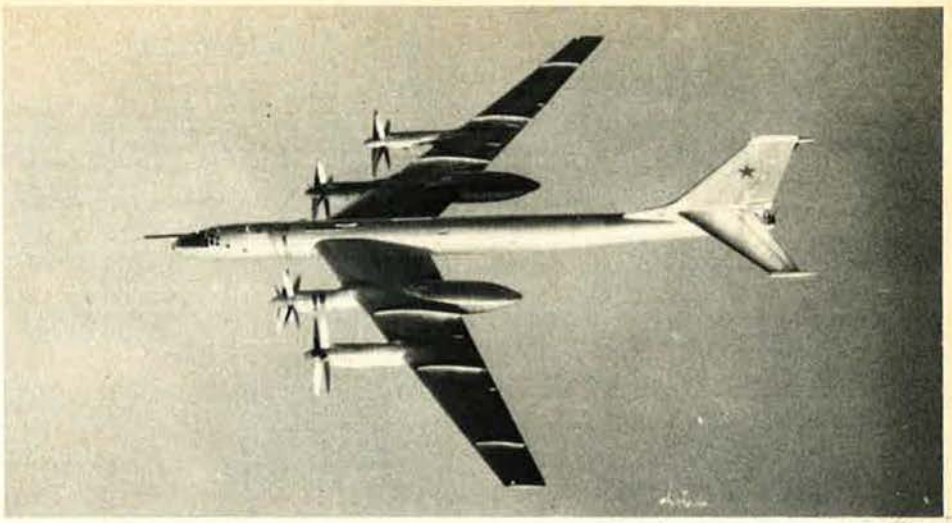
Performance: max speed 500 mph at 41,000 ft, range 7,800 miles with 25,000 lb of bombs.

Armament: six 23 mm guns in pairs in remotely-controlled forward dorsal and rear ventral turrets, and manned tail turret.

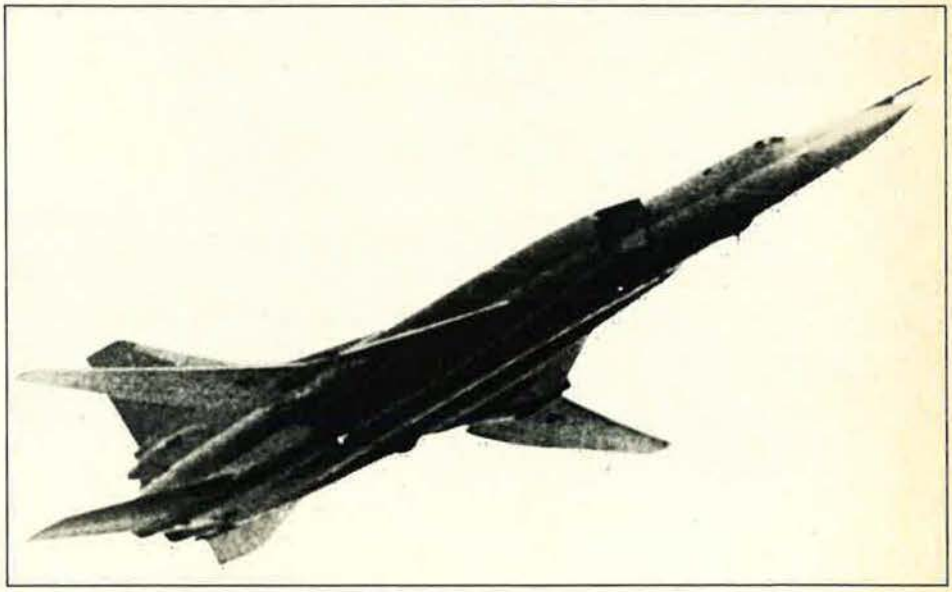
Tupolev Tu-26 (NATO 'Backfire')

Despite Soviet assurances that this elegant aircraft is a purely tactical bomber, and therefore should be excluded from SALT limitations, there is no longer any doubt of its strategic potential. Repeated statements by US officials have confirmed that, even without aerial refuelling or staging from bases in the Arctic, 'Backfires' could cover virtually all of the continental US on one-way missions, with recovery in third countries. Using Arctic staging and refuelling, they could achieve a similar target coverage and then return to their staging bases in the Soviet Union. Armed with standoff missiles, 'Backfires' in Naval Aviation service may represent a greater danger to allied shipping than do the relatively slow-moving Russian submarines.

Development of 'Backfire', which DoD has referred to as the Tu-26, probably started when the shortcomings of the Tu-22 became apparent. A prototype of the initial version was observed on the ground near the production factory at Kazan, in Central Asia, in July 1970. Up to twelve pre-production models were tested subsequently, and one early 'Backfire' remained airborne for a further ten hours after an in-flight refuelling. Two versions have been identified by non-classified NATO reporting names:



Tupolev Tu-95 (NATO 'Bear-F')



Tupolev Tu-26 (NATO 'Backfire')

Backfire-A. Initial version, with large landing gear fairing pods on wing trailing-edges. Production limited to sufficient aircraft for a single Dalnaya Aviatsiya squadron.

Backfire-B. Extensively redesigned operational version, overcoming range deficiency of 'Backfire-A'. Increased span. Landing gear pods eliminated except for shallow underwing fairings which do not protrude beyond trailing-edge. Entire fixed portion of wings believed to form integral fuel tankage; outer panels have thin section and flex considerably in flight. Engine air intakes are fitted with splitter plates and embody complex internal variable geometry. By early 1978, about 100 'Backfire-Bs' were thought to have been delivered to Dalnaya Aviatsiya and the Naval Air Force, with production continuing at the rate of 30 per year towards an eventual force of at least 250, and perhaps as many as 400, aircraft. *(Data for 'Backfire-B' follow.)*

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

Dimensions: span 113 ft spread, 86 ft swept, length 132 ft, height 33 ft.

Weight: gross 270,000 lb.

Performance: max speed Mach 2.25 to 2.5 at high altitude, supersonic at low altitude, max unrefuelled combat radius 3,570 miles.

Armament: single gun in radar-directed tail mounting. Nominal weapon load 20,800 lb. Mounting under fuselage for 'Kitchen' or 'Kingfish' air-to-surface missile. Soviet development of decoy missiles has been reported. 'Backfire' can also carry the full range of Soviet free-fall weapons.

Fighters

MiG-17 (NATO 'Fresco')

Twenty-five years after it entered production, this single-seat fighter continues to serve with the Soviet air forces, as well as with nearly 30 other air forces in eastern Europe, the Middle East, Africa, and Asia. There are no longer any MiG-17PF ('Fresco-D') limited all-weather interceptors in first-line squadrons of the PVO-Strany home air defence force; but some 200 MiG-17F ('Fresco-C') day fighter-bombers continue to equip Frontovaya Aviatsiya tactical support units deployed in less-critical areas. *(Data for MiG-17F follow.)*

Power Plant: one Klimov VK-1A turbojet engine, based on the Rolls-Royce Nene; 6,990 lb st with afterburning.

Dimensions: span 31 ft 0 in, length 36 ft 4 in, height 11 ft 0 in.

Weight: gross 14,750 lb.

Performance: max speed 700 mph at sea level, service ceiling 57,500 ft, combat radius 360 miles with two 550 lb bombs and two drop-tanks.

Accommodation: pilot only.

Armament: three 23 mm NR-23 guns. Four eight-rocket pods or two 550 lb bombs.

MiG-17 (NATO 'Fresco')

MiG-21 (NATO 'Fishbed')

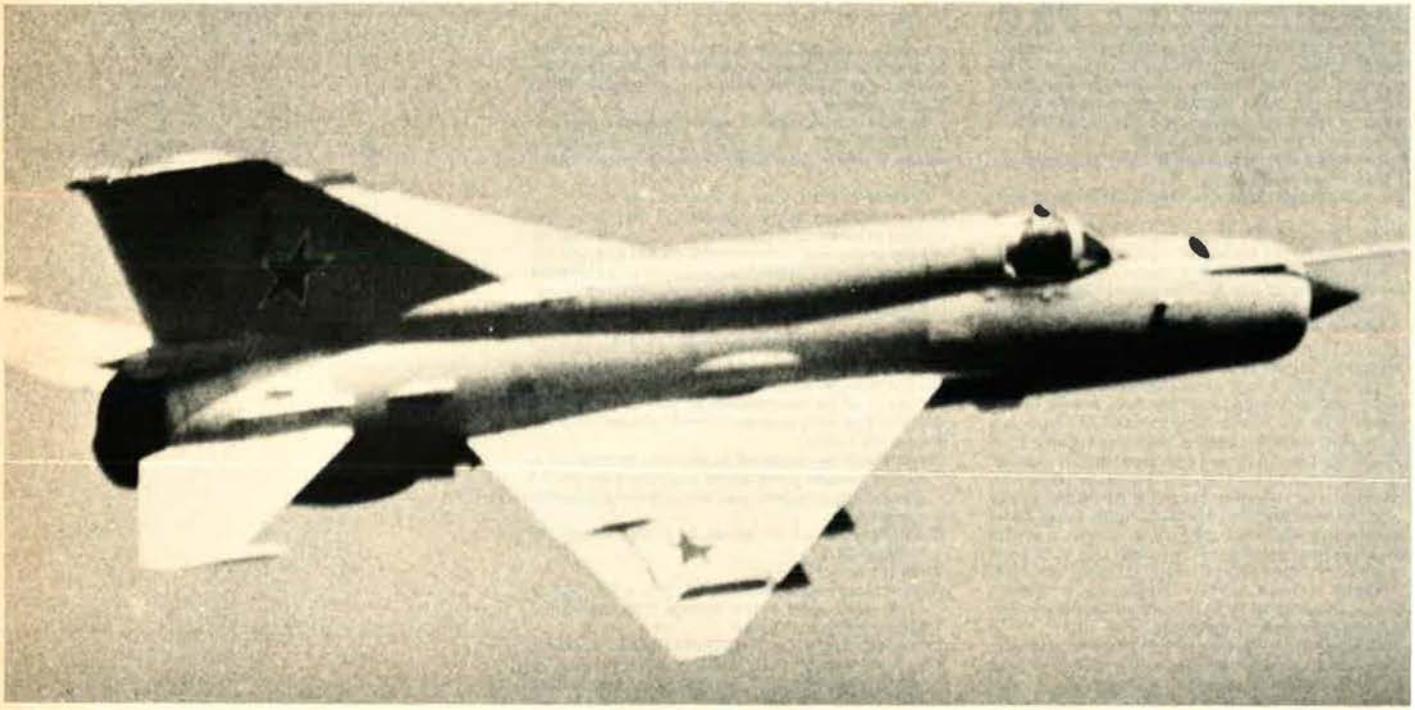
Already the most widely-used fighter in the world, this diminutive aircraft received a new lease on life with the introduction of the latest, much refined, MiG-21*bis* series. A quarter of a century ago, the late Colonel-General Artem Mikoyan had designed the original version on the basis of jet-to-jet combat experience during the Korean War, with the emphasis on good transonic and supersonic handling, high rate of climb, small size, and modest power. The resulting E-5 prototype of 1955 met the requirements; but the initial production model (NATO 'Fishbed-A') proved woefully short on range, search capability, and punch, and reflected the unimpressive Soviet constructional standards of the time. Subsequent development concentrated mainly on overcoming these deficiencies within the limitations of an airframe much smaller and lighter in weight than either of the US types that were built under the LWF (lightweight fighter) programme of the early seventies. How many have been manufactured in the Soviet Union, Czechoslovakia, India, and China (as the F-8) we may never know. They have been supplied to more than 30 air forces and are listed by *Jane's* in more than 20 different forms. Nearly one-third of the 4,600 aircraft equipping Soviet tactical air forces are MiG-21s, delivered in the following major versions:

MiG-21F ('Fishbed-C'). Short-range clear-weather fighter, with 12,676 lb st Tumansky R-11 afterburning turbojet, internal fuel capacity of 618 gallons, and radar ranging equipment in small air intake centrebody of movable three-shock type. Armed with one 30 mm gun and two K-13 (NATO 'Atoll') air-to-air missiles or sixteen-round pods of 57 mm rockets. Pylon for 130 gallon fuel tank under belly. Semi-encapsulated escape system, in which pilot is protected by canopy, ejected with seat as shield against slipstream. Pitot boom under nose.

MiG-21PF ('Fishbed-D'). Basic model of second series, with R1L search/track radar (NATO 'Spin Scan A') in enlarged intake centrebody to enhance all-weather capability. R-11 uprated to 13,120 lb st with afterburning. Internal fuel increased to 753 gallons. Gun deleted. Late production PFs have provision for two JATO rockets, and a flap blowing system (SPS) which reduces landing speed by 25 mph. Pitot boom above nose.

MiG-21PFM ('Fishbed-F'). Successor to PF, with SPS, wide-chord fin to improve stability, conventional ejection seat windscreen with quarter lights, and sideways-hinged canopy. R2L radar ('Spin Scan B') with reported lock-on range of under 8 miles and ineffective below 3,000 ft because of ground clutter. Max permissible speed at low altitude 683 mph.

MiG-21PFMA ('Fishbed-J'). Multi-role development of PFM, with four underwing pylons instead of two. Armament can include GP-9 underbelly pack, housing GSh-23 twin-barrel 23 mm gun, instead of external fuel tank. Deepened dorsal spine fairing above fuselage contains



MiG-21bis (NATO 'Fishbed-N')

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 infra-red K-13As on inboard pylons. Above-nose pitot boom offset to starboard. Zero-speed, zero-altitude ejection seat. Late production PFMAs can have GSh-23 gun installed within fuselage, with shallow underbelly fairing for the barrels, and splayed cartridge ejection chutes to permit retention of centreline tank.

MiG-21MF ('Fishbed-J'). Differs from PFMA in having lighter-weight, higher-rated Tumansky R-13-300 turbojet. Rearview mirror above canopy. Entered service in 1970.

MiG-21SMT ('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. Provision for ECM equipment in small removable wingtip pods. Deliveries believed to have started in 1971.

MiG-21*bis* ('Fishbed-L'). Third-generation multi-role air combat fighter/ground attack version, with wider and deeper dorsal fairing, updated electronics, and generally improved construction standards.

MiG-21*bis* ('Fishbed-N'). Advanced version of 'Fishbed-L' with Tumansky R-25 turbojet engine, rated at 16,535 lb st with afterburning. Enhanced electronics indicated by 'bow and arrow' antenna under nose. Operational for at least four years. *(Data for MiG-21MF follow.)*

Power Plant: one Tumansky R-13-300 turbojet engine; 14,550 lb st with afterburning.

Dimensions: span 23 ft 5½ in, length 51 ft 8½ 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, service ceiling 59,050 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 missiles.

MiG-23 (NATO 'Flogger-A, B, C, E, and F')

While retaining the minimum airframe cross-section characteristic of Soviet military design, this highly functional fighter is larger and far more sophisticated than its MiG predecessors. Production versions represent almost a total redesign by comparison with the prototype, which was demonstrated during the 1967 Aviation Day display at Domodedovo Airport, Moscow. The airframe now offers great flexibility in terms of power plant, equipment, and role. Most variants identified to date are MiG-23s, with a large splitter plate forward of each variable-geometry engine air intake, and a variable nozzle. The interdictor variant flown by Soviet units has fixed intakes, a fixed nozzle, and other significant changes, leading to a change of designation to MiG-27, and is described separately. Two fighter regiments of MiG-23s and -27s have been stationed in East Germany since 1973/74, and well over 1,000 of these variants are now in service with Soviet tactical air forces. Export models, with a lower equipment standard, operate with the air forces of Egypt, Iraq, Libya, and Syria. Variants of the MiG-23 identified by unclassified NATO reporting names are as follows:

MiG-23 ('Flogger-A'). Prototype.

MiG-23S ('Flogger-B'). Single-seat air combat fighter for Soviet AF. Compared with prototype all tail surfaces except ventral fin have been moved rearward, increasing gap between wing and tailplane; size of dorsal fin has been increased; fixed inboard wing leading-edges have been introduced. Equipment includes J-band radar (NATO 'High Lark'; search range 53 miles, tracking range 34 miles) in nose, ECM in fairings forward of starboard underwing pylon and above rudder, undernose laser rangefinder and Doppler.

MiG-23U ('Flogger-C'). Tandem two-seater for both operational training and combat use. Identical to MiG-23S except for second cockpit, with retractable periscopic sight for occupant, and modified fairing aft of canopy.

MiG-23S ('Flogger-E'). Export version of 'Flogger-B', equipped to lower standard. Smaller radar (NATO 'Jay Bird'; search range 18 miles, tracking range 12 miles) in shorter nose radome.

MiG-23- ('Flogger-F'). Export counterpart of Soviet Air Forces' MiG-27 ('Flogger-D') ground attack/interdictor. Has the nose shape and larger, low-pressure tyres of the MiG-27; but retains the power plant, variable-geometry intakes, and GSh-23 twin-barrel gun of the MiG-23S.

On all versions, wing sweep is variable manually, in flight or on the ground, reportedly to 16°, 45°, or 72°. Full-span single-slotted trailing-edge flaps are each in three sections, permitting continued actuation of outboard sections when wings are fully swept. Upper-surface spoilers/lift dumpers operate differentially in conjunction with horizontal tail surfaces, and collectively after touchdown. Extended-chord leading-edge flap on outboard two-thirds of each main (variable-geometry) wing panel. Horizontal tail surfaces operate differentially and collectively for aileron and elevator functions respectively. Conventional rudder. *(Data for Soviet AF MiG-23S follow.)*

Power Plant: one unidentified turbojet engine; thrust estimated 20,500 lb with afterburning. Variable-geometry air intakes and variable nozzle. Provision for external fuel tank on centreline pylon.

Dimensions: span 46 ft 9 in spread, 26 ft 9½ in swept, length 55 ft 1½ in.

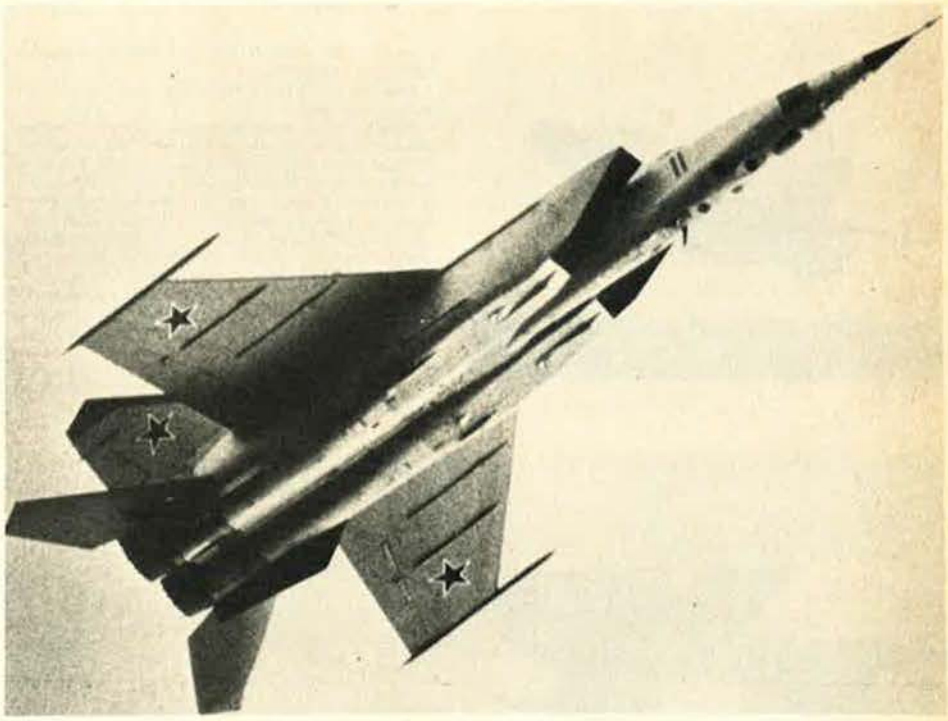
Weight: gross 28,000–33,050 lb.

Performance: max speed Mach 2.3 at height, Mach 1.1 at sea level, service ceiling 59,000 ft, combat radius 600 miles.

Accommodation: pilot only.

Armament: one twin-barrel 23 mm GSh-23 gun in belly pack. One pylon under centre fuselage, one under each engine air intake duct, and one under each fixed inboard wing panel, for air-to-air missiles (NATO 'Apex' and 'Aphid') or various other stores.

MiG-23S (NATO 'Flogger-B') (Ministry of Defence)



MiG-25R (NATO 'Foxbat-B') reconnaissance version (see description on p. 100)

MiG-25 (NATO 'Foxbat-A and C')

As a result of Lt Viktor Belenko's defection to Japan in a MiG-25 interceptor on September 6, 1976, much more is now known in the West about the structure and equipment of the world's fastest weapon-carrying aircraft. It is constructed mainly of steel, with titanium only in places subject to extreme heating, such as the wing leading-edges. The ejection seat is similar to that fitted to some versions of the MiG-21. The radar is the most powerful fitted to any interceptor, but uses vacuum tubes rather than modern circuitry, with emphasis on anti-jamming capability rather than range. ECM/ECCM standards are high, and US technicians admit that much can be learned from the MiG's structural fuel tanks and system of ground-controlled interception. Lt Belenko's MiG, built three years before the defection, did not have 'look-down, shoot-down' radar capability to any advanced degree.

Under the alternative Soviet designation E-266, a prototype set a speed record of 1,441.5 mph around a 1,000 km closed circuit, carrying a two-ton payload, as long ago as April 1965. Many subsequent records include a still-current speed of 1,852.61 mph around a 500 km circuit, and the absolute height record (subject to confirmation) of 123,523 ft. Five versions can be identified:

MiG-25 ('Foxbat-A'). Basic interceptor, with large radar (NATO 'Fox Fire') in nose, and armed with four air-to-air missiles on underwing pylons. Slightly reduced wing sweep towards tips. Wingtip anti-flutter bodies house CW target-illuminating radar.

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

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 radar or reconnaissance sensors in nose. The aircraft designated E-133 in which Svetlana Savitskaya set a women's world speed

MiG-27 (NATO 'Flogger-D') (Ministry of Defence)

Sukhoi Su-9 (NATO 'Fishpot-B')

record of 1,667.412 mph on June 2, 1975, is believed to have been a MiG-25U.

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

E-266M. Soviet designation of aircraft which recaptured two time-to-height records from the McDonnell Douglas F-15 *Streak Eagle* on May 17, 1975, and set a further record by climbing to 35,000 m (114,829 ft) in 4 min 11.3 sec. A subsequent flight set a yet-unconfirmed absolute height record of 123,523 ft. This aircraft is assumed to have an uprated power plant, enabling a future production version to carry six underwing missiles and, probably, a large gun. *(Data for 'Foxbat-A' follow.)*

Power Plant: two Tumansky R-31 (R-266) turbojet engines; each 24,250 lb st with afterburning. Internal fuel capacity approx 30,865 lb. Electrically-controlled variable ramps in intakes.

Dimensions: span 45 ft 9 in, length 73 ft 2 in, height 18 ft 4¼ in, wing area 603 sq ft.

Weights: basic operating 44,100 lb, gross 79,800 lb.

Sukhoi Su-15 (NATO 'Flagon-A')

Performance: never-exceed combat speed, with missiles Mach 2.8, service ceiling 80,000 ft, normal combat radius 700 miles.

Tupolev Tu-28P (NATO 'Fiddler')

MiG-27 (NATO 'Flogger-D')

The single-seat ground attack aircraft known to NATO as 'Flogger-D' has many airframe features in common with the MiG-23, but differs in such important respects that its Soviet designation has been changed to MiG-27. It appears to have a more powerful turbojet engine than the MiG-23, but has a fixed nozzle and fixed engine air intakes, consistent with the primary requirement of high subsonic speed at low altitude. The forward fuselage is also completely different from that of the interceptor versions of the MiG-23. There is additional armour on the flat sides of the cockpit, and the nose is sharply tapered in side elevation, with a small sloping window under a laser rangefinder and marked target seeker at the tip. Larger, low-pressure tyres are fitted. There is provision for carrying a ferry tank under each outer wing, which must be kept in a forward position when this is fitted. Operational equipment includes a different gun, and an ECM antenna above the port glove pylon.

The 'Flogger-F' export counterpart of the MiG-27 is a member of the MiG-23 series (which see). *(Data for 'Flogger-D' follow.)*

Power Plant: one unidentified turbojet engine; thrust estimated at 24,250 lb with afterburning. Internal fuel capacity 1,420 gallons.

Dimensions: As for MiG-23.

Weights: max weapon load 4,200 lb, gross 39,130 lb.

Performance: max ferry range (3 external tanks) 1,550 miles.

Accommodation: pilot only.

Armament: one six-barrel 23 mm Gatling-type gun; five pylons for unidentified external stores, known to include tactical nuclear weapons and, probably, AS-7 (NATO 'Kerry') air-to-surface missiles.

Sukhoi Su-9 (NATO 'Fishpot-B')

Nearly 25% of the PVO-Strany's force of 2,540 interceptors are 'Fishpots'. It might be assumed that Su-11s predominate, but Su-9s remain operational nineteen years after the type entered service.

Power Plant: one Lyulka AL-7F turbojet engine; 19,840 lb st with afterburning. Provision for two external fuel tanks side by side under fuselage.

Dimensions: span 27 ft 8 in, length 55 ft 0 in.

Armament: no guns; four 'Alkali' air-to-air missiles under wings.

Sukhoi Su-11 (NATO 'Fishpot-C')

As its NATO reporting name implies, the Su-11 limited all-weather interceptor is an uprated version of the Su-9. First displayed at Domodedovo in 1967, it has a lengthened nose of less tapered form, with an enlarged centrebody, and two slim duct fairings along the top of the fuselage, as on the Su-7B. Its armament is also much improved, and an uprated version of the AL-7F turbojet is installed.

Power Plant: one Lyulka AL-7F-1 turbojet engine; 22,046 lb st with afterburning.

Dimensions: span 27 ft 8 in, length 56 ft 0 in.

Weight: gross 30,000 lb.

Performance: max speed Mach 1.8 at 36,000 ft, ceiling 55,700 ft.

Accommodation: pilot only.

Armament: no guns; two air-to-air missiles (NATO 'Anab') under wings, one radar-homing, one infra-red homing.

Sukhoi Su-15 (NATO 'Flagon')

Numerically, the Su-15 is the backbone of the PVO-Strany domestic home defence force, with deliveries estimated to total around 1,000 operational aircraft. Their capability is limited by the current Soviet lack of a look-down, shoot-down system for interceptors, and by the shortcomings of the Tu-126 'AWACS'. Nonetheless, the Su-15 represented a great advance over the Su-11 when it first appeared, even though the original wings, tail surfaces, and cockpit area of the two types looked almost identical. Main differences were 'Flagon's' two side-by-side engines and large conical nose radome, which necessitated the side intake boxes with splitter plates. Development led to a succession of significant changes, and six variants may now be identified by NATO reporting names:

Flagon-A. Basic single-seater, of which a prototype and nine pre-production models participated in the Aviation Day display at Domodedovo in 1967. Simple delta wings, identical in form to those of Su-11, with constant sweep of approx 53°. Conical nose radome. Probably limited to small initial quantity.

Flagon-B. Experimental STOL version with wings of compound sweep (different from those of 'Flagon-D/E/F'), and three vertically-mounted lift-jet engines in centre fuselage. Demonstrated at Domodedovo, 1967. For R & D only.

Flagon-C. Two-seat training version of 'Flagon-D', probably with combat capability. Individual rearward-hinged canopy over each seat.

Flagon-D. Generally similar to 'Flagon-A' but with wings of compound sweep, produced by reducing the sweepback at the tips via a very narrow unswept section. Span approx 34 ft 6 in. Conical radome. First major production version.

Flagon-E. Wings similar to those of 'Flagon-D'. New and more powerful propulsion system, increasing speed and range. Uprated electronics. Major production version, operational since second half of 1973.

Flagon-F. Latest version in service, identified by ogival nose radome. Generally similar to 'Flagon-E'. *(Data for 'Flagon-A' follow.)*

Power Plant: two unidentified afterburning turbojets.

Dimensions: span 30 ft 0 in, length 68 ft 0 in.

Weight: gross 35,275 lb.

Performance: max speed Mach 2.5 above 36,000 ft, combat radius 450 miles.

Accommodation: pilot only.

Armament: no guns; two missiles (NATO 'Anab') under wings, one radar homing, one infra-red homing. Two further pylons for weapons or fuel tanks under centre fuselage.

Tupolev Tu-28P (NATO 'Fiddler')

The specification requirements to which the Tu-28P was designed were so demanding, in terms of long range, heavy weapon load, and radar performance, that Tupolev could meet them only by producing the largest fighter ever put into squadron service. When it was first displayed in public, at Tushino in 1961, it carried two missiles (NATO 'Ash'), each 18 ft long, had a large blister fairing under its fuselage, and was fitted with two ventral fins. Production 'Fiddlers' dispensed with the fairing and ventral fins, but appeared at Domodedovo in 1967 with

armament increased to four missiles. No more than 150 are thought to be deployed by the PVO-Strany, and unconfirmed reports suggest that these are being replaced by an interceptor version of the Tu-22.

Power Plant: two unidentified afterburning turbojet engines; each estimated at 27,000 lb st. Half-cone shock-body in each air intake.

Dimensions: span 65 ft 0 in, length 85 ft 0 in.

Weight: gross 100,000 lb.

Performance: max speed Mach 1.75 at 36,000 ft, ceiling 65,620 ft, range 3,100 miles.

Accommodation: crew of two in tandem.

Armament: four air-to-air missiles (NATO 'Ash') under wings, two radar homing, two infra-red homing.

Yakovlev Yak-28P (NATO 'Firebar')

Even by highly economical Soviet standards, the Yak-28 proved a remarkably versatile aeroplane. The same basic airframe was adaptable to a wide variety of roles, enabling the Yak-28 to take over most of the tasks performed by the earlier Yak-25/26/27 family, and add a few of its own. The Yak-28P transonic all-weather interceptor variant emphasised how easy it was to misinterpret aspects of Soviet design. The long pointed fairings forward of the balancer wheel housings had no sinister significance, being simply lead-filled for aerodynamic reasons. Similarly, the much longer dielectric nosecone fitted retrospectively to some aircraft did not indicate any increase in radar capability or aircraft performance, but simply a change of material and shape. About 300 Yak-28Ps remain operational.

Power Plant: two turbojet engines, believed to be related to the Tumansky R-11 fitted in some MiG-21s; each 13,120 lb st with afterburning. Each intake houses a centrebody shock-cone.

Dimensions: span 42 ft 6 in, length 71 ft 0½ in, height 12 ft 11½ in.

Weight: gross 35,000 lb.

Performance: max speed Mach 1.1 at 35,000 ft, service ceiling 55,000 ft, combat radius 575 miles.

Accommodation: crew of two in tandem.

Armament: two air-to-air missiles (NATO 'Anab') under outer wings, with alternative infra-red or semi-active radar homing heads.

Yakovlev Yak-28P (NATO 'Firebar') (Tass)

Attack Aircraft

Sukhoi Su-7 (NATO 'Fitter-A')

Despite a reported endurance of only eight minutes with full afterburning, and restricted combat radius, this single-seat ground attack fighter was built in very large numbers. At least 400 continue to serve with Soviet tactical air force units; others equip front-line squadrons of fifteen air forces throughout the world. The design goes back to the early fifties, as the prototype Su-7 was first seen in company with the prototype of the Su-9 interceptor at the 1956 Aviation Day display. Study of the two types revealed that their airframes were almost identical, except for the use of swept and delta wings respectively; they also proved to have the same Lyulka engine. Formations of up to 21 aircraft were operational in time to participate in the 1961 Aviation Day flypast. Su-7s were subsequently used in action by India, against Pakistan, and by Arab air forces in the Middle East. Standard versions are the Su-7B and Su-7BM, the latter with a low-pressure nosewheel tyre, necessitating bulged doors to enclose it when retracted.

Power Plant: one Lyulka AL-7F-1 turbojet engine; 22,046 lb st with afterburning. Internal fuel capacity 7,000 lb. Provision for two external tanks under belly, combined capacity 2,100 lb. Two JATO rockets can be fitted under rear fuselage to shorten take-off run.

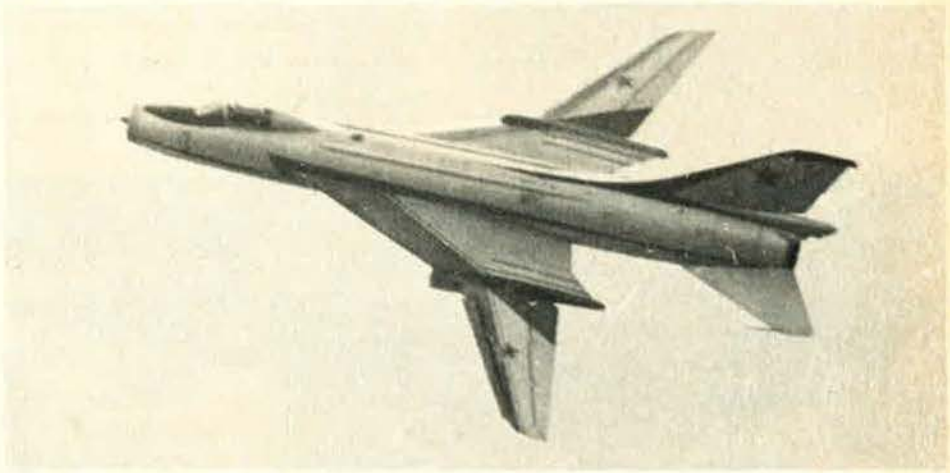
Dimensions: span 29 ft 3½ in, length 57 ft 0 in, height 15 ft 0 in.

Weights: empty 19,000 lb, gross 29,750 lb.

Performance: max speed Mach 1.6 clean or Mach 1.2 with external stores at 36,000 ft, or 530 mph at sea level without afterburning, service ceiling 49,700 ft, combat radius 200–300 miles.

Accommodation: pilot only.

Armament: two 30 mm NR-30 guns in wing roots, each with 70 rounds; underwing pylons for two 1,650 lb and two 1,100 lb bombs, or rocket pods. External weapon load reduced to 2,200 lb when two underbelly fuel tanks are carried.



Sukhoi Su-7 (NATO 'Fitter-A')

Sukhoi Su-17, Su-20, and Su-22 (NATO Fitter-C and D')

These three types are variants of the same variable-geometry adaptation of the Su-7, and all received the JATO reporting name 'Fitter-C' in their basic form. The Su-17 is operated by the Soviet AF; the Su-20 and Su-22 are export models, differing in both power plant and equipment standards. Prototype for the whole family was an R & D aircraft shown at Domodedovo in 1967 and allocated the NATO reporting name 'Fitter-B'. Only some 3 ft of each wing was pivoted, outboard of a very large fence, the remainder of the airframe being virtually identical with that of the Su-7. An attachment for an external tore was built into each wing fence, but there seemed no reason to expect 'Fitter-B' to form the basis of a production aircraft, in view of the modest improvement in overall performance offered by such minimal modification. Discovery of at least one or two squadrons of generally-similar aircraft in service with the Soviet tactical air forces in 1972 came as a surprise, suggesting that even a small improvement in range and endurance by comparison with the Su-7 was considered worthwhile. Several hundred are now deployed by Soviet tactical air forces, including the ground attack regiment based at Finsterwalde in East Germany. Operators of the export versions include the Polish, Egyptian, and Peruvian air forces. Differences between the various versions are as follows:

Su-17 ('Fitter-C'). Original Soviet AF model, with Lyulka AL-21F-3 turbojet, rated at 25,000 lb st with afterburning and offering better specific fuel consumption than AL-7F-1. Manual wing sweep control. Equipment said to include SRD-5M (NATO 'High Fix') I-band centrebody ranging radar, ASP-5ND fire control system, and Sirena 3 omni-directional radar homing and warning system.

Sukhoi Su-17 (NATO 'Fitter-C') (Flug Revue)

Su-17 ('Fitter-D'). Su-17 with added small undernose radome and laser marked target seeker in intake centrebody.

Su-20 ('Fitter-C'). Export model. Variations in rear fuselage contours by comparison with Su-17 suggest that Su-7's AL-7F-1 afterburning turbojet may be retained.

Su-22 ('Fitter-C'). Variant of Su-20, delivered to Peru in 1977. Further reduced equipment standard, with Sirena 2 limited-coverage radar warning receiver, virtually no navigation aids, and IFF incompatible with Peru's SA-3 (NATO 'Goa') missiles. Weapons include 'Atoll' air-to-air missiles. *(Data for Su-17 'Fitter-C' follow.)*

Power Plant: see under model description. Provision for large drop-tank under each wing fence.

Dimensions: span 45 ft 11¼ in spread, 34 ft 9½ in swept, length 61 ft 6¼ in, height 15 ft 7 in, wing area 431.6 sq ft spread, 400.4 sq ft swept.

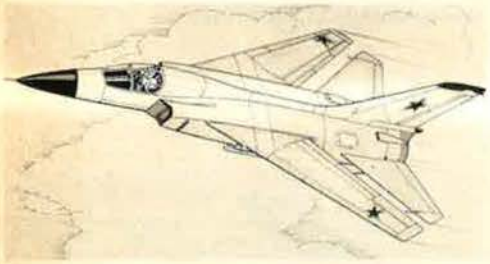
Weights: empty 22,046 lb, take-off clean 30,865 lb, gross 41,887 lb.

Performance: max speed Mach 2.17 at height, Mach 1.05

at sea level, ceiling 59,050 ft, combat radius with 4,409 lb external stores 224–391 miles according to profile.
Accommodation: pilot only.
Armament: two 30 mm NR-30 guns in wing roots; eight pylons under fuselage and wings for up to 11,023 lb of bombs, rocket pods, and guided missiles, including the air-to-surface AS-7 (NATO 'Kerry').

Sukhoi Su-19 (NATO 'Fencer')

First modern Soviet fighter developed specifically as a fighter-bomber for the ground attack mission, the Su-19 remains an enigma more than three years after it began to enter service with an operational evaluation squadron in East Germany. At least 250 now serve with first-line squadrons in the European theatre, including units in Lusatia and a regiment at Chernaykhovsk, near Kaliningrad on the Soviet Baltic coast. Yet the only photograph released to date is fuzzy and indistinct, and the accompanying artist's impression must be regarded as provisional. An RAF assessment of the Su-19's potential is that it offers five times the weapon load and five times the range of its immediate predecessor, enabling it to reach any target in England from East German bases. Except for the side-by-side two-seat cockpit, the overall lines of the fuselage, air intake trunks, and vertical tail surfaces appear to have much in common with those of the Su-15. Wing sweep seems to be about 23° in the fully spread position, and 70° fully swept. The outer panels are fitted with the first pivoting pylons seen on a Soviet variable-geometry aircraft.
Power Plant: possibly two Lyulka AL-21F turbojets, as fitted in Su-17.
Dimensions: span 56 ft 3 in spread, 31 ft 3 in swept, length 69 ft 10 in.
Weight: gross 68,000 lb.
Performance: max speed above Mach 2 at height, combat radius (lo-lo-lo) over 200 miles.



Artist's impression of Sukhoi Su-19 (NATO 'Fencer')

Yakovlev Yak-36 (NATO 'Forger')

Armament: one 23 mm GSh-23 twin-barrel gun in belly; six pylons under fuselage, wing-root gloves, and outer wings for more than 10,000 lb of guided and unguided air-to-surface weapons.

Yakovlev Yak-28 (NATO 'Brewer-A, B, and C')

A small number of two-seat tactical attack Yak-28s remain in service with Soviet units in secondary areas. Most have been switched to support roles, as described under the *Reconnaissance, ECM, and Early Warning Aircraft* heading.

Yakovlev Yak-36 (NATO 'Forger')

Continued study of photographs of Yak-36s based on the carrier/cruiser *Kiev* during its maiden voyage through the Mediterranean and North Atlantic, in July 1976, leaves little doubt that the aircraft were from an early production series, operated by a development squadron. Those with an identification number above 20 painted on their intake trunks had a row of small auxiliary intake doors aft of each lip; those with lower numbers did not. At no time were these aircraft seen to fly with external weapons under their wings, although gun packs and rockets were observed on those parked on deck. At least one example of the rather crude-looking two-seat training version of the Yak-36 was also in evidence. NATO reporting names given to these two variants are:
Forger-A. Basic single-seater. About ten or twelve appear to be carried by the *Kiev*, in addition to Kamov Ka-25 helicopters. Primary operational roles are assumed to be attack and reconnaissance.
Forger-B. Two-seat trainer. Second cockpit forward of normal cockpit, with blister canopy at lower level. Rear fuselage lengthened to compensate for longer nose. No ranging radar or weapon pylons. Overall length about 58 ft 0 in.

First operational fixed-wing VTOL combat aircraft revealed by the Soviet Union, the Yak-36 has a single large turbojet, exhausting through a pair of rotating nozzles aft of the wing roots. Two lift-jets are mounted in tandem aft of the cockpit, inclined at an angle so that their thrust is exerted both upward and slightly forward. As the main vectored-thrust nozzles turn up to 10° forward of vertical during take-off and landing, the total of four effluxes can be envisaged as forming a V under the fuselage. Only vertical take-offs were observed during operations from the *Kiev*. It is difficult to conceive how STOL take-off could be effected with such a power plant arrangement, which also seems to rule out the possibility of thrust vectoring in forward flight, which has proved such an advantage on the Harriers of the US Marine Corps. Puffer-jets at the wingtips and tail help to give the Yak-36 commendable stability during take-off and landing.
Power Plant: one unidentified turbojet, without afterburner; thrust estimated at 17,000 lb. Two lift-jets; each estimated at 5,600 lb st.
Dimensions: span 23 ft 0 in, length 49 ft 3 in.
Weight: gross 22,050 lb.
Performance: max speed Mach 1.3 at height.
Accommodation: pilot only.
Armament: four pylons under inner wings for stores, including gun pods and rocket packs.

Reconnaissance, ECM, and Early Warning Aircraft

Antonov An-12 (NATO 'Cub-C')

MiG-21R (NATO 'Fishbed-H')
(Flug Revue)

Antonov An-12 (NATO 'Cub-C')

Both the Soviet Air Force and Navy operate a variant of the An-12 turboprop transport equipped for ECM duties (NATO 'Cub-C'), and examples were photographed in Egyptian Air Force markings during the period of Russian presence in Egypt. The glazed nose and undernose radome of the transport version are retained, but an ogival 'solid' fuselage tailcone, housing electronic equipment, is fitted instead of the usual gun position. Additional electronic pods are faired into the forward fuselage and ventral surfaces.

Ilyushin Il-14 (NATO 'Crate')

The traditional Soviet reluctance to discard any aircraft that remains airworthy is exemplified by the variety of types that have been adapted for reconnaissance, ECM, and other support duties after replacement in their primary roles. Thus, small numbers of Il-14 transports, each powered by two 1,900 hp Shvetsov ASh-82T piston engines, are operated on ECM and reconnaissance tasks by the Soviet and other Warsaw Pact air forces.

MiG-21 (NATO 'Fishbed-H')

Two versions of this supersonic single-seat fighter are equipped as specialised tactical reconnaissance aircraft:
MiG-21R ('Fishbed-H'). Basically similar to MiG-21PFMA, but with a pod housing forward-facing or oblique cameras, infra-red sensors, or ECM devices, and fuel, carried on the fuselage centreline pylon. Suppressed antenna at mid-fuselage; optional ECM equipment in wingtip fairings.
MiG-21RF ('Fishbed-H'). Generally similar to MiG-21R, but based on MiG-21MF.

MiG-25 (NATO 'Foxbat-B and D')

Although generally similar to the basic MiG-25 interceptor, the reconnaissance variants have a modified wing and, carrying no external weapons, are not limited to Mach 2.8. Two versions have been identified in service, as follows:
MiG-25R ('Foxbat-B'). Basic reconnaissance version, with five camera windows and various flush dielectric panels forward of cockpit. Small dielectric nosecap for radar. Equipment believed to include Doppler navigation system, and side looking airborne radar (SLAR). No armament. Slightly reduced span. Wing leading-edge sweep constant from root to tip.

Mil Mi-4 fitted with communications jamming equipment (Ministry of Defence)

Left: Tupolev Tu-126 (NATO 'Moss') (Ministry of Defence)
Below: Yakovlev Yak-28 (NATO 'Brewer-E')

MiG-25R ('Foxbat-D'). Similar to 'Foxbat-B', but with larger SLAR dielectric panel, further aft on starboard side of nose, and no cameras.
Dimensions: 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.

Mil Mi-4 (NATO 'Hound')

Superseded by turbine-powered helicopters in their original transport and anti-submarine roles, Mi-4s continue in service with support units. A version first identified in 1977 is shown in an accompanying illustration. The multiple antennae projecting from the front and rear of the cabin, on each side, are communications jammers.
Power Plant: one Shvetsov ASh-82V piston engine; 1,700 hp.
Dimensions: rotor diameter 68 ft 11 in, length of fuselage 55 ft 1 in, height 17 ft 0 in.
Weight: gross 17,200 lb.

Tupolev Tu-126 (NATO 'Moss')

The Tu-126 is the PVO-Strany's counterpart to the USAF's Boeing E-3A AWACS (Airborne Warning and Control System). Ten or twelve are operational, with airframe and power plant developed from those of the Tu-114 turboprop airliner rather than from the smaller-fuselage Tu-95 bomber. The 36 ft diameter rotating radar "saucer" above the fuselage is 6 ft larger than that of the E-3A; however, at its present stage of development, the Tu-126 is believed by US defence experts to have only limited effectiveness over water and to be ineffective over land.
Power Plant: four Kuznetsov NK-12MV turboprop engines; each 14,795 ehp.
Dimensions: span 167 ft 8 in, length 188 ft 0 in.
Armament: none

Yakovlev Yak-28 (NATO 'Brewer')

The original 'Brewer-A, B, and C' versions of the Yak-28 were two-seat tactical attack aircraft, with the navigator/bomb-aimer stationed in the glazed nose. Most have been switched from first-line attack to support roles, and the most important Yak-28s now operational are probably the following two versions:

Brewer-D. Reconnaissance aircraft, carrying cameras instead of weapons in its internal bomb-bay.

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 other, additional antennae and fairings are apparent. A rocket pod can be carried under each outer wing, between the external fuel tank and balancer wheel housing.

Dimensions, weight, and **performance** should be in the same order as those of the Yak-28P ('Firebar') interceptor (which see).

Transports

Antonov An-8 (NATO 'Camp')

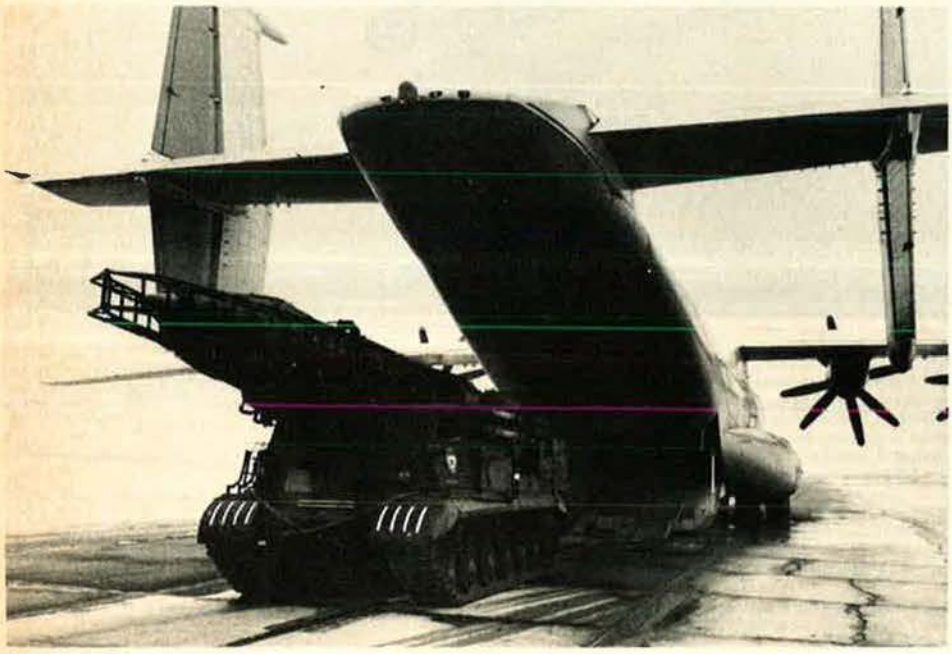
About half of the 100 An-8s built in the second half of the fifties are thought to remain in service with the Soviet military air transport force. Used for support duties, such as paratroop training and monitoring of radioactive fallout, they are seldom photographed, being completely overshadowed by the scaled-up, four-engined An-12 which followed them on the production line.
Power Plant: two Ivchenko AI-20V turboprop engines; each 4,000 ehp.
Dimensions (approx): span 98 ft 5 in, length 85 ft 3½ in.
Weights: max payload 19,840 lb, gross 83,775 lb.
Performance: max speed 373 mph, range 2,175 miles at 298 mph.
Accommodation: designed to carry 42–48 passengers.
Armament: Provision for one 23 mm NR-23 gun in manned tail position.

Antonov An-12 (NATO 'Cub')

Now in its 19th year of service, this mainstay of the Soviet military air transport force is expected to be replaced progressively by the turbofan Il-76. In early 1977, An-12s still constituted nearly half of the 1,500 aircraft available for troop and freight carrying, with total airlift capacity for two full army divisions of 14,000 men and their equipment, over a radius of 750 miles. Layout is

Antonov An-8 (NATO 'Camp')

Paratroops with Antonov An-12 (NATO 'Cub-A') (Tass)



'Scud-A' rocket vehicle disembarking from an Antonov An-22 (NATO 'Cock') (Tass)

Antonov An-26 (NATO 'Curl') of Hungarian Air Force

Antonov An-32 (NATO 'Cline') (Brian M. Service)

conventional for a freighter, with access to the hold via a ramp-door which forms the bottom of the upswept rear fuselage when closed. This ramp-door is made in two longitudinal halves, which can be hinged upward inside the cabin to permit direct loading from trucks on the ground, or air-dropping of supplies and equipment. A full load of 100 paratroops can be despatched via this exit in under one minute. The 'Cub-C' elint version is described separately.

Power Plant: four Ivchenko AI-20K turboprop engines, each 4,000 ehp.
Dimensions: span 124 ft 8 in, length 108 ft 7¼ in, height 34 ft 6½ in.
Weights: empty 61,730 lb, gross 121,475 lb.
Performance: max speed 482 mph, service ceiling 33,500 ft, range 2,236 miles with max payload.
Accommodation: crew of six; freight, vehicles, or 100 parachute troops. Built-in freight handling gantry with capacity of 5,070 lb.
Armament: two 23 mm NR-23 guns in manned tail turret.

Antonov An-14 (NATO 'Clod')

A few of these STOL light transports are operated by the air forces of the Soviet Union, its friends and allies, including Bulgaria, East Germany, and Guinea. Access to the cabin is via rear clamshell doors. All-weather operation is said to be practicable, with full-payload take-off and landing runs of 328 ft and 230 ft respectively, on concrete.

Power Plant: two Ivchenko AI-14RF piston engines: each 300 hp.
Dimensions: span 72 ft 2 in, length 37 ft 6½ in, height 15 ft 2½ in, wing area 427.5 sq ft.
Weights: empty 4,409 lb; gross 7,935 lb.
Performance: max speed 138 mph at 3,280 ft, service ceiling 17,060 ft, range 404 miles with max payload.
Accommodation: pilot and one passenger on flight deck; six or seven passengers, or 1,590 lb of freight, in main cabin.
Armament: none

Antonov An-22 (NATO 'Cock')

The prototype of this huge turboprop freighter flew for the first time on February 27, 1965. Three participated in the Aviation Day display at Domodedovo in July 1967, demonstrating their military potential by disembarking batteries of 'Frog-3' rockets and SA-4 ('Ganef') surface-to-air missiles on tracked launchers. Production continued until 1974, and estimates of the number delivered to the A-VDV military air transport force vary from 30 to 50. Max payload, 176,350 lb.

Power Plant: four Kuznetsov NK-12MA turboprop engines; each 15,000 shp.
Dimensions: span 211 ft 4 in, length 190 ft 0 in, height 41 ft 1½ in, wing area 3,713 sq ft.
Weights: empty 251,325 lb, gross 551,160 lb.
Performance: max speed 460 mph, range 6,800 miles with 99,200 lb payload.
Accommodation: crew of five or six; 28–29 passengers in cabin forward of main freight hold. Four travelling gantries and two winches to speed freight handling.
Armament: none.

Antonov An-24 (NATO 'Coke')

Of the 1,100 An-24s known to have been built, the majority are flown by Aeroflot and fourteen other airlines. At least fifteen air forces have acquired the type, usually in small numbers, and up to 200 serve with the Soviet air force (including An-26s, described separately). The **An-24T** freighter differs from the basic passenger-carrying **An-24V** in having a belly freight door at the rear, instead of the port-side passenger door, and two ventral fins instead of one. The belly door can be opened in flight for air-dropping payload or parachutists. The **An-24RV** and **An-24RT** versions differ in having a 1,985 lb st RU 19-300 auxiliary turbojet in the rear of the starboard engine nacelle, for turboprop starting and to provide additional power for take-off, climb, and cruising flight, as required. *(Data for An-24V follow.)*

Power Plant: two Ivchenko AI-24A turboprop engines; each 2,550 ehp.
Dimensions: span 95 ft 9½ in, length 77 ft 2½ in, height 27 ft 3½ in, wing area 807.1 sq ft.
Weights: empty 29,320 lb, gross 46,300 lb.
Performance: normal cruising speed 280 mph at 19,700 ft, service ceiling 27,560 ft, range 341 miles with max payload. 1,490 miles with max fuel.
Accommodation: crew of three to five; seats for 44–52 passengers in main cabin. (An-24T can carry 30 paratroops, 38 combat-equipped troops, or 24 litters instead of freight.)
Armament: none.

Antonov An-26 (NATO 'Curl')

This much improved freight version of the An-24 is appearing in service with air forces as widespread as those of Bangladesh, Poland, Hungary, and Peru, as well as with Soviet military air transport units. It is basically an An-24T with more powerful engines and a completely redesigned rear fuselage. The latter embodies a large loading ramp, which forms the underside of the rear fuselage when retracted, and 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 air-dropped. Conversion of the standard freighter to carry troops or litters takes 20 to 30 minutes in the field. Optional equipment includes an OPB-1R sight for pinpoint dropping of freight. Max payload is 12,125 lb.

Power Plant: two Ivchenko AI-24T turboprop engines; each 2,820 ehp. One 1,985 lb st RU 19-300 auxiliary turbojet in starboard nacelle *(see An-24 entry)*.
Dimensions: span 95 ft 9½ in, length 78 ft 1 in, height 28 ft 1½ in.
Weights: empty 33,113 lb, gross 52,911 lb.
Performance: cruising speed 264–270 mph at 19,675 ft, service ceiling 26,575 ft, range 559 miles with normal 9,920 lb payload, 1,398 miles with 4,687 lb.
Accommodation: crew of five, plus station for load supervisor or despatcher. Electrically-powered mobile hoist, capacity 3,300 lb, and conveyor to facilitate loading and air-dropping. Provision for carrying 40 paratroops or 24 litters.
Armament: none.

Antonov An-32 (NATO 'Cline')

Announced in May 1977, and exhibited at the Paris Air Show at the end of that month, the An-32 has the basic airframe of the An-26, fitted with two uprated versions of the engines fitted to the An-12, and with a slotted

Antonov An-72, new light transport

tailplane and enlarged ventral fins. It is able to operate from airfields 13,000 to 14,750 ft above sea level in an ambient temperature of 25°C, and can transport 3 metric tons of freight over a 683 mile stage length, with fuel reserves. Maximum payload is 6 metric tons.

Power Plant: two Ivchenko AI-20M turboprop engines; each 5,180 ehp.
Dimensions: as for An-26.
Weight: gross 57,320 lb.
Performance: normal cruising speed 317 mph, service ceiling 31,150 ft, max range 1,367 miles.
Accommodation: crew of five; freight, or 39 troops, 30 paratroops, or 24 litters and a medical attendant.
Armament: none.

Antonov An-40

Reports in the Summer of 1977 suggested that the Antonov design bureau was working on a new, very large, turbofan-powered transport in the class of the USAF's Lockheed C-5 Galaxy. It is said to be intended as a replacement for the turboprop-powered An-22 strategic freighter.

Antonov An-72

Photographs of a new light transport aircraft, designated An-72, were issued by the official Soviet news agency in late December 1977. In configuration, the aircraft resembles closely the Boeing YC-14 advanced medium STOL transport, developed under USAF contract as a C-130 replacement. The An-72 is, however, a very much smaller type, with a payload of 5 metric tons, compared with 36 metric tons for the YC-14. Dimensions, weights, and performance figures had not been released by mid-January 1978, except for a cruising speed of 370–435 mph. Upper-surface blowing by the high-mounted engines, the use of large leading-edge and trailing-edge flaps, and tandem main landing gear are expected to give the An-72 STOL performance from unprepared airfields. It is intended as a replacement for the An-24/26 series.

Ilyushin Il-18 (NATO 'Coot')

At least nine air forces have operated versions of this four-engined airliner, usually in a VIP transport role. Fewer than twenty are thought to remain in service with the Soviet air force.

Power Plant: four Ivchenko AI-20M turboprop engines; each 4,250 ehp.
Dimensions: span 122 ft 8½ in, length 117 ft 9 in, height 33 ft 4 in.
Weights: empty 76,350 lb, gross 134,925 lb.
Performance: max cruising speed 419 mph, range 3,230 miles with max fuel, or 1,990 miles with max payload.
Accommodation: crew of five; up to 122 passengers.
Armament: none.

Ilyushin Il-76 (NATO 'Candid')

Most important of the transport aircraft currently in production in the Soviet Union, this thoroughly modern four-turbofan heavy freighter is being deployed initially as a replacement for the A-VDV's An-12s. Aircraft were shown in service, presumably with a development squadron, in an official film released in 1975, only four years after the first flight of the prototype, on March 25, 1971. The military transport was seen to have a rear gun turret, and to be able to carry parachute troops as an alternative to freight. An Il-76 is also known to have been evaluated as a tanker for the 'Backfire' bomber force, and is expected to supersede the Myasishchev M-4 in this role.

The Il-76 is described in Soviet statements as an aircraft for commercial operation in Siberia, the north of the Soviet Union, and the Far East, where conditions are often difficult, with short, unprepared airstrips. Its basic task was to transport 40 metric tons of freight for a distance of 3,100 miles (5,000 km) in under six hours. Design features include rear-loading ramp/doors, a T-tail, full-span leading-edge slots, and double-slotted flaps for good field performance, a navigator's station in the glazed nose, with ground-mapping radar in a large undernose fairing, and a unique and complex landing gear. The nose unit is fitted with two pairs of wheels, side by side. Each main unit comprises four pairs of wheels in two rows, and retracts in such a way that the wheels remain vertical but at 90° to the direction of flight. Four long fairings are required, to enclose the wheels and actuating gear on each side. The entire accommodation is pressurised. Advanced mechanical handling systems are fitted for containerised and other freight. Equipment for all-weather operation includes a computer for automatic flight control and automatic landing approach.

A series of 24 official records set by the Il-76 in July 1975 include a payload of more than 70 tonnes (154,590 lb) 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.

Power Plant: four Soloviev D-30KP turbofan engines; each 26,455 lb st.
Dimensions: span 165 ft 8 in, length 152 ft 10½ 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 maximum payload of 88,185 lb, max range 4,163 miles.
Accommodation: crew of three to five.
Armament: gun turret in tail.

Ilyushin Il-86 (NATO 'Camber')

Whether or not this first Soviet wide-bodied transport aircraft will enter military service remains to be seen. The prototype flew for the first time on December 22, 1976, after taking off from a 5,970 ft runway at the old Moscow Central Airport of Khodinka. In mid-1977, it was exhibited at the Paris Air Show.

Power Plant: four Kuznetsov NK-86 turbofan engines; each 28,660 lb st.
Dimensions: span 157 ft 8 in, length 195 ft 4 in, height 51 ft 10½ in, wing area 3,444 sq ft.
Weights: max payload 92,600 lb, gross 418,875–454,150 lb.
Performance: cruising speed 560–590 mph at 30,000–36,000 ft, max range 2,858 miles, range with max payload 1,460 miles.
Accommodation: crew of three or four; up to 350 passengers in basic nine-abreast seating.

Ilyushin Il-76 (NATO 'Candid') (Tass)

Ilyushin Il-18 (NATO 'Coot') of Yugoslav Air Force

Ilyushin Il-86 (NATO 'Camber') (Brian M. Service)

Trainers

Aero L-29 Delfin (NATO 'Maya')

Aero L-39

MiG-15UTI (NATO 'Midget') (Tass)

Sukhoi Su-7U (NATO 'Moujik')

Yakovlev Yak-28U (NATO 'Maestro') (Tass)

Aero L-29 Delfin (NATO 'Maya')

It has long been the practice of Warsaw Pact nations to standardise aircraft of all categories throughout their air forces. Thus, the L-29 two-seat jet basic and advanced trainer, designed and manufactured in Czechoslovakia, is standard equipment in all of these nations except Poland, which prefers its own TS-11 Iskra. More than 3,000 L-29s were built between 1963 and 1974, and continue to fly with more than a dozen air forces.

Power Plant: one M 701c 500 turbojet engine; 1,960 lb st.
Dimensions: span 33 ft 9 in, length 35 ft 5½ in, height 10 ft 3 in.
Weights: empty 5,027 lb, gross 7,804 lb.
Performance: max speed 407 mph at 16,400 ft, service ceiling 36,100 ft, range 555 miles with external tanks.
Accommodation: crew of two, in tandem.
Armament: provision for two bombs of up to 220 lb, eight air-to-ground rockets, or two 7.62 mm machine-gun pods under wings.

Aero L-39

When this basic and advanced trainer made its first appearance in the west, at the 1977 Paris Air Show, it became known that between 400 and 500 were already in service with the air forces of Bulgaria, Czechoslovakia, East Germany, Hungary, Iraq, and the Soviet Union, as replacements for L-29 Delfins. Designed by an all-Czechoslovakian team, the prototype had flown for the first time on November 4, 1968.

Power Plant: one Ivchenko AI-25-TL turbofan engine; 3,792 lb st.
Dimensions: span 31 ft 0½ in, length 40 ft 5 in, height 15 ft 5½ in, wing area 202.36 sq ft.
Weights: empty 7,341 lb, gross (trainer, clean) 10,075 lb.
Performance: max speed 485 mph at 19,700 ft, service ceiling 37,730 ft, range 528 miles on internal fuel.
Accommodation: crew of two, in tandem.
Armament: provision for underwing bombs, rockets, and air-to-air missiles.

MiG-15UTI (NATO 'Midget')

After completing their basic and initial advanced training on the L-29 or L-39, pupil pilots of the Soviet Air Force graduate to this tandem two-seat version of the once-renowned MiG-15 jet fighter. The airframe differs from that of the original single-seater mainly in having an aft cockpit for an instructor in place of some fuselage fuel tankage. Armament is reduced to a single gun on most of the trainers, which continue in service with more than thirty air forces. Next stage of training after the MiG-15UTI is normally on one of the two-seat adaptations of current operational aircraft described after this entry.

Power Plant: one Klimov VK-1 turbojet engine; 5,952 lb st.
Dimensions: span 33 ft 0⅞ in, length 32 ft 11¼ in, height 12 ft 1⅝ in.
Weights: empty 8,818 lb. gross (clean) 10,692 lb.
Performance: max speed 631 mph at sea level, range 590 miles (clean) or 885 miles (with two underwing tanks) at 32,800 ft.
Accommodation: crew of two, in tandem.
Armament: normally one 23 mm NS-23 gun or one 12.7 mm UBK-E machine-gun under port side of nose.

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** is generally similar to the MiG-21F, but has two cockpits in tandem under a sideways-hinged double canopy, larger main wheels and tyres, a one-piece forward airbrake, and repositioned pitot boom, above the air intake. It carries no guns, and exists in two forms, later production models having a wide-chord fin and deeper dorsal spine fairing. A third variant is the **MiG-21US,** which adds SPS flap-blowing and a retractable periscope for the instructor. The latest **MiG-21UM** is a trainer counterpart of the MiG-21MF, with R-13 turbojet and four underwing stores pylons.

MiG-23U (NATO 'Flogger-C')
(See page 97.)

MiG-25U (NATO 'Foxbat-C')
(See page 97.)

Sukhoi Su-7U (NATO 'Moujik')

The Soviet and nine other air forces use this tandem two-seat adaptation of the Su-7B as an operational trainer for their ground attack pilots. Changes are minimal. The aft cockpit is fitted with a slightly-raised canopy, from which a prominent dorsal spine extends back to the base of the tail-fin.

Sukhoi Su-9U (NATO 'Maiden')

This operational training version of the Su-9 single-seat all-weather fighter has a tandem cockpit installation identical with that of the Su-7U.

Sukhoi Su-15 trainer (NATO 'Flagon-C')
(See page 98.)

Tupolev Tu-22U (NATO 'Blinder-D')
(See page 94.)

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-36 trainer (NATO 'Forger-B')
(See page 100.)

Helicopters

Kamov Ka-25 (NATO 'Hormone')

Although the design and construction of the Ka-25 appear crude by western standards, a truly remarkable variety of equipment is packed into the small airframe. It can now be revealed that the version illustrated in last year's *Gallery* was 'Hormone-B', intended to acquire targets for ship-launched cruise missiles. A transport version has also been reported; but the only variants that may yet be identified by NATO reporting names are as follows:

Hormone-A. Basic ASW version, with large flat-bottomed housing for undernose search radar, and racks for small stores on each side of the fuselage. Other equipment varies from one aircraft to another. Some have an underfuselage weapon bay. A few have a streamlined blister fairing built into the base of the central tailfin; others have a fairing of flower-pot shape, with a transparent top, above the central point of the tailboom. Each of the four wheels of the landing gear is usually enclosed in an inflatable pontoon, surmounted by inflation bottles. The rear 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; an electro-optical sensor and a towed magnetic anomaly detector are also carried. ASW Ka-25s, equipped for all-weather operations, fly from cruisers of the *Kara* and *Kresta* classes, the carrier/cruiser *Kiev*, and from the helicopter cruisers *Moskva* and *Leningrad*, each of which accommodates about 18 aircraft. 'Hormone' and 'Haze' *(see page 106)* have largely replaced piston-engined Mi-4s in the Soviet Navy's ship and shore based force of around 250 helicopters.

Hormone-B. Special electronics variant, able to acquire targets for cruise missiles launched from the ship on which it is deployed. Larger undernose radome with more spherical undersurface. Cylindrical radome under rear of cabin. Data link equipment. *(Data for 'Hormone-A' follow.)*

Power Plant: two Glushenkov GTD-3 turboshaft engines; each 900 shp.
Dimensions: rotor diameter (each) 51 ft 8 in, length 32 ft 0 in, height 17 ft 7½ in.
Weight: gross 16,100 lb.
Performance: max speed 137 mph, service ceiling 11,500 ft, range 405 miles.
Accommodation: crew of two on flight deck; other crew members in main cabin, which is large enough to contain 12 folding seats for passengers in transport role.
Armament: ASW torpedoes, nuclear depth charges, and other stores in underfuselage weapon bay, when installed. Reported installation of small air-to-surface 'fire and forget' missiles on some aircraft.

Mil (WSK-Swidnik) Mi-2 (NATO 'Hoplite')

About 3,000 helicopters designed by the Mil bureau support the operations of the Soviet tactical air forces. Virtually all of them are turbine-powered, and the only one not built in the USSR is the small Mi-2, of which manufacture was transferred to the WSK-PZL-Swidnik in Poland in 1964. Many hundreds have been delivered for military and commercial service, with the air forces of Czechoslovakia, Poland, Romania, and the Soviet Union among known operators.

Power Plant: two Isotov GTD-350P turboshaft engines; each 400 or 450 shp.
Dimensions: rotor diameter 47 ft 6¾ in, length of fuselage 39 ft 2 in, height 12 ft 3½ in.
Weights: basic operating 5,213 lb, gross 8,157 lb.
Performance: max speed 130 mph at 1,640 ft, service ceiling 13,125 ft, range 360 miles with max fuel, 105 miles with max payload.
Accommodation: pilot on flight deck; eight passengers, 1,543 lb of freight, or four litters and medical attendant in cabin.
Armament: provision for air-to-surface rocket pod, or two 'Sagger' air-to-surface 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. At least 500 production Mi-6s are believed to be in commercial and military service, the latter with the air forces of the Soviet Union, Bulgaria, Egypt, Iraq, Syria, and North Vietnam.

Power Plant: two Soloviev D-25V turboshaft engines; each 5,500 shp.
Dimensions: rotor diameter 114 ft 10 in, length of fuselage 108 ft 10½ in, height 32 ft 4 in.
Weights: empty 60,055 lb, gross 93,700 lb.
Performance: max speed 186 mph, service ceiling 14,750 ft, range 404 miles with 13,228 lb payload.
Accommodation: crew of five; up to 65 passengers, 26,450 lb of freight; or 41 litters and two medical attendants.
Armament: some aircraft have a gun of unknown calibre in the nose.

Mil Mi-8 (NATO 'Hip')

Well over a thousand Mi-8s have been built, mainly for military use. Largest operator by far is the Soviet AF, which utilises the helicopter as an assault transport, heavily armed with rockets and supported by the formidable Mi-24. At least 25 other air forces also operate Mi-8s.

Power Plant: two Isotov TV2-117A turboshaft engines; each 1,500 shp.
Dimensions: rotor diameter 69 ft 10¼ in, length of fuselage 60 ft 0¾ 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 264 miles as passenger transport.
Accommodation: crew of two or three; up to 32 passengers, 8,820 lb of freight, 12 litters and attendant.
Armament: a wide variety of external stores can be carried on a twin rack on each side of fuselage, including bombs and pods each containing sixteen 57 mm rockets.

Mil Mi-10 (NATO 'Harke')

No more than ten of these specialised flying cranes are thought to be in service with the Soviet Air Force. Each embodies the power plant, rotor system, transmission, gearboxes, and most equipment of the Mi-6. The depth of the fuselage is reduced considerably, and the tailboom is deepened so that the flattened undersurface extends unbroken to the tail. The Mi-10 also lacks the wings of the standard Mi-6. Payloads can be carried by sling or cable, clasped under the belly, or on interchangeable wheeled platforms slung between the legs of the wide-track, stalky landing gear. Further freight, or up to 28 passengers on tip-up seats, can be accommodated in the main cabin.

Kamov Ka-25 (NATO 'Hormone-A') (US Navy)

Mil (WSK-PZL-Swidnik) Mi-2 (NATO 'Hoplite') (Tass)

Mil Mi-6 (NATO 'Hook') (Tass)

Mil Mi-8 (NATO 'Hip') of Finnish Air Force (Peter J. Bish)

Mil Mi-24 (NATO 'Hind-A') (Flug Revue)

Mil Mi-24 (NATO 'Hind-D')

Dimensions: rotor diameter 114 ft 10 in, length of fuselage 107 ft 9¾ in, height 32 ft 2 in.
Weights: empty 60,185 lb, gross 96,340 lb, max payload including platform 33,070 lb.
Performance: max speed 124 mph, service ceiling 9,850 ft, range 155 miles with 26,455 lb platform payload.

Mil Mi-14(?) (NATO 'Haze')

A float-equipped variant of the Mi-8 was reported to be under test in the Soviet Union in early 1974, with the designation V-14, or Mi-14. This is now believed to be the shore-based anti-submarine helicopter known to NATO as 'Haze', of which photographs were first published in the Spring of 1977. Clearly derived from the Mi-8, 'Haze' is the first Soviet production helicopter to have a boat hull of the kind embodied in the Sikorsky Sea King series. Together with a sponson on each side at the rear, this should give the helicopter a degree of amphibious capability. Other features evident in photographs include a large undernose radome, a towed magnetic anomaly detection (MAD) bird stowed against the rear of the fuselage pod, and fully retractable landing gear. Dimensions, power plant, and dynamic components should be generally similar to those of the Mi-8.

Mil Mi-24 (NATO 'Hind')

A new dimension was added to the mobility and hitting power of Warsaw Pact forces in eastern Europe in early 1974, when it became known that at least two units, of approximately squadron strength, in East Germany had been equipped with Mi-24 assault helicopters. In much the same class as the US Army's Sikorsky UH-60A Black Hawk, now in initial production, each of the first series of Mi-24s accommodated a squad of eight combat-equipped troops, and also carried heavy armament to clear the drop zone of enemy troops and vehicles. Design features new to Soviet rotorcraft included a fully retractable landing gear.

During the past year it has become apparent that the Mi-24 has developed in two complementary forms, one configured for optimum efficiency as an assault transport, while retaining heavy armament; the other as an advanced gunship with secondary transport capability. Deliveries of all models are believed to exceed 350, with an increasing proportion of the latest variants. Full regiments of Mi-24s are based at Parchim and Stendal, northwest and west of Berlin, near the border with West Germany. The four variants of which details may be published are known by the following NATO reporting names:

Hind-A. Armed assault transport, with large enclosed flight deck for crew of four. The auxiliary wings of this version have considerable anhedral and each carry three weapon stations for heavy armament, supplemented by large-calibre machine-gun in nose. Anti-torque rotor, originally on starboard side of offset tail pylon, repositioned to port side on later and converted aircraft. Initial production Mi-24s were of this type.

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 is believed to have preceded 'Hind-A' and was not built in large numbers.

Hind-C. 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 tail rotor on port side, but with front fuselage completely redesigned for primary gunship role. Tandem stations for weapon operator (in nose) and pilot have individual canopies, with rear seat raised to give pilot an unobstructed forward view. Probe fitted forward of top starboard corner of bulletproof windscreen at extreme nose may be part of low-airspeed sensing device, to indicate optimum conditions for minimum dispersion of 57 mm rockets. Under nose is a four-barrel Gatling-type machine-gun in a turret with a wide range of movement in azimuth and elevation. Undernose pack for sensors, including possibly a forward-looking infra-red scanner and low-light-level TV. Wing armament retained. Many small antennae and blisters. Nosewheels further aft, and semi-exposed when retracted.

Soviet women pilots have set seven helicopter records in an aircraft identified as a Mil A-10, with two 1,500 shp Isotov TV2-117A turboshafts, as fitted in the Mi-8. They include a speed of 212.105 mph over a 15/25 km course, and climb to 6,000 m (19,685 ft) in 7 min 43 sec, representing performance capability that might be expected from an aircraft in the class of the Mi-24. *(Data for 'Hind-A' follow.)*

Power Plant: two Isotov turboshaft engines, related to the TV2-117A; each 1,500 shp.
Dimensions: rotor diameter 55 ft 9 in, length of fuselage 55 ft 9 in, height 14 ft 0 in.
Weight: gross 22,000 lb.
Accommodation: crew of four; eight combat equipped troops.
Armament: one machine-gun in nose; mountings for four anti-tank missiles (NATO 'Swatter') and four other stores, including rocket pods (each thirty-two 57 mm rockets), under stub-wings.

Strategic Missiles

SS-4 (NATO 'Sandal') (Tass)

SS-8 (NATO 'Sasin')

SS-4 (NATO 'Sandal')

First deployed in 1959, this is the medium-range ballistic missile (MRBM) that precipitated the Cuba crisis three years later. Its development, via the earlier SS-3 ('Shyster') drew heavily on wartime German V-2 technology. About 500 are thought to remain operational, mostly near the western borders of the Soviet Union but some east of the Urals, targeted on China. The age of the weapon system is indicated by the fact that about 12 tractors with special trailers, and 20 men, are needed to transport, erect, and fire the SS-4. Numbers may be reduced as more SS-20s become available.
Power Plant: one four-chamber RD-214 liquid-propellant (nitric acid/kerosene) sustainer; 163,142 lb thrust in vacuo.
Guidance: inertial.
Warhead: alternative nuclear (1 megaton) or high-explosive.
Dimensions: length 77 ft 0 in, diameter 5 ft 7 in.
Launch weight: 60,000 lb.
Performance: max speed Mach 6.7, max range 1,100 miles.

SS-5 (NATO 'Skean')

About 100 of these intermediate-range missiles supplement SS-4s and SS-20s in the 620-strong Soviet IRBM/MRBM force. All are thought to be in the western USSR, some in silos. The SS-5 represented a further development of the SS-3/SS-4 concept, with control by vanes acting on the motor exhaust rather than by external fins.
Power Plant: single-stage liquid-propellant engine with four chambers.
Guidance: inertial.
Warhead: nuclear (1 megaton).
Dimensions: length 80 ft 0 in, diameter 8 ft 6 in.
Performance: max range 2,175 miles.

SS-7 (NATO 'Saddler')

The SALT I agreement listed a total of 209 older SS-7 and SS-8 ICBMs that were expected to be replaced eventually by submarine-launched ballistic missiles. Dismantling of the launch sites has been under way since 1976 and no more than 109 SS-7s and SS-8s remain. The SS-7 is a two-stage liquid-propellant missile, about 107 ft long, and able to deliver a 5 megaton warhead over a range of 6,800 miles with a CEP (circular error probability) of under 2 km (1¼ miles).

SS-8 (NATO 'Sasin')

This two-stage liquid-propellant ICBM was first displayed in a Moscow military parade in November 1964, suggesting that it may have been regarded as a backup to the SS-7, which has never been revealed in public. Only 83 ft long, its warhead, range, and accuracy were in the same order as those of the SS-7, with which it is now being withdrawn from service.

SS-9 (NATO 'Scarp')

This mighty three-stage liquid-propellant missile was the heavyweight of the Soviet ICBM force at the time the SALT I agreement was signed, in May 1972. There were then 288 operational SS-9s, with 25 new silos under construction in SS-9 complexes. It was assumed that all 313 launchers would eventually carry new SS-18 missiles, and conversion of SS-9 launch groups to the SS-18 began in 1973. By the beginning of last year the number of SS-9s in service had already been reduced to 210. They were produced in five versions, identified by the US Department of Defense as follows:

SS-9 Mod 1. First displayed in Moscow on November 7, 1967. Operational deployment thought to have started in 1965. Only a relatively small number still emplaced, each with a single re-entry vehicle of slightly smaller yield than that of the Mod 2. Before deployment of the current generation of missiles began, these were the only operational Soviet ICBMs considered to possess the combination of yield and accuracy needed to attack successfully hard targets like America's Minuteman missile silos.

SS-9 Mod 2. This version constitutes the bulk of the SS-9 force. Single re-entry vehicle, with the largest yield of any known ICBM prior to the new SS-18.

SS-9 Mod 3. Under test until 1971 both in a depressed trajectory mode and as a Fractional Orbital Bombardment System (FOBS). There is no evidence that this version became operational.

SS-9 Mod 4. Test vehicle for Soviet multiple independently-targeted re-entry vehicles (MIRVs). De-

spite an improvement in targeting flexibility, this version was not deployed.

SS-9 Mod 5. Launch vehicle for the Soviet Union's satellite-killing payloads. Tests from Tyuratam against satellites launched from Plesetsk suggested that an operational launch of the SS-9 Mod 5 could be made within 90 minutes of receiving an order to intercept. *(Data for SS-9 Mod 2 follow.)*

Power Plant: three-stage liquid-propellant.
Guidance: inertial, offering CEP of better than 1.5 km (0.9 mile).
Warhead: nuclear (25 megatons).
Dimensions: length 113 ft 6 in, diameter 10 ft 0 in.
Performance: range 7,500 miles.

SS-11 (NATO 'Sego')

A total of 970 of these 'light' ICBMs were deployed in May 1972, with 66 new silos under construction. All 1,036 launchers were expected to carry SS-17 and/or SS-19 missiles in due course, but conversion is proceeding more slowly than the Pentagon anticipated. No photograph of an SS-11 has ever been identified. It is believed to be about 3 ft shorter than the SS-13, and to resemble the much larger SS-8 in external shape, with no space between its liquid-propellant stages. There are three versions.

SS-11 Mod 1. Operational since 1966. Single re-entry vehicle, stated by US Department of Defense to be of slightly higher yield than that of the comparable American Minuteman, but considerably less accurate. Of 970 originally deployed, about 50 have been replaced by SS-11 Mod 3 and others by SS-17s. As Mod 1 has been tested over both intercontinental and reduced ranges, the displaced missiles may be adapted for an IRBM role, unrestricted by SALT I.

SS-11 Mod 2. Similar to Mod 1, but fitted with penetration aids. Included in Mod 1 totals.

SS-11 Mod 3. First operational Soviet missile with MRVs (three 300 kiloton). Tests began in 1969, and greater targeting flexibility and accuracy led to rapid deployment; more than 60 emplaced. Range about 6,200 miles.

SS-13 (NATO 'Savage')

In the Minuteman category, the SS-13 is the only solid-propellant ICBM in the Soviet inventory at the present time, and only 60 are deployed. The top two stages are, however, used by themselves in the SS-14 IRBM. It is anticipated that the SS-13 will be replaced by the SS-16.

Power Plant: three-stage solid-propellant.
Guidance: inertial, offering CEP of 2 km (1¼ miles).
Warhead: nuclear (1 megaton).
Dimensions: length 66 ft 0 in, max diameter 6 ft 6 in (first-stage skirt).
Performance: range 5,000 miles.

SS-14 (NATO 'Scamp/Scapegoat')

The 'Scapegoat' intermediate-range ballistic missile carried by this mobile weapon system appears to comprise the top two stages of the SS-13, giving it an overall length of about 35 ft. The NATO reporting name 'Scamp' refers to the complete weapon system, based on the JS III heavy tank chassis. The missile, inside its hinged container, is raised to a vertical position for launch by hydraulic jacks at the rear of the vehicle. The container is then moved away from the missile and its launch platform before firing. Range of this IRBM is estimated at 2,500 miles. Areas of deployment are reported to include the Chinese frontier near Buir Nor, in Outer Mongolia.

SS-15 (NATO 'Scrooge')

This mobile ballistic missile system employs the same basic JS III transport/erector/launch vehicle as the SS-14, with a different missile. Nothing is known of the latter, except that it is fired from its launch-tube, which is raised to a vertical position for firing. The launch-tube is about 62 ft long, with a diameter of 6 ft 6 in, suggesting that the missile might have a range of up to 3,500 miles.

SS-X-16

Deployment of the SS-X-16, only solid-propellant missile among the four new Soviet ICBMs, has been delayed longer than anticipated in the west. Nonetheless, it remains a major potential threat because of its relationship with the SS-20, which *is* deployed. By building and storing large numbers of SS-X-16 third stages, the Soviet Union would possess the means to convert all its SS-20 mobile IRBMs into ICBMs at any time, thereby increasing greatly the intercontinental force. The SS-X-16 is about the same size as the SS-13, which it was expected to replace, with greater range and payload capacity. It is fitted with a post-boost vehicle (PBV, known in the US as a bus-type dispensing system), but has been tested to date with only a single re-entry vehicle. The Department of Defense believes that, like the SS-20, the SS-X-16 could be deployed in land-mobile form. Its range is about 5,000 miles.

SS-17

The FY 1978 Defense Department Report commented that "The new SS-17, SS-18, and SS-19 missiles continue to be deployed in modified and upgraded silos at a rapid rate. We estimate that there are now [January 1977] about 40 SS-17s, over 50 SS-18s, and around 140 SS-19s in the force. We believe that some of the modified silos have been hardened to resist very high over-pressure". The currently-operational version of the SS-17 has four MIRVs, shaped for high-speed atmospheric re-entry to ensure greater accuracy, and may achieve capability against hard targets by the early 1980s. Tests with a single large re-entry vehicle were initiated in February 1976. The SS-17 is intended to be cold-launched from modified SS-11 silos.

Warhead: nuclear (four MIRVs of 1 megaton each).
Dimensions: length 75 ft 0 in, max diameter 8 ft 6 in.
Performance: range 6,200 miles with CEP of around 500 m (0.3 mile).

SS-18

Most formidable ICBM yet deployed anywhere in the world, the two-stage liquid-propellant SS-18 has about 30% more throw weight than the SS-9 it is replacing, and a degree of accuracy comparable with that of the SS-17. In consequence, a force of about 300 SS-18s (permitted under SALT I) could pose a serious threat to the American Minuteman force in their silos, even after the silos have been upgraded. Being cold-launched, the SS-18 does not require such a large-diameter silo as the SS-9, enabling existing silos to be considerably reinforced against nuclear attack. Three versions have been identified.

SS-18 Mod 1. Initial operational type, with single 25 megaton warhead.

SS-18 Mod 2. Known to have been tested with eight relatively large (1–2 megaton) MIRVs dispensed by a post-boost vehicle (PBV) similar to that employed on the US Minuteman III and Poseidon missiles. Potentially the most effective anti-Minuteman ICBM, this version is already deployed and is believed to be capable of carrying up to ten MIRVs.

SS-18 Mod 3. Longer-range version, with single re-entry vehicle lighter and more accurate than that of Mod. 1. Crew training launches began in February 1976.

Dimensions: length 118 ft 0 in, max diameter 10 ft 0 in.
Performance: range 6,500 miles.

SS-19

This SS-11 replacement has been under test since early 1974, proving so successful that more than 150 SS-19s have already been deployed. Each carries a MIRVed payload of six re-entry vehicles, twice as many as Minuteman III carries and described as being twice as large. Although shaped for high-speed atmospheric re-entry, to improve accuracy, these warheads are not expected to offer reasonable hard target kill capability until the 1980s. However, a version with a single re-entry vehicle is being tested. By the time all current ICBMs have been replaced with 1,400 of the SS-16/19 series, the Soviet Union may well deploy around 7,000 one-megaton to two-megaton warheads in their ICBM force alone. The hot-launched SS-19 is thought to have a range of more than 6,300 miles and to be longer than the SS-11 and SS-17, requiring more extensive modification to any existing silos in which it is emplaced.

SS-20

Only some 20 of these mobile solid-propellant IRBMs are thought to be deployed at the present time; but if, as expected, they replace the older SS-4s and SS-5s on a one-for-one basis, they will treble the number of warheads provided by the earlier weapons. The SS-20 consists of the first two stages of the SS-X-16 ICBM, has a demonstrated range of at least 2,300 miles, and carries three MIRVs. Of significance is that it could be given a range conforming to the SALT definition of ICBM range (5,500 km; 3,420 miles) either by the addition of a third stage or by offloading MIRVs.

AS-3 (NATO 'Kangaroo')

Resembling a sweptwing jet fighter in size and configuration, this air-to-surface missile was displayed for the first time under its Tu-95 carrier aircraft on Soviet Aviation Day, 1961. Little has been seen of it since that time, except for a launch sequence in an officially released Soviet film. A nuclear warhead is standard.

Dimensions: span 30 ft 0 in, length 48 ft 11 in.
Performance: max speed Mach 2, range 400 miles.

AS-4 (NATO 'Kitchen')

Developed as a stand-off weapon for the Tu-95 and Tu-22 strategic bombers, and now carried also by the swing-wing 'Backfire', the AS-4 was first seen on a single Tu-22 ('Blinder-B') in 1961. Most of the 22 Tu-22s which participated in the 1967 Aviation Day display at Domodedovo carried an AS-4, semi-submerged in the fuselage, and production by 1976 was stated by the UK Defence Minister to be around 1,000. The missile has an aeroplane configuration, with stubby delta wings and cruciform tail surfaces. Propulsion is believed to be by liquid-propellant rocket motor; a nuclear warhead can be assumed.

SS-9 (NATO 'Scarp')

SS-13 (NATO 'Savage')

SS-14 (NATO 'Scamp/Scapegoat')

SS-15 (NATO 'Scrooge')

Dimension: length 37 ft 0 in.
Performance: range 185 miles at low altitude.

AS-6 (NATO 'Kingfish')

First sighting of this formidable new air-to-surface missile was by the pilot of a Japan Air Self-Defence Force F-86F, in late December 1977. When scrambled to investigate a Tu-16 ('Badger') flying 50 miles to the north of the Noto Peninsula, he was able to photograph the aircraft which was carrying a 'Kingfish' under its port wing. The missile has a cylindrical body with ogival nose; two short-span, long-chord wings; and a cruciform tail unit with folding ventral fin. Propulsion is said to be by liquid-propellant rocket motor, with inertial midcourse guidance, and active radar terminal homing, giving an exceptional degree of accuracy. Primary carrier is expected to be the Tu-26 ('Backfire').
Dimensions: span 8 ft 2½ in, length 34 ft 6 in.

Airborne Tactical and Defence Missiles

Helicopter missile (NATO 'Swatter')

No photograph has yet shown the type of interim anti-tank missile carried on the four wingtip launchers of the 'Hind-A' version of the Mil Mi-24 assault helicopter, pending availability of the AS-8. However, the weapon carriers appear to have no provision for wire guidance, and 'Swatter' is the only one of three standard Soviet anti-tank missiles known to operate without wires. It is steered in flight via elevons on the trailing-edges of its rear-mounted cruciform wings. Its blunt nose suggests the likelihood of a terminal homing system, with control by means of the small foreplanes.

Other Soviet helicopters capable of carrying missiles in this category include the 'Hind-D' attack version of the Mi-24 and the Ka-25 ASW helicopter.
Dimensions: span 2 ft 2 in, length 2 ft 11½ in.

AS-2 (NATO 'Kipper')

This is another of the aeroplane-configuration air-to-surface missiles displayed under carrier aircraft at the 1961 Aviation Day display, but hardly mentioned since that time. Described by the commentator at Tushino as an anti-shipping weapon, the AS-2 is similar in configuration to the larger and more refined US Hound Dog, with swept wings and underslung turbojet engine. Radar is carried in the nose of the Tu-16 launch aircraft.
Dimensions: span 16 ft 0 in, length 31 ft 0 in.
Performance: max speed Mach 1.2, range 130 miles.

AS-2 (NATO 'Kipper') under Tu-16

AS-5 (NATO 'Kelt')

According to the UK Minister of Defence, well over 1,000 AS-5s had been delivered by the Spring of 1976. About 25 were used operationally during the October 1973 war between Israel and the Arab states, when Tu-16s from Egypt launched them against Israeli targets. Only five eluded the air and ground defences, to hit a supply depot and two radar sites in Sinai.

The AS-5 has a similar aeroplane-type configuration to that of the turbojet-powered AS-1 ('Kennel') which it superseded. The switch to rocket propulsion eliminated the need for a ram air intake, and permitted the use of a larger radar inside the hemispherical nose fairing.
Dimensions: span 15 ft 0 in, length 31 ft 0 in.
Performance: range 100 miles.

AA-3 (NATO 'Anab') missiles on Sukhoi Su-11 interceptor (Novosti)

AS-7 (NATO 'Kerry')

Nothing is known about this tactical air-to-surface guided missile, except that it is carried by the Su-19, and by the current generation of Soviet close support aircraft. It is said to have a radio command guidance system, to weigh about 2,650 lb, and to have a range of 6.2 miles.

AS-8

AS-8 is reported to be the designation given in the west to the "fire and forget" tactical missile that has been developed for the Mi-24 ('Hind-A and D') helicopter, and will also arm a new Soviet lightweight attack helicopter now under development. Similar in concept to the US Hellfire, it is believed to have a max range of 5 miles in its initial form, as delivered to Mi-24 units in 1977.

AS-X-9

A reported anti-radiation missile, with a range of 50–56 miles, to arm the Su-19 ('Fencer').

AS-X-10

Described as an electro-optical homing air-to-surface missile with a range of about 6.2 miles. A similar weapon, but with a range of about 25 miles, is referred to in the US as the Soviet Advanced TASM (tactical air-to-surface missile) and is probably at a comparable stage of development.

AA-1 (NATO 'Alkali')

First Soviet air-to-air missile to become operational, 'Alkali' equipped the older generation of PVO-Strany interceptors, such as the Su-9 and all-weather versions of the MiG-19, and can be expected to disappear from service soon. It has a solid-propellant rocket motor and I/J-band semi-active radar guidance system.
Dimensions: length 6 ft 2 in, body diameter 7 in, wing span 1 ft 10¾ in.
Performance: range 3.7 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 infra-red guidance. It has long been standard armament on home and export versions of the MiG-21. A solid-propellant rocket motor is fitted.
Dimensions: length 9 ft 2 in, body diameter 4.72 in, fin span 1 ft 8¾ in.
Performance: range 3 to 4 miles.

'Advanced Atoll'

The latest multi-role 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 infra-red homing 'Atoll' on the inboard pylon. The radar version is known at present as 'Advanced Atoll'.

AA-3 (NATO 'Anab')

The UK Ministry of Defence estimates production of this solid-propellant air-to-air missile as being "in the thousands". It was first observed as armament of the Yak-28P all-weather fighters which took part in the 1961 Aviation Day display at Tushino. Subsequently, it became standard on the Sukhoi Su-11 and Su-15 interceptors. Each aircraft normally carries one 'Anab' with an I/J-band semi-active radar seeker and one with an infra-red homing head.
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 have been produced as armament for the Tu-28P and MiG-25 interceptors of PVO-Strany. The version with infra-red homing head is normally carried on the inboard pylon under each wing of the Tu-28P, with an I/J-band semi-active radar homing version on each outboard pylon.
Dimensions: length 18 ft 0 in (IR) or 17 ft 0 in (SAR).
Performance: range 18.5 miles.

AA-6 (NATO 'Acrid')

This is the air-to-air missile that was identified during 1975 as one of the weapons carried by the 'Foxbat-A' interceptor version of the MiG-25. Its configuration is similar to that of 'Anab' but it is considerably larger. Photographs suggest that the version of 'Acrid' with an infra-red homing head is normally carried on each inboard underwing pylon, with a radar-homing version on each outer pylon. The wingtip fairings on the fighter, different in shape from those of 'Foxbat-B', are thought to house continuous-wave target illuminating equipment for the radar-homing missiles.
Dimension: length 20 ft 0 in (radar version).
Performance: range at least 23 miles.

AA-7 (NATO 'Apex')

This long-range air-to-air missile is one of the two types known to be carried as standard armament by interceptor versions of the MiG-23. No details are available, except that 'Apex' has a solid-propellant rocket motor. It is likely to exist in both infra-red and radar-homing versions. The following data should be regarded as provisional:
Dimensions: length 14 ft 1¼ in, body diameter 9.4 in, wing span 3 ft 5½ in.
Performance: range 17 miles.

AA-8 (NATO 'Aphid')

Second type of missile carried by the MiG-23, 'Aphid' is a close-range solid-propellant weapon with infra-red homing guidance.
Dimensions: length 6 ft 6¾ in, body diameter 5.12 in.
Performance: range 3.5–5 miles.

Surface-to-Air Missiles

ABM-1 (NATO 'Galosh')

The SALT I agreement permitted each nation a total of 100 ABMs (anti-ballistic missiles) on launchers for defence of the national capital and 100 more for defence of an ICBM launch area. ABM deployment was further reduced to one site for each country at the Moscow Summit meeting of late June and early July 1974. The Soviet 'Galosh' ABM system deployed around Moscow consists at present of 64 operational launchers and associated radars. There is no indication that the other 36 launchers are to be added to the system, although Soviet ABM R & D continues at a high priority, with two completely new systems reported. Missiles purported to be 'Galosh' have been paraded through Moscow, inside containers 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.

SA-1 (NATO 'Guild')

This missile was first displayed in a Moscow military parade on November 7, 1960. Although subsequently reported to be deployed as a standard anti-aircraft weapon, it took no further part in the regular Moscow parades until 1968, when it appeared on May Day. The SA-1 is not thought to have been supplied to any country outside the USSR, and its phase-out there has probably started.

Dimensions: length 39 ft 0 in, body diameter 2 ft 3½ in.
Performance: range 20 miles.

SA-2 (NATO 'Guideline')

Unlike the SA-1, this missile has been supplied to most of the Soviet Union's allies and friends, and is a standard anti-aircraft weapon in about 20 countries. It was used extensively in combat in North Vietnam and the Middle East, and has been improved through several versions as a result of experience gained. One variant, first exhibited in Moscow in November 1967, has an enlarged, white-painted warhead without the usual small canard surfaces. It was claimed to be far more effective than earlier versions, and may have a nuclear warhead. About 3,500 SA-2 launchers are thought to remain operational in the Soviet Union, although the number declines annually. Data for the standard export version:

Power Plant: liquid-propellant sustainer, burning nitric acid and hydrocarbon propellants; solid-propellant booster.
Guidance: automatic radio command, with radar tracking of target. Some late versions employ terminal homing.
Warhead: normally 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: 5,000 lb.
Performance: max speed Mach 3.5, slant range 25 miles, effective ceiling 60,000 ft.

SA-3 (NATO 'Goa')

Soviet counterpart of the American HAWK, the SA-3 is deployed in increasing numbers by the Soviet Union, its allies, and friends as a mobile low-altitude system to complement the medium/high-altitude SA-2. As the **SA-N-1**, it is also the most widely-used surface-to-air missile in the Soviet Navy, fired from a roll-stabilised twin-round launcher.

Power Plant: two-stage solid-propellant.
Guidance: radio command, with radar terminal homing.
Warhead: high-explosive.
Dimensions: length 22 ft 0 in, body diameter 1 ft 6 in, wing span 4 ft 0 in.
Performance: max speed Mach 3.5, slant range 25 miles, effective ceiling 60,000 ft.

SA-4 (NATO 'Ganef')

Ramjet propulsion gives this anti-aircraft missile a very long range. Its usefulness is further enhanced by its mobility, as it is carried on a twin-round tracked launch vehicle which is itself air-transportable in the An-22 military freighter. The SA-4 was first displayed publicly in 1964, and is a standard Soviet weapon.

Power Plant: ramjet sustainer; four wrap-around solid-propellant boosters.
Guidance: radio command.
Warhead: high-explosive.
Dimensions: length 28 ft 10½ in, body diameter 2 ft 8 in, wing span 7 ft 6 in.
Launching weight: 3,975 lb.
Performance: slant range 43 miles, effective ceiling 80,000 ft.

SA-5 (NATO 'Gammon')

There is reckoned to be a total of 12,000 missiles on 10,000 surface-to-air missile launchers operational at 1,650 sites throughout the Soviet Union. However, deactivation of SA-2 sites has been under way for some time, at a slightly faster rate than the commissioning of new SA-3 and SA-5 sites. The SA-5 is described by the US Department of Defense as providing long-range, high-altitude defence for Soviet targets. When first displayed publicly in Moscow, in 1963, it was said to have anti-missile capability. This must be limited, even if the warhead section separates after second-stage burnout and is able to use an inbuilt rocket motor during the final stages of interception.

Power Plant: two-stage solid-propellant, possibly with terminal propulsion for warhead.
Guidance: radar homing.
Dimensions: length 54 ft 0 in, body diameter 2 ft 10 in, wing span 12 ft 0 in.
Performance: slant range 155 miles, effective ceiling 95,000 ft.

SA-6 (NATO 'Gainful')

This mobile low-altitude weapon system took an unexpectedly heavy toll of Israeli aircraft during the October 1973 war. Its unique integral rocket/ramjet propulsion system was a decade in advance of comparable western technology, and the US-supplied ECM equipment which 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. Export models have been acquired by Egypt, Iraq, Libya, Syria, and Vietnam.

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; semi-active 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 22 miles, effective ceiling 59,000 ft.

SA-7 (NATO 'Grail')

This Soviet counterpart of the US shoulder-fired, heat-seeking Redeye first proved its effectiveness in Vietnam against slower, low-flying aircraft and helicopters. It repeated the process during the 1973 Arab–Israeli war, despite countermeasures, including the use of decoy flares, and deflecting upward the exhaust of helicopters. In addition to its use by infantry, the SA-7 is carried by vehicles, including ships, in batteries of four, six, and eight, for both offensive and defensive employment, with radar aiming. An uprated version has a more powerful motor, giving higher speed and an effective ceiling of about 14,000 ft. *(Data for basic version.)*

Power Plant: solid-propellant boost/sustainer.
Guidance: infra-red homing.
Warhead: high-explosive, weight 5.5 lb.
Dimensions: length 4 ft 5 in, body diameter 2.75 in.
Performance: max speed Mach 1.5, slant range 2.25 miles, effective ceiling 5,000 ft.

SA-8 (NATO 'Gecko')

First displayed publicly during the parade through Moscow's Red Square on November 7, 1975, this short-range, all-weather surface-to-air weapon system has much in common with the European Roland. Missile configuration is conventional, with canard foreplane control surfaces and fixed tail-fins. Fire control equipment and quadruple launcher are mounted on a rotating turret, carried by a new 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-8 may use the same missile as the well-established but enigmatic naval SA-N-4 system. Each vehicle is believed to carry a total of 8 missiles.

Power Plant: probably dual-thrust solid-propellant.
Guidance: command guidance by proportional navigation. Infra-red terminal homing.
Warhead: high-explosive, about 90–110 lb weight.
Dimensions: length 10 ft 6 in, body diameter 8.25 in.
Performance: range up to 5 miles.

SA-9 (NATO 'Gaskin')

This weapon system comprises a BRDM amphibious vehicle, carrying two pairs of box launchers for missiles described as uprated SA-7 'Grails'. The launchers rest flat on the rear of the vehicle when not required to be ready for launch. Range of the missile is approximately 5 miles.

SA-N-3 (NATO 'Goblet')

The twin-round surface-to-air missile launchers fitted to many of the latest Soviet naval vessels, including the carrier/cruiser *Kiev*, helicopter cruisers *Moskva* and *Leningrad*, and *Kara* and *Kresta II* cruisers, carry a new and more effective missile than the SA-N-1 ('Goa'). Known as the SA-N-3, this could be similar to the SA-6.

SA-2 (NATO 'Guideline') (Tass)

SA-3 (NATO 'Goa')

SA-6 (NATO Gainful')

SA-N-4

Little is known about this naval close-range surface-to-air weapon system, although at least 33 SA-N-4 installations are known to be operational on six classes of ships of the Soviet Navy. The retractable twin-round 'pop-up' launcher is housed inside a bin on deck. It is likely that the missiles are similar to those used in the land-based mobile SA-8 system.

Airman's Bookshelf

Firsts and Foremosts

The Guinness Book of Air Facts and Feats, Third Edition, edited by John W. R. Taylor, Michael J. H. Taylor, and David Mondey. Guinness Superlatives Limited, Enfield, Middlesex, UK, 1977. 240 pages with appendices, bibliography, and index. $12.75.

Military Airlift Command passengers curious as to the earliest precedent for the cold-chicken-and-juice box lunches served up by in-flight kitchens will discover in this third edition of historical air facts and records that the first instance of airborne catering occurred nearly sixty years ago when Handley Page Transport introduced lunch baskets on its October 1919 flights. Hundreds of other morsels of information (some famous, many obscure) cram these compactly edited pages chronicling what the editors rather broadly describe as "the thrilling events that have made a highway of the skies" from the mythical age to the post-World War II era.

Editors John W. R. Taylor (who also edits *Jane's All the World's Aircraft* and whose "Jane's Supplement" appears in this magazine every other month), Michael J. H. Taylor, and David Mondey have revised most of the text from the 1973 edition, and have added a chapter on research and experimental aircraft, a complete list of official world height, distance, and speed records from the early 1900s, and a current though not always detailed inventory of the world's operational military aircraft. There are also hundreds of photographs and illustrations, including three sections in full color.

Aside from appendices, the material is apparently arranged for the browser, since general chapter divisions like "The Second World War," and the absence of subheadings defy readers seeking narrower referencing for bombers, transports, or other categories. Readers are left to plow through the first sentence of each entry before learning its subject or significance. (A very detailed index helps those who know what they are looking for.) Still, scholars as well as general readers will find this panoramic collection of air facts and feats unrivaled for its thoroughness, as well as entertaining for its often surprising—if not always earthshaking—disclosures.

—Reviewed by Capt. Anthony Lynn Batezel, Contributing Editor.

End of an Era

55 Days: The Fall of South Vietnam, by Alan Dawson. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1977. 366 pages. $12.50 hardback.

Just after noon, on April 30, 1975, a North Vietnamese tank crashed the gates of Saigon's Independence Palace. Atop the tank rode black-pajama-clad Sister Nguyen Trung Kien, a twenty-year-old, war-orphaned, Viet Cong peasant guerrilla. At 12:45 p.m., with Saigon President General Duong Van (Big) Minh at her side, she hoisted the Communist flag over the Palace, symbolically ending the Vietnam War. Only eight hours before, a US Marine helicopter had lifted from the pad on top of the American Embassy carrying Ambassador Graham Martin. That last evacuation flight had marked the end of the official American presence in Vietnam.

Such vivid descriptions of people and incidents fill Alan Dawson's dramatic chronicle of South Vietnam's last fifty-five days. By telling the stories of real people in those days, he adds human interest to the drama of history. We see and feel their heartbreak and hardship, selfishness and suffering, cruelty and corruption: the personal tragedy of war affecting peasants and powerful alike. At the same time, Dawson provides a chronologically arranged journalist's description and analysis of the days' fast-breaking events. He adds, wherever necessary for interpretation and understanding, social and historical background.

His research appears to be complete, and his seven years as a perceptive eyewitness in Vietnam—two as an American soldier and five as a journalist—are evident throughout the narrative. His observations and judgments seem accurate, from the beginning of the offensive at Ban Me Thuot on March 10, through the final collapse, and in his "Afterword" about postwar Communist Vietnam (he stayed four months in Saigon after the fall).

Dawson's judgments of the events he observed, so intricately woven among the threads of shattered lives and nightmare-like days, are often controversial. He suggests that initially the North Vietnamese tried to abide by the cease-fire, but finally began to fight US and Saigon fire with fire. In evaluating the entire American experience in Vietnam, he asserts that our need "always to succeed" led to our policy "that the war was going well" and "killed thousands more than necessary." He also attributes our total failure in Vietnam to our blindness to reality and our wishful thinking.

Furthermore, he describes incident after incident during the evacuation's final days and hours in which American officials lied to save their own skins, coldheartedly ignoring obligations and abandoning Vietnamese, Korean, Filipino, and Taiwanese allies and employees. And even American citizens! In one such incident, an American demolition team burned rather than abandon more than a million US dollars; yet we skipped the country owing $840,000 in wages to the Vietnamese guards on whom we had depended for security.

The same action-packed reporting style that makes the book so exciting also leads to its two weaknesses. First, reading a chapter is like reading a week of newspapers. The collections of smaller stories of people and events to paint over-

all pictures sometimes seem confusing. The second occurs as he pursues his thesis that the collapse resulted primarily from bad morale in the South Vietnamese armed forces, compounded by Thieu's strategic blunders of abandoning the Central Highlands and Hué without a fight.

In his journalistic fervor, the author damages his credibility by describing at least five different Vietnamese military units as being the best that Saigon had in the field.

Despite these minor excesses, the book is well-written and interesting. Most valuable is its point of view. Dawson, unlike so many who have written about Vietnam, knows what he's talking about; his observations are not narrowed or slanted by having served a particular master in the US government: military, diplomatic, or intelligence. His observations and interpretations tell us much that we must know and never forget.

—Reviewed by Maj. Wayne A. Myers, USAF, Department of English, USAF Academy. The reviewer has had extensive experience in Vietnam and is a coauthor of a revised three-volume monograph, The Evacuation of Vietnam, *soon to be published by the Office of History, PACAF.*

New Books in Brief

Corps Commander, by Sir Brian Horrocks, with Eversley Belfield and Hubert Essame. One of Britain's foremost fighting generals who commanded the XXX Corps from Normandy to the Baltic during WW II, tells what it was like from the front line, where he was actively involved, to the highest councils, where he was often in contact with Eisenhower, Montgomery, and others. Maps, photos, table, index. Charles Scribner's Sons, New York, N. Y., 1978. 256 pages. $14.95.

The Fighting 109, by Uwe Feist, Norman E. Harms, and Mike Dario. While there are many books on the Messerschmitt Bf 109 fighter, the longest-produced military aircraft in history, this one is a photo-essay with nearly 300 photos of the fighter in action. Appendix, bibliography, index. Doubleday & Co., Inc., New York, N. Y., 1978. 198 pages. $10.50.

The First Croydon Airport, 1915–1928, by Bob Learmonth, Joanna Nash, and Douglas Cluett, editor. "It was in those makeshift huts, and on that far from level airfield, that civil aviation grew up," the foreword to this book states. Here is a memorable look at the huts and ruts at Croydon Airport, situated some ten miles from London, and the men and machines that got civil aviation off the ground. Photos, maps, index. Available post-free from Sutton Libraries and Arts Services, Central Library, St. Nicholas Way, Sutton, Surrey, SM1 1EA, England. 1977. 88 pages. $2.95.

Focke Wulf 190 at War, by Alfred Price. First operational in autumn of 1941, this famous Luftwaffe fighter gave its enemies a nasty shock, the author says, because it could outrun, outclimb, and outdive the Spitfire V, mainstay of the British RAF. Photos, glossary. Charles Scribner's Sons, New York, N. Y., 1978. 160 pages. $12.50.

F4U Corsair at War, by Richard Abrams. This is the story of Vought's Corsair which saw service as a fighter and fighter-bomber with the US Marines and Navy, and with the British, French, and New Zealand air forces. It served in WW II and Korea and was still in production ten years after becoming operational. Photos. Charles Scribner's Sons, New York, N. Y., 1978. 160 pages. $12.50.

The Kremlin and Labor: A Study in National Security Policy, by Roy Godson. The author, associate professor of government and director of the international labor program at Georgetown University, concludes that while some may argue that the Kremlin has lost interest in using organized labor as an instrument of policy, for them the labor instrument, like the military instrument, is one of a number of means of affecting political conditions in the non-Communist world. Appendix, notes. National Strategy Information Center, Inc. Crane, Russak & Co., Inc., New York, N. Y., 1977. 79 pages. $3.25.

Mao Tse-Tung on Guerrilla Warfare, translated and with a new introduction by Brig. Gen. Samuel B. Griffith, USMC (Ret.). This pamphlet is one of the most influential documents in military history. Appendix. Anchor Press/Doubleday, Garden City, N. Y., 1978. 131 pages. $6.95.

Messerschmitt 109 at War, by Andre van Ishoven. A distinguished Belgian aviation journalist tells, in a series of firsthand accounts, the remarkable story of the development and combat experience of the Bf 109. It was the dominant fighter in the Luftwaffe throughout much of World War II. Photos. Charles Scribner's Sons, New York, N. Y., 1978. 160 pages. $12.50.

Military Base Closings: Benefits for Community Adjustment, American Enterprise Institute for Public Policy Research. This report analyzes pending legislative proposals in light of the continued need to close bases and the economic problems resulting from such closings. Notes. Available from the Institute, 1150 17th St., N. W., Washington, D. C. 20036, 1977. 20 pages. $2.

A Pictorial History of the World War II Years, by Edward Jablonski. A mass of pictures and line drawings plus full-page maps detailing all major battles, strategies, and tactics by Allies and Axis make this volume an excellent addition to any library. Index. Doubleday & Co., Inc., New York, N. Y., 1978. 319 pages. $12.50.

Prospects for Peace in the Middle East, American Enterprise Institute for Public Policy Research. This is an edited transcript of an AEI public policy forum that took place last fall during which former key government officials vigorously discussed the prospects for an early general settlement between Israel and the Arab states. Available from the Institute, 1150 17th St., N. W., Washington, D. C. 20036, 1978. 42 pages. $2.

U.S. Industrial Outlook: 1978, Department of Commerce. This massive volume analyzes 150 US manufacturing industries and forty-two nonmanufacturing industries according to international and domestic performance, and presents five-year economic projections for each industry. Appendix, index. Available from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402, 1978. 480 pages. $6.75.

—Reviewed by Robin Whittle

UPDATE

Most AIR FORCE Magazine readers know that the Aerospace Education Foundation is a nonprofit, non-endowed affiliate of the Air Force Association. Several articles have appeared in the magazine describing the US Air Force occupational courses that the Foundation has reproduced and made available to civilian schools at cost.

The twenty-three Air Force courses that the Foundation has reproduced thus far are: Automotive Principles (Group-Paced); Automotive Principles (Self-Paced); Automotive Principles (Self-Paced CAI) PLATO; General Purpose Vehicles; Towing and Servicing Vehicles; Refueling Vehicles; Materials Handling Vehicles; Heavy Equipment Vehicles; Diagnostic Test Equipment; Transmissions; Air Conditioners; Instructional System Materials Development; Still Photographer; Still Photojournalism; Cooking, Baking and Serving; Technical Instructor; Audio-Visual Methods; Development and Management of Instructional Systems; Development of Learning Objectives; Tests and Measurements; Academic Counseling; Technical Writer; Electronic Principles (Self-Paced).

Eight more courses will be ready for distribution by the Foundation early this year, with about twenty others to follow later in the year. More than 700 civilian schools and training systems in forty-eight states have purchased nearly 1,200 Air Force course packages, representing some 210,000 hours of instruction. Among the intangibles that accrue from this Foundation project are enhancement of the Air Force public image and a double return on the taxpayer's dollar.

Adapting Air Force courses to civilian use is done at no expense to the government. But it does cost money to perform the myriad tasks involved in making master copies of the courses, including all still and motion visual materials.

Announcing The Scott Associate Plaque

The Foundation is grateful to AFA for its financial support, as it is to the many individuals—both in and out of the Association — and to the industrial organizations that have provided support in a variety of ways. The Jimmy Doolittle Fellow Program, for example, is helping fund this unique undertaking. But we are striving for more support so we can contribute more to the nation's educational systems. Now there is a new program that I'd like to tell you about.

Two years ago, at AFA's National Convention, I made a presentation on the Foundation to a joint session of the AFA Enlisted and Junior Officer Advisory Councils. CMSgt. Walter E. Scott of Travis AFB, Calif. (who was the keynote speaker at the 1977 AFA Convention) was so impressed with the Foundation's work that he volunteered to help in any way he could. Here is what Chief Scott has done:

First, he and his wife became the pioneer members of the newly created Foundation Heritage Club, through which individuals can provide in their wills for bequests to the Foundation.

Second, he has appeared before groups of civilian leaders and educators to describe the work of the Foundation.

Third, on his own initiative he has had handsome wooden plaques with the AFA seal (shown above) produced for presentation to individuals or organizations that contribute $25.00 to the Foundation. Thus far, he has presented sixty-seven plaques, which, in his honor, we have named the Scott Associate Plaque.

The Foundation's Board Chairman, Sen. Barry Goldwater, and the Foundation's officers and trustees join me in expressing deep appreciation to Chief Scott for his magnificant contributions to the Foundation.

For additional details on any of the Foundation's operations, please contact me at the address below:

—Michael J. Nisos
Managing Director

AEROSPACE EDUCATION FOUNDATION
1750 Pennsylvania Avenue, N.W., Washington, D.C. 20006
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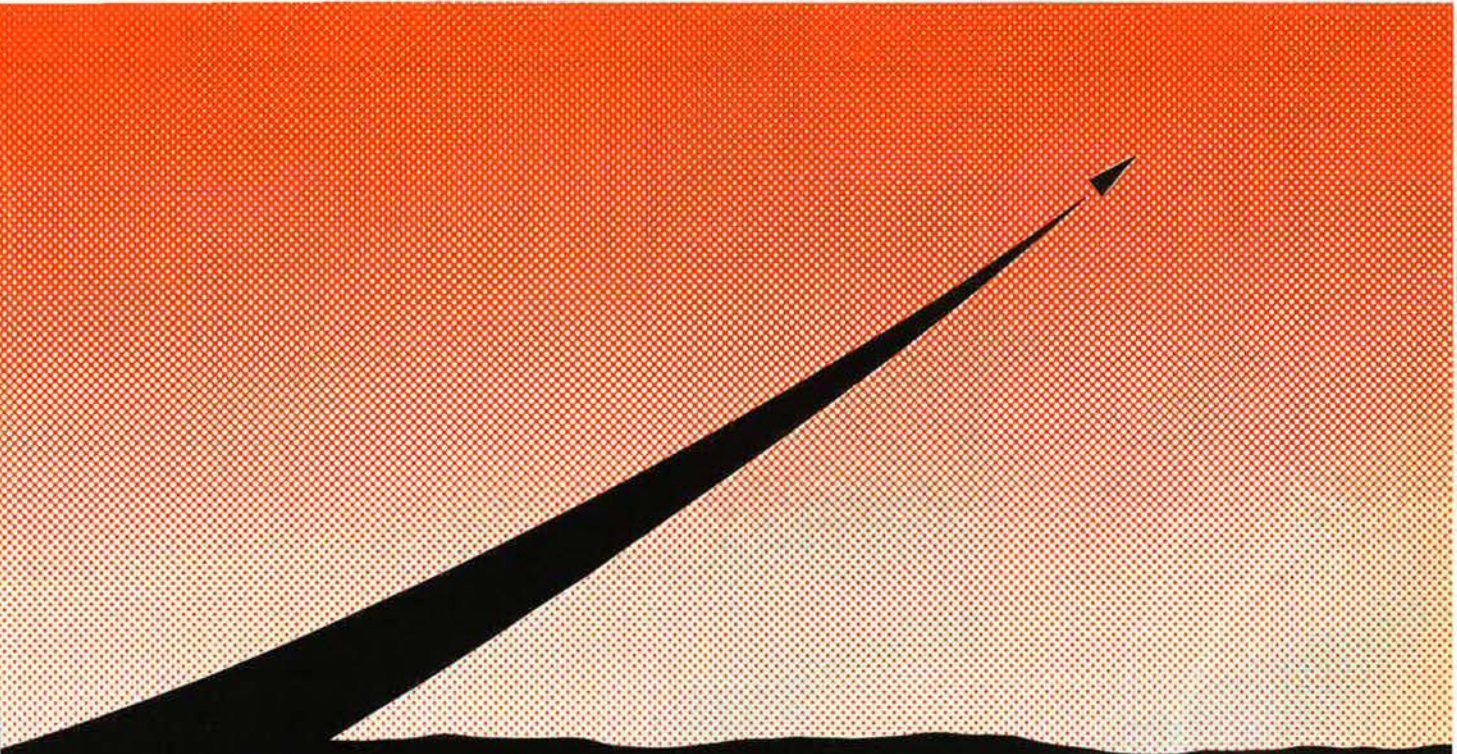

The Annual Air Force Almanac

In May, AIR FORCE Magazine will publish its 28th Annual Air Force Almanac issue... the largest and most authoritative reference work on the US Air Force. The 1978 issue will include important reference material, organization charts and statistical data on the Air Force Commands and Agencies, as well as a Guide to Air Force Bases worldwide, USAF and NASA R&D facilities, the list of aces, Medal of Honor winners... plus special articles by the Secretary of the Air Force and the Chief of Staff.

A Gallery of Weapon Systems is being prepared by the staff of "Jane's All the World's Aircraft" with comprehensive descriptions and photographs of all USAF aircraft and missiles. Also included will be expanded data on Air Force budgets, personnel, aircraft inventory, flying hours and procurement.

As you can see, this issue will be a most valuable desktop reference issue, consulted many times during the year by decision-makers in the Air Force, government and the aerospace industry.

You are invited to participate in this important issue with your advertising.

Closing for advertising reservations is March 24, copy by April 5.

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

The Bulletin Board

By James A. McDonnell, Jr., MILITARY RELATIONS EDITOR

Budget Highlights—About People

A six percent pay raise for USAF military and civilian personnel, but a reduction of 10,000 in their numbers. An estimated 6.5 percent cost-of-living raise for military retirees. An increased allowance for moving trailers. A pay cut for government civilians who are also military Reservists.

These are among the "people" highlights of the Carter Administration defense budget for FY '79, which Congress is already grappling with. FY '79 begins next October.

During that fiscal year, the Air Force, if the budget holds, will cut its military force by 6,000 to 565,000, ending two years of the long-sought "level-off" posture. However, Hq. USAF officials said the small reduction will not touch off any special turbulence or cause any RIFs. While no special early-out opportunities have been firmed up, officials held out the possibility that some may materialize later. Civilian personnel, now about 249,000 strong, will drop 4,000 in FY '79.

The modest personnel cuts will help the Air Force maintain its present manpower spending level of slightly more than $8 billion a year.

The active-duty pay raise estimate is far from firm, since the President retains the option of "capping" it at a lower figure. And his ultimate decision on how much of the raise he will shift from basic pay to BAQ will also help determine the actual increase members will receive.

The retired military force—all services—is scheduled to grow by 43,000, for a total of 1,285,000 by October 1979. Military retired pay outlays, increasing by about $1 billion annually, are estimated to hit $10.1 billion during FY '79.

The Administration again wants to curtail the "dual pay" that civil servants who are also Reservists collect when taking summer training, feeling it can save $30 million in the process. The budget also includes $8 million more so that trailerites can receive full reimbursement when PCSing with their houses on wheels. And it carries an additional $88 million for junior enlisted travel benefits overseas. The services—and thousands of individual service members—have been demanding the latter funds to keep young families abroad above the poverty level. AFA has long supported this step.

Congress, of course, could reject some of these budget requests. It did so last year on the civilian-Reservist dual-pay issue.

Col. George E. Day, holder of nearly seventy military decorations and awards, including the Medal of Honor, was a POW in Southeast Asia for five and a half years. He is the only prisoner to have escaped from confinement in North Vietnam and then be recaptured by the Viet Cong in the South. Recently retired, Colonel Day is one of the nation's most experienced jet fighter pilots, having logged 4,500 hours of single-engine jet time. He holds a master of arts degree and a law degree, and is a member of the South Dakota and Florida bars.

Proper Uniform Wear Underscored

If there was ever any doubt that USAF leaders insist on strict adherence to uniform wear regulations, it is being dispelled by an unusual move. Despite printing cutbacks generally, the service is distributing to every single blue-suiter, Reservists and Guardsmen included, a new uniform guide. That's a whopping 800,000 copies. It's a thirty-two-page, five- by eight-inch pamphlet that carefully spells out, with illustrations, what gear is worn with each of the Air Force's eleven uniform combinations (five for men, five for women, and the unisex utility outfit).

Officials regard the uniform guide as a close cousin of the new "Standards" directive, AFR 30-1, that deals with discipline, conduct, and appearance.

Pay Change Issue Red Hot

Testimony, declarations, and reports on military pay proliferated early this year as the President's Commission on Military Compen-

sation prepared to recommend changes in the twenty-year retirement system. *(See "AFA Believes," below.)* The Commission's eagerly awaited report to the President is due March 15, although slippage would not be surprising. Once Mr. Carter indicates his views, the Defense Department will start preparing legislative proposals. But Pentagon and Capitol Hill experts don't look for actual changes for at least one year, more likely two.

At press time, the controversy over the sensitive early-retirement issue was steaming. Service people are furious over even the mention of tampering with the twenty-year option. Observers see a major brouhaha coming.

Most of the service Chiefs, USAF's Gen. David C. Jones included, strongly urged continuation of the present system *(see last month's "Bulletin Board").* But JCS Chairman Gen. George S. Brown, USAF, in a late January appearance before the Pay Commission, backed off. Saying changes are inevitable, he suggested that the twenty-year minimum be extended and that "an alternative" must be found. Like other Pentagon leaders, Brown called for a "grandfather" clause to protect people now in service.

General Brown's position raised eyebrows in the military community. Some officers expressed shock at his failure to stand foursquare behind the twenty-year option. Navy Secretary W. Graham Claytor also broke ranks with other top service

AFA Believes . . .

Our Views on Military Compensation

On January 17, 1978, AFA President Gerald V. Hasler sent the letter that follows to Charles J. Zwick, Chairman of the President's Commission on Military Compensation. We think this forceful statement of what AFA believes concerning the several issues under consideration by the Commission will be of interest to all members.

Mr. Charles J. Zwick, Chairman
President's Commission on Military Compensation
666 11th St., N.W., Suite 520
Washington, D. C. 20001

Dear Mr. Zwick:

Thank you for this opportunity to present the views of the Air Force Association on the all-important issue of military compensation.

On behalf of our more than 155,000 members, I want to say that we are hopeful that the work of your Commission will represent a vital step in assuring that dedicated military people are properly compensated for their efforts. With that in mind, I briefly will cite some of AFA's concerns. . . .

There is a growing effort within the services to restore the once strong tradition which held that military duty is a calling, a way of life, not just a job.

The Air Force Association endorses this effort. But if we expect our nation's youth to go along, then we—associations, individuals, and the government—must stand firmly behind them once they put on their military uniforms.

The sacrifices involved, and the dangers military people face, demand the full understanding of the nation. This includes the support of benefits designed to compensate for the disadvantages of service life. Perceived piecemeal hacking at pay and entitlements, and threats to their existence, have dismayed the military community; members question whether the public and government truly value their services and sacrifices.

What is strongly needed, AFA believes, is a "bill of rights" stating precisely what entitlements are now available, and which will not be withdrawn during the individual's term of service.

The Air Force Association opposes hasty adoption of a military "salary" system, which supporters say would give members a better idea of their overall take-home pay. Actually, most military personnel do understand the present pay system and its major planks—basic pay, quarters and subsistence allowances, and the tax advantage on the allowances. What they fear, in any replacement plan, is the net loss with the disappearance of the tax-free allowances.

Although we caution against a salary system, numerous improvements in related compensation elements are long overdue. Here are major ones the Association supports:

- Full travel payments for junior enlisted families.
- Per diem for enlisteds, comparable to that for officers.
- Equalized hazardous-duty pay for all ranks.
- Cost-of-living supplements for members in high-cost areas.
- Elimination of monetary discrimination against mobile home owners.

In the retirement area, AFA believes that any new nondisability plan adopted must guarantee no pay cut for current retirees or for members on active duty at the time of enactment. Any such plan, in addition, should not be linked with any Social Security program.

The Association, furthermore, opposes any proposal that would limit employment opportunities for retirees, the great majority of whom are enlisted, and it favors removal of the dual compensation curbs on retired Regular officers. We believe the latter group is being discriminated against and, as a consequence, the government is losing talented managers. Retired pay, after all, is earned income.

Among the traditional entitlements that will enhance the services' "way of life" image, provided they are not gutted or constantly attacked, are commissaries, survivor benefits, and dependent medical and dental care. In that regard, we recommend removal of the SBP provision wherein survivors eligible for Social Security must have their SBP benefits offset by proportionate amounts of their deceased spouse's Social Security benefits.

AFA urges improved management to cut commissary subsidies, but opposes any reduction of benefits of commissary services. For most uniformed members and their families, the commissary is sacrosanct. Further governmental attacks on these stores may be regarded by many personnel as "the last straw."

To restore health care to its former highly regarded status, AFA urges a return to the 90th percentile method of determining a reasonable rate under CHAMPUS, broader use of incentives to attract and retain military physicians and dentists, and dental care for active-duty dependents, retirees, and their families.

Thank you again for this opportunity to present AFA's views to you and to the Blue Ribbon Commission. We look forward with hope that your final recommendations will—within the framework of economic restraints—justly compensate the truly dedicated men and women of our nation's armed forces in the monetary area, because they can never be truly compensated for their devotion to duty and for their service to country. We all are in their debt for that.

Sincerely,

/s/ Gerald V. Hasler

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executives, saying he favors a "more cost-effective, flexible" retirement system.

In his appearance before the Pay Commission, Air Force Secretary John C. Stetson heartily endorsed the present retirement system. He urged full travel benefits for junior enlisted families, but blasted proposals for a military "salary system."

The Pay Commission and its staff, meantime, considered different retirement proposals. One would leave enlisted members under the present arrangement and place officers under provisions of the Retirement Modernization Act. RMA is designed to get less-needed people to leave before normal retirement and encourage others to serve much longer than at present. At least parts of RMA seem certain to be included in the Commission's recommendations. Other ideas the group has studied include a "modified Civil Service" retirement plan with payoffs delayed until age fifty-five, and reduced pensions for retirement at twenty years.

In related military pay developments:

• One of the nation's leading military personnel experts, and a past participant in AFA seminars, John R. Blandford, declared that if the twenty-year privilege for enlisted members is removed, "substantial numbers of . . . [NCOs] will not reenlist. That is a foregone conclusion. The loss of leadership will be staggering, and its effect upon our national security could be devastating."

Mr. Blandford was formerly chief counsel of the House Armed Services Committee, where he played a major role in shaping existing military personnel legislation. His statement highlights an eighty-four-page report that the Fleet Reserve Association prepared for the Pay Commission, to make sure the Commission understands how enlisted people feel about pay and benefits.

Blandford sat on a Fleet Reserve Association panel that last year questioned scores of enlisted members of all services. The report hits hard at the erosion of benefits and indicates that the growing attitude among the rank and file is, "What are we going to lose next?"

• Rep. Les Aspin (D-Wis.) released a Library of Congress study he said is a "thorough refutation of the prevailing view that the military has been suffering an erosion of benefits." Benefits in recent years have increased, the frequent service critic declared. The study contends that eighty-two percent of the changes in military compensation made by Congress over the past decade were favorable to service people. Gen. George Brown called the Aspin statement "phoney."

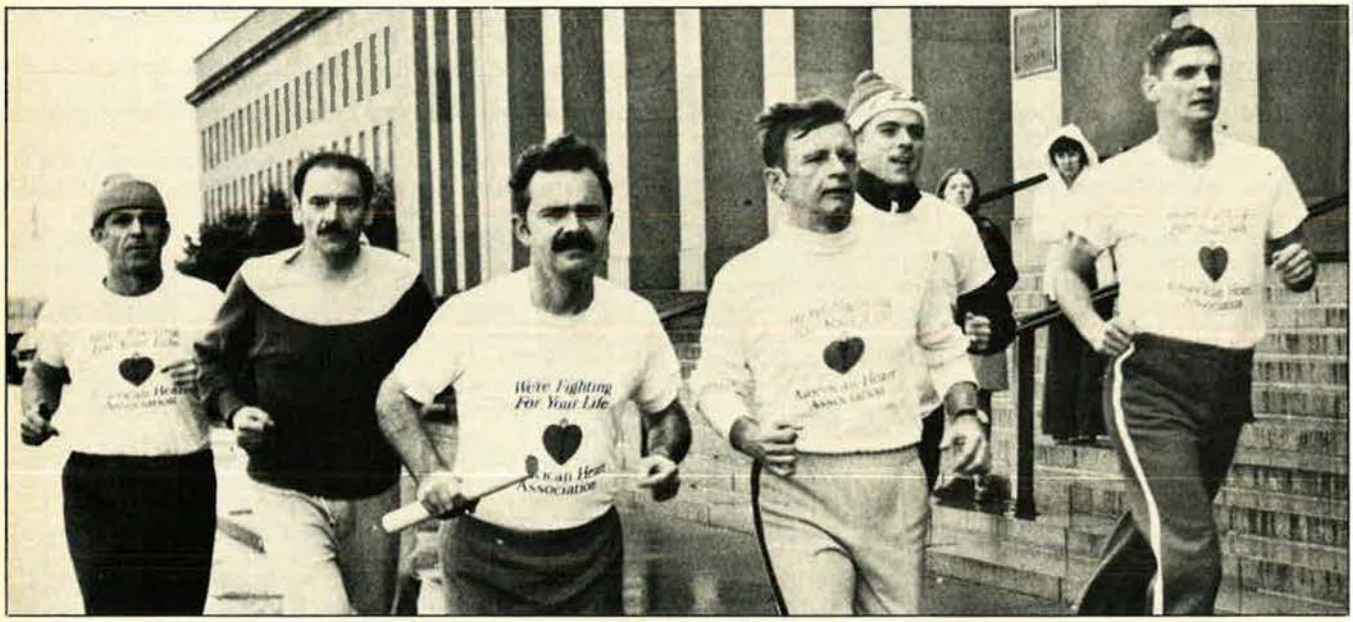
• The Congressional Budget Office (CBO) issued a report listing savings it said could be attained by changing the military retirement system. For example, deferring full pensions to age fifty-five or sixty, but providing partial annuities until then, would save $19 billion by the year 2000, the report says.

With this type of input, it's no wonder the pot is sizzling.

Sea Pay Hike Near?

US sailors afloat receive a mere $8 to $22 per month in sea pay, amounts they regard as a joke. Navy for years has tried to get sea pay raised, while successive administrations have said "no." But in a recent surprise move, the Defense Department and the Office of Management and Budget agreed; they asked Congress for increased sea pay in amounts of from $25 to $100 per month.

Though more sea pay is long overdue, the flip-flop—on this one pay item—came amidst the Pentagon's moratorium on compensation changes while the Presidential pay commission studies are going on. Maybe it pays—for sailors—to have a chief executive with a Navy background.



Air Force Lt. Cols. Edwin W. Thompson, far left, and Ronald T. Lanman, second from right, and four other officers from the Armed Forces Staff College complete a twenty-eight-hour relay "jogathon" at the Pentagon. The relay began 200 miles away in Norfolk, Va., and raised money for the Heart Association. Staff College personnel pledged nearly $1,500.

Advanced Degree Holders Soar

Despite the fact that USAF officer strength plunged during the past five years, the number of line officers holding graduate degrees soared. The growth was entirely in master's degrees; Ph.D. holders remained steady at about 1,100.

Hq. USAF figures also show that, as of last September, only 2,030 of the 82,889 active-duty line officers lacked a college degree. Five years earlier, 11,271 had been without a degree.

The latest figures show 29,340 line officers holding master's and doctoral sheepskins; that's 35.4 percent of the line force. This compares with 19,809 advanced degree holders five years ago. That earlier figure represented nineteen percent of the then 104,110 line officers in service.

The sharp increase, officials explained, is the result of young officers scrambling for second degrees via off-duty study under USAF's Education Services program, to make themselves competitive for promotion. Few make major without an advanced degree. Unfortunately for USAF, a great many of such degrees are in business, management, and other areas and do not meet assignment requirements.

During FY '77, according to the Hq. USAF education office, 3,285 officers (and 1,695 airmen) won baccalaureate degrees via Education Services participation; nineteen officers and one airman won doctorates. In the same year, there were more than 183,000 undergraduate and nearly 70,000 graduate course enrollments of officers and airmen. Tuition assistance financed most of the undergraduate enroll-

Ed Gates . . . Speaking of People

Good News and Bad on Commissaries

Three years ago, the forecast on the military commissary front was bleak indeed; there was no good news in sight. But that's pretty much changed. The good news is here, although there remains a bit of the bad stuff, too. And the latter is so unnecessary.

In early 1975, the government was taking direct aim on military commissaries, the services' long-treasured fringe benefit. The Administration urged Congress to save money by withdrawing appropriated funds, which for years had paid commissary workers' salaries. The gap was to be made up by raising store patrons' grocery bills.

Dire things were predicted; the most extreme was that as commissary surcharges rose, customers would gradually switch to civilian outlets. Commissary sales, in turn, would shrink, and soon the in-service stores would be forced to close. Patrons would have no alternative but to use the more costly commercial supermarkets. No more twenty percent savings, no more convenience.

None of this has come to pass, of course, though for a couple of years the issue was in doubt. Pro-commissary forces, particularly associations like AFA, battled harder for the preservation of the traditional commissary system than the formidable commissary critics fought against it and, at least for the short term, the system now appears out of trouble. The federal subsidies that help make the system attractive continue and the threats have subsided.

USAF, meantime, established a live-wire Commissary Service. It laid on management improvements, special sales promotions, and other innovations likely to appeal to customers.

It's not worried about the future, for early this year Air Force unveiled its most comprehensive commissary building-refurbishing program in history. As reported in last month's "Bulletin Board," thirty-three new Air Force stores will be built and sixty-four others will be renovated this year through 1982. Some of the new construction is under way. The price tag for the entire project is a whopping $150 million.

What it means is that ninety-seven of the 163 stores in the Air Force-wide commissary system are to be replaced or remodeled. Many will reappear complete with bakeries and delicatessens. Floor space will be increased to ease crowding, to cut lines, and to "get people in and out much faster," an official at Hq. USAF said. "There'll be more variety and more selection of items, more checkout lines, and the latest in modern cash registers," he added.

How is all this being financed without appropriated money? Congress, it will be remembered, in early 1976 okayed an increase in the surcharge (added to each customer's bill) from three percent in the continental US and from two-and-one-half percent abroad, to four percent worldwide. The increase for USAF has built up a construction kitty of some $26 million annually, but which officials expect to grow in the immediate years ahead because "business is increasing."

Clearly the day is fast approaching when Air Force stores will be the equal of the best in civilian supermarkets.

In a related move for military shoppers, the Army-Air Force Exchange Service recently announced that many new exchanges are going up this year and next, and that others will undergo major renovation. An example is Lackland AFB, Tex., which will spend $1.5 million to expand its main exchange. Included in the "new-store" list are fifteen USAF "convenience" exchange stores, two shopping centers (slated for completion later this year at Castle AFB, Calif., and Bolling AFB, D. C.), and repair of existing stores at seven sites.

All the above—saving the commissary system, improvement in store management, maintenance of a reasonable surcharge, stepped-up commissary modernization, and the related improvements among the exchanges—add up to considerable good news. It's a substantial package, of real importance to the military community. And it reflects the leadership's determination to retain and strengthen traditional incentives.

Unfortunately, there's a bit of bad news for commissary customers that, it should be made clear, is not the fault of any service. The culprits are the Civil Service Commission and the Justice Department, which have decided that the kids who bag groceries at the commissaries are, in fact, government employees, cannot receive tips, and must receive the minimum wage. The Defense Department appealed this ridiculous ruling, but it got nowhere. At press time, we were told the ruling would go into effect soon.

Instead of a service charge increase of two percent to take care of the baggers' wages, plans call for imposing a "user's fee" of about the same size. For shoppers not wanting to use that arrangement, checkout lanes for self-service bagging are planned, an informed source said. All in all, the bagging decision sounds like a first-class mess for all concerned, particularly for the military children who earn spending money bagging groceries. They'll make much less without tips and—another Civil Service-Justice absurdity—will be liable for taxes on their earnings.

Hopefully, Congress will restore sanity by adopting the bill introduced by Rep. Les Aspin (D-Wis.), which would overturn the ruling. ■

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ments, the GI Bill most of the graduate courses.

The AFIT program, meanwhile, is retrenching each year. The latest annual list of AFIT civilian institution selectees found only 492 officers picked for master's degree programs and only thirty-one for doctoral degrees. Smaller than last year, another drop is forecast in next year's list. AFIT students are earmarked for specific billets, mainly in technical-scientific posts.

Years ago, fewer than half of USAF's officers held even one degree. In the early 1960s, then Chief of Staff Gen. Curtis E. LeMay decided that all new officers must have a bachelor's degree, and by late 1972 almost ninety percent of the line force had one. Advanced degrees also proliferated. The accompanying table shows the picture (with percentages rounded off) for the past five years.

USAF Line Officers

	No Degree	%	Bachelors	%	Masters	%	Doctorates	%
Dec. '72	11,271	10.8	73,030	70.0	18,667	17.9	1,142	1.0
Dec. '74	6,288	6.7	64,908	69.2	21,421	22.8	1,157	1.2
Sept. '76	2,939	3.4	55,558	64.9	25,717	30.0	1,107	1.3
Sept. '77	2,030	2.4	51,519	62.1	27,971	33.7	1,092	1.3

Safest Cities in the World

If you're working or living at an Air Force base you're in one of the world's "safest cities," according to Lt. Gen. John P. Flynn, USAF's Inspector General. He cited a recent study of on-base crime compared with crime in neighboring cities.

The cities didn't come out very well. The IG reported that Stateside Air Force bases are seventeen times safer than their contiguous neighbors. The study compared 1976 FBI statistics on civilian communities with USAF base findings. CONUS bases in the south had the lowest crime rate—0.86 per 1,000 population—compared with an average rate of 1.41 per 1,000 CONUS-wide. The crime rate for PACAF bases was a lofty 4.89, for USAFE bases, a low 1.13.

Examined another way, General Flynn reported that "of the eighty CONUS bases compared, 96.3 percent were safer than their adjacent civilian communities." He said "controlled access" to bases, tough recruiting screening, and "ability to eliminate offenders from service" are major reasons why USAF bases are almost crime free.

Union, CAP Bills Get Action

A House Armed Services subcommittee in late January began considering the Senate-passed bill to bar military unions, and measures to strengthen the Civil Air Patrol. The long-sought CAP legislation, endorsed strongly by AFA, would let the Air Force budget appropriated funds for the auxiliary.

The antiunion measure is seen stirring up renewed controversy on the explosive issue as it heads for likely House approval later this year.

In other early second-session actions, the full House Armed Services Committee approved retirement bills affecting very small numbers of people. One authorizes Air Force and Army enlisted Reservists to retire with twenty years of service. Another allows recalculation of retired pay for certain active duty performed after initial retirement. The subcommittee was expected to approve, in early February, another minor retirement bill that opens retired pay eligibility to certain heretofore ineligible Reservists who did not perform service during wartime.

The full House was scheduled to vote on the Defense Officer Personnel Management Act (DOPMA) in early- or mid-February. DOPMA cleared the Committee last year, but its fate in the Senate is uncertain; it has been blocked by Sen. Sam Nunn (D-Ga.).

The reconvened lawmakers, meanwhile, have tossed numerous new veterans bills into the hopper. Rep. G. V. Montgomery (D-Miss.), for example, is sponsoring HR 10495 and HR 10498. One would improve pensions for vets of all US wars and their survivors, and the second would hike dependency-indemnity compensation (DIC) for dependent parents.

Personnel Center Expanding

The USAF Military Personnel Center manages the careers—promotion, assignment, retirement, etc.—of most Air Force members. It is no surprise that some 10,000 blue-suiters visit the Randolph AFB, Tex., facility annually, to check their records and consult with career advisors.

But that number is expected to grow with the Center's expansion, now taking place. A newly built three-story wing adjoining the main Center building is bringing all 2,000 MPC military and civilian employees under one roof. It gives the facility 75,000 square feet of additional space. Some of it is being earmarked for visiting officers and NCOs, so they can study their records in comfort and privacy, not in the cramped office previously used.

The Center, meantime, is expanding its career advisor services for airmen in several job fields, and is giving special attention to USAF's 4,800 chief master sergeants. Most "chiefs" retire at the twenty-six-year point, thus causing the loss of considerable experience. The service wants to keep more chiefs to thirty years, and it recently selected forty-six of them for thirty-three years of service. Chosen from more than 800 who sought the extended tenure, the forty-six are considered by authorities as "absolutely the top NCOs" anywhere. They're getting key assignments and their preferred locations.

The Chiefs Group, which manages the E-9s' careers much the same way the Colonels Group manages full colonels, reports that 719 USAF chiefs have college degrees. A great many chiefs hold jobs previously assigned to officers, officials noted.

Fund Drive Goal: $2.5 Million

The annual Air Force Assistance Fund drive, just under way, is looking for a record-breaking $2 million from active-duty members and a half million from Reservists, Guardsmen, and retirees. Hq. USAF, though not naming a quota, has

ublished a "suggested giving uide" based on a person's basic ay. It runs from $1 for those earn- ng $4,000 basic pay to $40 if an- ual base pay is $35,000 or more. ive dollars is the recommended ift for members making $9,000 asic.

Campaign officials said that both he Air Force Village and the nlisted Widows Home recently pened eligibility to Air Reserve nd Air Guard families and sur- ivors. Accordingly, the drive is so- iciting contributions from the two omponents, as well as from USAF etirees. Last year's fund drive col- ected $1.8 million, of which the ir Force Aid Society received 943,000, the Enlisted Widows ome $616,000, and the Village 236,000. Most contributors des- gnate the disposition of their ledges.

ists Out Earlier

Air Force made a long overdue ove recently—beginning with the ew full colonels' list—when it tarted announcing hike rosters s soon as they are approved y the USAF Secretary. Before, lists ere hung up until the President kayed them. One wonders why it ook so long; after all, even one xtra day of "not knowing" can be orture to some who are "sweating t out." The new O-6 list has 769 ames. The selection rate for line officers was thirty-four percent. By group, pilots did best—thirty-nine percent.

Dual Comp Relief Sought

Attorneys for a large group of retired Regular military officers, all of whom work or have worked for the government, have gone to the US Supreme Court in an attempt to overturn the "dual-compensation" restriction. It forces them, but not retired Reserve officers working for Uncle Sam, to forfeit half of their annual retired pay in excess of $3,860. The US Court of Claims earlier rejected the suit by the 874 retired Regular officers. The adverse decision, the attorneys said, also affects 5,000 others in similar status plus Regulars who are "inhibited" from seeking jobs with the government because of the compulsory forfeiture.

Short Bursts

Don't ask us how, but according to the Defense Department, there are twenty-six military **retirees on the nondisability list**—repeat, nondisability list—who are between thirty and thirty-four years of age. All are Navy and Marine Corps.

The **Veterans Administration** advises that: (1) the last Civil War veteran died in 1959, yet the VA still provides benefits for 285 widows and helpless children of vets of that war; (2) the VA's budget for FY '79 is $19.2 billion, up from $18.9 billion this year, with the increase scheduled for health care; and (3) the Culpeper National Cemetery, Culpeper, Va., has just reopened for burials. Space became available earlier when the Burton Hammond Veterans of Foreign Wars Post 2524 donated land adjacent to the cemetery.

In-patient charges at **military hospitals** for service dependents rose early this year from $4.10 to $4.40 per day.

Air Force is **looking for volunteers** in these areas: aircraft mechanics and maintenance NCOs to retrain into flight engineers; officers to become aides-de-camp and basic military training officers; and NCOs for attaché assignments in US embassies abroad. Base CBPOs should have the story.

The first USAF **women to enter missile-launch jobs** are starting special training and will begin their new work later this year. Fifteen officers were chosen in January, twenty-five enlisted women in February.

CMSgt. Phillip R. Harvey, on aerospace industry liaison duty in San Diego, has won $10,000 in suggestion money since he started turning in clever ideas in 1966. He was recently named **Suggester of the Year** for 1977, by a nonprofit organization called the National Association of Suggestion Systems. ■

Senior Staff Changes

RETIREMENTS: Gen. Daniel **James,** Jr.; M/G Jack I. **Posner;** M/G David **Waxman,** USAFR.

PROMOTIONS: To General: Bryce **Poe** II; to Brigadier General: Robert A. **Rosenberg.**

CHANGES: B/G William P. Acker, from Dep. Cmdr., Hq. US Mil. Enlistment Processing Comd., Ft. Sheridan, Ill., to Cmdr., USAF Recrtg. Svc., ATC, and DCS/Recrtg., ATC, Randolph AFB, Tex., replacing M/G Melvin G. Bowling . . . **B/G Stanley C. Beck,** from Comdt. of Cadets, USAFA, Colo., to Comdt., ACSC, AU, Maxwell AFB, Ala., replacing M/G William L. Nicholson III . . . **M/G Melvin G. Bowling,** from Cmdr., USAF Recrtg. Svc., ATC, and DCS/Recrtg., ATC, Randolph AFB, Tex., to V/C, 6th ATAF, Izmir, Turkey . . . **Col. (B/G selectee) Joseph H. Connolly,** from Mil. Asst. to Dir., Contract & Weap. Acquisition, Dep. Under Sec. Def. for R&E, Washington, D.C., to Cmdr., Def. Contract Admin. Rgn., DLA, Los Angeles, Calif.

L/G Howard M. Fish, from Dep. Asst. Sec. Def. (Security Assistance), and Dir., DSAA, to Asst. VC/S, Hq. USAF, Washington, D.C. . . . **Col. (B/G selectee) Guy L. Hecker, Jr.,** from Cmdr., 509th Bomb Wg., SAC, Pease AFB, N.H., to Cmdr., 45th Air Div., SAC, Pease AFB, N.H. . . . **M/G William L. Nicholson III,** from Comdt., ACSC, AU, Maxwell AFB, Ala., to V/C, 15th AF, SAC, March AFB, Calif. . . . **B/G Dalton S. Oliver,** USAFR, from Mobilization Assistant to Comd. Surg., ATC, Randolph AFB, Tex., to Mobilization Assistant to Surg. Gen., Hq. USAF, Washington, D.C., replacing retiring M/G David Waxman, USAFR . . . **L/G (Gen. selectee) Bryce Poe II,** from Cmdr., AF Acquisition Log. Div., AFLC, Wright-Patterson AFB, Ohio, to Cmdr., AFLC.

Col. (B/G selectee) Marc C. Reynolds, from Dir., Materiel Mgt., Sacramento ALC, AFLC, McClellan AFB, Calif., to V/C, Sacramento ALC, AFLC, McClellan AFB, Calif. . . . **Col. (B/G selectee) Thomas C. Richards,** from V/Comdt. of Cadets, USAFA, Colo., to Comdt. of Cadets, USAFA, Colo., replacing B/G Stanley C. Beck . . . **Col. (B/G selectee) Graham W. Rider,** from Cmdr., Det. 30, San Antonio ALC, AFLC, Kelly AFB, Tex., to Dir., Plans, DCS/Plans & Programs, Hq. AFLC, Wright-Patterson AFB, Ohio.

SENIOR ENLISTED ADVISOR: CMSgt. Lawrence A. Shellhammer, from Personnel Sergeant Major, AFOSI, Washington, D.C., to Senior Enlisted Advisor, AFOSI, Washington, D.C., replacing retiring CMSgt. Billy Johnson. ■

AFA News

By Don Steele, AFA AFFAIRS EDITOR

THE RED RIVER VALLEY CHAPTER, N. D., AND THE THOMAS B. McGUIRE, JR., CHAPTER, N. J., cited for effective programming in support of AFA's mission, most recently exemplified in their sponsorship of programs recognizing Air Force units and civic leaders, respectively.

—USAF PHOTO BY A1C GINA LYNNE JOHNSEN

Organizations from each of the five major units at Grand Forks AFB, N. D., recently received outstanding performance awards from AFA's Red River Valley Chapter. The units—the 319th Munitions Maintenance Sqdn., the 321st Transportation Sqdn., the 321st Combat Support Group's Food Service Div., the USAF Hospital, and the Military Working Dog Section of the 321st Security Police Group—were recognized at the Chapter's recent Awards Banquet. In the photo, Security Police Dog Handler A1C Rodney Fleming and "Pete" accept congratulations from Chapter President Maury Rothkopf.

AFA's Thos. B. McGuire, Jr., Chapter recently sponsored a breakfast meeting at McGuire AFB, N. J., to recognize local civic leaders for their support. Distinguished guests included, from left, Pemberton Township Mayor Elmer D'Imperio; Col. (Brig. Gen. selectee) James L. Gardner, Jr., 438th Military Airlift Wing Commander; Mount Holly Township Mayor Joseph D. Weber, Jr.; AUSA's Fort Dix Chapter President Mike Kittis; Maj. Gen. Thomas M. Sadler, 21st Air Force Commander and the principal speaker; Chapter President William J. Demas; Wrightstown Chamber of Commerce President Jack Collins; Mount Holly Township Councilwoman Grace Donnelly; Wrightstown Borough Mayor Dr. Hubert Byron; and Mrs. Ethel Matson, President, Wrightstown Area Chapter of Deborah Hospital.

—USAF PHOTO BY SSGT JIM LAVISKA

Brig. Gen. Thomas H. McMullen, DCS/Requirements, Tactical Air Command, Langley AFB, Va., was the guest speaker at a recent dinner meeting of AFA's Homestead, Fla., Chapter. Discussing the program are, from left, Chapter President Ed Walker; Col. Samuel R. Johnson, 31st Tactical Fighter Wing Commander; General McMullen; and Col. T. M. Hamilton, 31st Combat Support Group Commander.

At a dinner meeting sponsored recently by AFA's Austin, Tex., Chapter, Rep. J. J. "Jake" Pickle (D-Tex.), left, assisted by Chapter President Barney Pusin, right, presents AFROTC Cadet James Patterson, center, from Texas A&M University, the Chapter's "Distinguished Military Cadet Award." The Chapter's "Man of the Year Award" went to Frank McBee, Tracor Corp. Board Chairman.

chapter and state photo gallery

The Air Power Chapter of Los Angeles, Calif., recently presented an Air Force flag to the newly established AFJROTC Unit at South Gate High School. Al Myers, right, a member of the Chapter's Executive Council, made the presentation to Lt. Col. Carl Holmquist, USAF (Ret.), left, Aerospace Education Instructor, during the school's homecoming football game. The AFJROTC Color Guard are, from left, Cadets Myron Williams, Mark Spurlock, Ki-Hong Kim, and Duane Williams.

—PHOTO BY ROBERT J. EICHENBERG

Brig. Gen. James A. Abrahamson, left, Program Director, F-16 System Program Office, Wright-Patterson AFB, Ohio, was the guest speaker at a recent Curtis E. LeMay-Orange County Chapter dinner meeting. He is shown making a humorous point in the opening remarks of his presentation on the Air Force's new multirole fighter. Chapter President Tom Scott is at the right.

—USAF PHOTO

More than 300 members and guests attended the Enid, Okla., Chapter's quarterly dinner meeting at Vance AFB at which Gen. John W. Roberts, Commander, Air Training Command, at the podium, was the guest of honor and speaker. Head-table guests included, from left, Mrs. Curtis; Chapter President Oscar Curtis; Mrs. Magner; and Col. Thomas J. Magner, Commander, 71st Flying Training Wing, Vance AFB.

—USAF PHOTO

Among the more than 150 members and guests who attended the Chicagoland, Ill., Chapter's first Holiday Ball at the Chicago Yacht Club were, from left, Chapter President Dick Becker; Lt. Col. Sheldon Brown, USAR, Reserve Officers' Association's Department of Illinois President; Alexander C. Field, Jr., Vice President for AFA's Great Lakes Region; Maj. Gen. Ted Sorenson, USAFR, Past National ROA President; and Maj. Gen. Edwin Robertson, Chanute Technical Training Center Commander.

COMING EVENTS

AFA National Board of Directors Meeting, Sands Hotel, Las Vegas, March 3–4 . . . **Arnold Air Society and Angel Flight 30th Annual National Conclave,** Del Webb Townehouse, Phoenix, Ariz., April 1–6 . . . **Fifteenth National Air Force Salute,** New York Hilton, New York City, April 8 . . . **Tennessee State AFA Convention,** Arnold Engineering Development Center, April 14–15 . . . **Massachusetts State AFA Convention,** Hanscom AFB, April 22 . . . **Florida State AFA Convention,** Fort Walton Beach, April 28–30 . . . **Tenth Annual Bob Hope AFA Charity Golf Tournament,** March and Norton AFBs, Calif., April 28–30 . . . **South Carolina State AFA Convention,** Myrtle Beach AFB, May 5–6 . . . **Virginia State AFA Convention,** Charlottesville, May 6 . . . **Colorado State AFA Convention,** Pueblo, May 12–13 . . . **California State AFA Convention,** Sacramento, May 19–21 . . . **New Jersey State AFA Convention,** Golden Eagle Inn, Cape May, May 19–21 . . . **AFA Golf and Tennis Tournaments,** The Broadmoor, Colorado Springs, Colo., May 26 . . . **AFA Board of Directors and Nominating Committee Meetings,** The Broadmoor, Colorado Springs, Colo., May 27 . . . AFA's Nineteenth **Annual Dinner honoring the Outstanding Squadron at the Air Force Academy,** The Broadmoor's International Center, Colorado Springs, Colo., May 27 . . . **Connecticut State AFA Convention,** Howard Johnson Conference Center, Windsor Locks, June 3 . . . **New York State AFA Convention,** Niagara Falls, June 9–10 . . . **Texas State AFA Convention,** Kahler Green Oaks Inn, Fort Worth, July 28–30 . . . **AFA's 32nd Annual National Convention,** Sheraton-Park Hotel, Washington, D. C., September 17–20 . . . **AFA's Aerospace Development Briefings and Displays,** Sheraton-Park Hotel, Washington, D. C., September 19–21 . . . **AFA National Symposium,** Los Angeles, Calif., October 26–27 . . . **Seventh Annual Air Force Ball,** Century Plaza Hotel, Century City, Calif., October 27.

AFA News

Retired CMSAF Richard D. Kisling was the guest speaker at the Middle Georgia Chapter's Birthday Ball, observing the Thirtieth Anniversary of the USAF. Three awards were presented: the Chapter's Maj. Gen. A. J. Beck Scholarship and Airman of the Year Awards to Amn. W. R. Turley and A1C Robert Riddell, respectively; and the Georgia State AFA award to the Employee of the Year at Robins AFB, Edward A. Hawkins. Shown participating in the traditional cake cutting are, from left, Chapter President Betty Clark; Dr. Dan Callahan, Vice President for AFA's Southeast Region; Mrs. Michelle Callahan; Georgia State AFA President William L. Copeland; Mrs. Liz Spalding; Maj. Gen. John R. Spalding, Jr., Warner Robins Air Logistics Center Commander; Mrs. Esther Becker; and Brig. Gen. William J. Becker, Vice Commander of the Logistics Center.

AFA Medal of Merit Presentations

The names of the recipients of AFA's Medals of Merit are announced at the annual National Convention. However, the awards are presented throughout the year in the respective recipient's home area, and are reported at various times in this department. In **photo #1,** AFA Board Chairman George M. Douglas, left, presents Hoadley Dean, Vice President for AFA's North Central Region, his Medal of Merit during a recent visit to Mr. Douglas's Denver office. **Photo #2** shows Margaret "Peg" Reed, right, Vice President for AFA's Northwest Region, presenting the award to AFA National Director Sherman W. Wilkins, left, during a recent Greater Seattle, Wash., Chapter meeting. In **photo #3,** E. F. "Sandy" Faust, left, Vice President for AFA's Southwest Region, presents the medal to retired Air Force Maj. Gen. Jerry D. Page, Immediate Past President of the Wichita Falls, Tex., Chapter, during a recent Chapter meeting. During a December meeting of the Lawrence D. Bell, N. Y., Chapter, William C. Rapp, Vice President for AFA's Northeast Region, presents the Medal of Merit, in **photo #4,** to retired Air Force Brig. Gen. Henry C. Newcomer, right, a former member of the Chapter's Executive Council. At the Texas State AFA's Executive Committee Meeting in Kerrville, hosted by the Heart of the Hills Chapter, State President T. A. "Tim" Glasgow, right, presented Medals of Merit to Texas State AFA Executive Vice President F. L. Frank Jones, left in **photo #5;** and to Texas State AFA Vice President (Awards) George C. Lambkin, left in **photo #6.**

chapter and state photo gallery

The observance of the 74th Anniversary of the Wright brothers' first powered flight was cosponsored by the Air Force Association, The First Flight Society, and the National Park Service on December 17, 1977. The photo at left above shows North Carolina State AFA President William M. Bowden and Mrs. Lee Manch, widow of the Doolittle Raid leader for whom AFA's Jack Manch, Va., Chapter is named, presenting the Air Force Association memorial wreath at the monument marking the site of the first flight at Kill Devil Hills, N. C. The First Flight Luncheon at Nags Head featured an address by Forwood C. Wiser, President, Pan American World Airways, and the unveiling of the portrait of the US Army Air Service officers who made the first round-the-world flight in 1924. In the photo above at right, Maj. Gen. Leigh Wade, USAF (Ret.), left, the guest of honor and the only surviving pilot of the flight, and Paul E. Garber, Historian Emeritus of the Smithsonian Institution, unveil the portrait. Capt. Fred Merritt, USCG (Ret.), President of The First Flight Society, and Mr. Wiser are to Mr. Garber's left. The portrait will be enshrined in the First Flight Shrine at the Wright Memorial Visitors Center.

Maj. Gen. Lawrence A. Skantze, DCS/Systems, Air Force Systems Command Headquarters, was the guest speaker at a recent meeting of AFA's Northern Connecticut Chapter. General Skantze, center, is shown visiting with the officials of two AFA Industrial Associate companies—Richard J. Coar, left, Group Executive Vice President/ Technology & Strategic Planning, Pratt & Whitney Aircraft Group, United Technologies Corp.; and Donald Nigro, right, President, Manufacturing Div., Pratt & Whitney Aircraft Group, United Technologies Corp.

Among the distinguished participants and guests at the Greater Seattle, Wash., Chapter's Fall Dinner Meeting were, from left, Chapter President Kendall Russell, Major General, USAF (Ret.); Mrs. Sandy Klima; Margaret "Peg" Reed, Vice President for AFA's Northwest Region; O. C. "Ollie" Boileau, President, Boeing Aerospace Co.; Mrs. Lee Boileau; the guest speaker, Otto Klima, Vice President & General Manager, Re-Entry & Environmental Systems Div., General Electric Co. Aerospace Group; and Mrs. Polly Russell.

This Is AFA

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

OBJECTIVES

The Association provides an organization through which free men may unite to fulfill the responsibilities imposed by the impact of aerospace technology on modern society; to support armed strength adequate to maintain the security and peace of the United States and the free world; to educate themselves and the public at large in the development of adequate aerospace power for the betterment of all mankind; and to help develop friendly relations among free nations, based on respect for the principle of freedom and equal rights to all mankind.

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Endicott, N.Y.

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Arnold Air Society
St. Paul, Minn.

Rev. Msgr. Rosario L. U. Montcalm
(ex officio)
National Chaplain
Holyoke, Mass.

VICE PRESIDENTS

Information regarding AFA activity within a particular state may be obtained from the Vice President of the Region in which the state is located.

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Midwest Region
Nebraska, Iowa, Missouri, Kansas

AFA News photo gallery

Maj. R. C. Eckard, USAFR, a member of AFA's Tulsa Chapter, Okla., was honored as the Outstanding Air Force ROTC Liaison Officer for 1977 in the South Central Area. The award was presented at a meeting sponsored by the Tulsa Chapter. Shown are, from left, Calvin Pitts, the guest speaker from NASA's Ames Research Center; Capt. Fred Crawford, USAF Admissions Counselor for ROTC, who presented the award; Major Eckard; and Chapter President Ed McFarland.

More than seventy members and guests attended a luncheon meeting sponsored recently by the Military Affairs Committee of the Greater Providence, R. I., Chamber of Commerce and featuring AFA National President Gerald V. Hasler as the guest speaker. Following his address, Mr. Hasler, left, received a token of appreciation from Committee Chairman John M. Skaradowski, right.

During the Alamo, Tex., Chapter's observance of Pearl Harbor Day, Chapter President Jim Williams, left, and San Antonio Mayor Emeritus W. W. McAllister, Sr., center, present Rep. Abraham "Chick" Kazen (D-Tex.), right, a member of the House Armed Services Committee, the Chapter's "W. W. McAllister, Sr., Patriotism Award."

NEW HIGHER AVIATION DEATH BENEFITS

Dependable Protection from

Air Force Associatio

Important Benefits!

COVERAGE YOU CAN KEEP. Provided you apply for coverage under age 60 (see "ELIGIBILITY") your insurance may be retained at the same low group rates to age 75.

FULL TIME, WORLD WIDE PROTECTION. The policy contains no war clause, hazardous duty restriction, combat zone waiting period or geographical limitation.

DISABILITY WAIVER OF PREMIUM. If you become totally disabled at any time prior to age 60 for at least a 9-month period, your coverage will be continued in force without further payment of premiums as long as you remain disabled.

FULL CHOICE OF SETTLEMENT OPTIONS. All standard forms of settlement options, as well as special options agreed to by the insured and United of Omaha, are available to insured members.

CONVENIENT PAYMENT PLANS. Premium payments may be made by monthly government allotment (payable to Air Force Association), or direct to AFA in quarterly, annual or semi-annual installments.

DIVIDEND POLICY. AFA's primary policy is to provide maximum coverage at the lowest possible cost. Consistent with this policy, AFA has provided year end dividends (20% for 1976) to insured members in twelve of the past fifteen years, and has increased the basic amount of coverage on four separate occasions.

Additional Information

Effective Date of Your Coverage. All certificates are dated and take effect on the last day of the month in which your application for coverage is approved, and coverage runs concurrently with AFA membership. AFA Military Group Life Insurance is written in conformity with the insurance regulations of the State of Minnesota. The insurance will be provided under the group insurance policy issued by United of Omaha to the First National Bank of Minnesota as trustees of the Air Force Association Group Insurance Trust.

EXCEPTIONS: There are a few logical exceptions to this coverage. They are: **Group Life Insurance:** Benefits for suicide or death from injuries intentionally self-inflicted while sane or insane will not be effective until your coverage has been in force for 12 months.

The Accidental Death Benefit and Aviation Death Benefit shall not be effective if death results: (1) From injuries intentionally self-inflicted while sane or insane, or (2) From injuries sustained while committing a felony, or (3) Either directly or indirectly from bodily or mental infirmity, poisoning or asphyxiation from carbon monoxide, or (4) During any period a member's coverage is being continued under the waiver of premium provision, or (5) From an aviation accident, either military or civilian, in which the insured was acting as pilot or crew member of the aircraft involved, except as provided under AVIATION DEATH BENEFIT.

Eligibility

All active duty personnel of the Armed Forces of the United States and members of the Ready Reserve* and National Guard* (under age 60), Armed Forces Academy cadets*, and college or university ROTC cadets* are eligible to apply for this coverage provided they are now, or become, members of the Air Force Association.

*Because of restrictions on the issuance of group insurance coverage, applications for coverage under the group program cannot be accepted from cadets or Reserve or Guard personnel residing in Florida, New York, Ohio or Texas. Members in these states may request special application forms from AFA for individual policies which provide coverage quite similar to the group program.

Please Retain This Medical Bureau Prenotification For Your Records

Information regarding your insurability will be treated as confidential. United Benefit Life Insurance Company may, however, make a brief report thereon to the Medical Information Bureau, a nonprofit membership organization of life insurance companies, which operates an information exchange on behalf of its members. If you apply to another bureau member company for life or health insurance coverage, or a claim for benefits is submitted to such a company, the Bureau, upon request, will supply such company with the information in its file.

Upon receipt of a request from you, the Bureau will arrange disclosure of any information it may have in your file. (Medical information will be disclosed only to your attending physician.) If you question the accuracy of information in the Bureau's file, you may contact the Bureau and seek a correction in accordance with the procedures set forth in the federal Fair Credit Reporting Act. The address of the Bureau's information office is P.O. Box 105, Essex Station, Boston, Mass. 02112. Phone (617) 426-3660.

United Benefit Life Insurance Company may also release information in its file to other life insurance companies to whom you may apply for life or health insurance, or to whom a claim for benefits may be submitted.

CURRENT BENEFIT TABLES

AFA STANDARD PLAN — PREMIUM: $10 per month

Insured's Attained Age	Basic Benefit*	Extra Accidental Death Benefit*	Total Benefit
20-24	$75,000	$12,500	$87,500
25-29	70,000	12,500	82,500
30-34	65,000	12,500	77,500
35-39	50,000	12,500	62,500
40-44	35,000	12,500	47,500
45-49	20,000	12,500	32,500
50-54	12,500	12,500	25,000
55-59	10,000	12,500	22,500
60-64	7,500	12,500	20,000
65-69	4,000	12,500	16,500
70-74	2,500	12,500	15,000

Aviation Death Benefit:*

Non-war related	$25,000
War related	$15,000

AFA HIGH OPTION PLAN — PREMIUM: $15 per month

Insured's Attained Age	Basic Benefit*	Extra Accidental Death Benefit*	Total Benefit
20-24	$112,500	$12,500	$125,000
25-29	105,000	12,500	112,500
30-34	97,500	12,500	110,000
35-39	75,000	12,500	87,500
40-44	52,500	12,500	65,000
45-49	30,000	12,500	42,500
50-54	18,750	12,500	31,250
55-59	15,000	12,500	27,500
60-64	11,250	12,500	23,750
65-69	6,000	12,500	18,500
70-74	3,750	12,500	16,250

Aviation Death Benefit:*

Non-war related	$37,500
War related	$22,500

*The Extra Accidental Death Benefit is payable in the event an accidental death occurs within 13 weeks of the accident, except as noted under **Aviation Death Benefit** (below).

***AVIATION DEATH BENEFIT:** The coverage provided under the Aviation Death Benefit is paid for death which is caused by an aviation accident in which the insured is serving as pilot or crew member of the aircraft involved. Under this condition, the Aviation Death Benefit is paid in lieu of all other benefits of this coverage. Furthermore the non-war related benefit will be paid in all cases where the death does not result from war or an act of war, whether declared or undeclared.

OPTIONAL FAMILY COVERAGE

(may be added to either Standard or High Option Plan)
PREMIUM: $2.50 per month

Insured's Attained Age	Life Insurance Coverage for Spouse	Life Insurance Coverage for each Child*
20-39	$10,000	$2,000
40-44	7,500	2,000
45-49	5,000	2,000
50-54	4,000	2,000
55-59	3,000	2,000
60-64	2,500	2,000
65-69	1,500	2,000
70-74	750	2,000

*Between the ages of six months and 21 years, each child is provided $2,000 coverage. Children under 6 months are provided with $250 coverage once they are 15 days old and discharged from hospital.

essional Association! Apply Now!

Military Group Life Insurance

APPLICATION FOR AFA MILITARY GROUP LIFE INSURANCE

United of Omaha

Group Policy GLG-2625
United Benefit Life Insurance Company
Home Office Omaha Nebraska

Full name of member _____
Rank Last First Middle

Address _____
Number and Street City State ZIP Code

Date of birth Mo. Day Yr.	Height Weight	Social Security Number

Please indicate category of eligibility and branch of service.

- ☐ Extended Active Duty
- ☐ Ready Reserve or National Guard
- ☐ Air Force
- ☐ Other _____ (Branch of service)
- ☐ Air Force Academy
- ☐ _____ Academy
- ☐ ROTC Cadet _____ Name of college or university

Name and relationship of primary beneficiary

Name and relationship of contingent beneficiary

This insurance is available only to AFA members

- ☐ I enclose $13 for annual AFA membership dues (includes subscription ($9) to AIR FORCE Magazine).
- ☐ I am an AFA member.

Please indicate below the Mode of Payment and the Plan you elect.

HIGH OPTION PLAN		Mode of Payment	STANDARD PLAN	
Members Only	Members and Dependents		Members Only	Members and Dependents
☐ $ 15.00	☐ $ 17.50	**Monthly** government allotment. I enclose 2 months' premium to cover the period necessary for my allotment (payable to Air Force Association) to be established.	☐ $ 10.00	☐ $ 12.50
☐ $ 45.00	☐ $ 52.50	**Quarterly.** I enclose amount checked.	☐ $ 30.00	☐ $ 37.50
☐ $ 90.00	☐ $105.00	**Semiannually.** I enclose amount checked.	☐ $ 60.00	☐ $ 75.00
☐ $180.00	☐ $210.00	**Annually.** I enclose amount checked.	☐ $120.00	☐ $150.00

Names of Dependents To Be Insured	Relationship to Member	Dates of Birth Mo Day Yr.	Height Weight

Have you or any dependents for whom you are requesting insurance ever had or received advice or treatment for: kidney disease, cancer, diabetes, respiratory disease, epilepsy, arteriosclerosis, high blood pressure, heart disease or disorder, stroke, venereal disease or tuberculosis? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance been confined to any hospital, sanitarium, asylum or similar institution in the past 5 years? Yes ☐ No ☐

Have you or any dependents for whom you are requesting insurance received medical attention or surgical advice or treatment in the past 5 years or are now under treatment or using medications for any disease or disorder? Yes ☐ No ☐

IF YOU ANSWERED "YES" TO ANY OF THE ABOVE QUESTIONS, EXPLAIN FULLY including date, name, degree of recovery and name and address of doctor. (Use additional sheet of paper if necessary.)

I apply to United Benefit Life Insurance Company for insurance under the group plan issued to the First National Bank of Minneapolis as Trustee of the Air Force Association Group Insurance Trust. Information in this application, a copy of which shall be attached to and made a part of my certificate when issued, is given to obtain the plan requested and is true and complete to the best of my knowledge and belief. I agree that no insurance will be effective until a certificate has been issued and the initial premium paid.

I hereby authorize any licensed physician, medical practitioner, hospital, clinic or other medical or medically related facility, insurance company, the Medical Information Bureau or other organization, institution or person, that has any records or knowledge of me or my health, to give to the United Benefit Life Insurance Company any such information. A photographic copy of this authorization shall be as valid as the original. I hereby acknowledge that I have a copy of the Medical Information Bureau's prenotification information.

Date _____, 19 ____ _____
Member's Signature

3/78
Form 3676GL App

Application must be accompanied by check or money order. Send remittance to: Insurance Division, AFA, 1750 Pennsylvania Avenue, NW, Washington, D.C. 20006

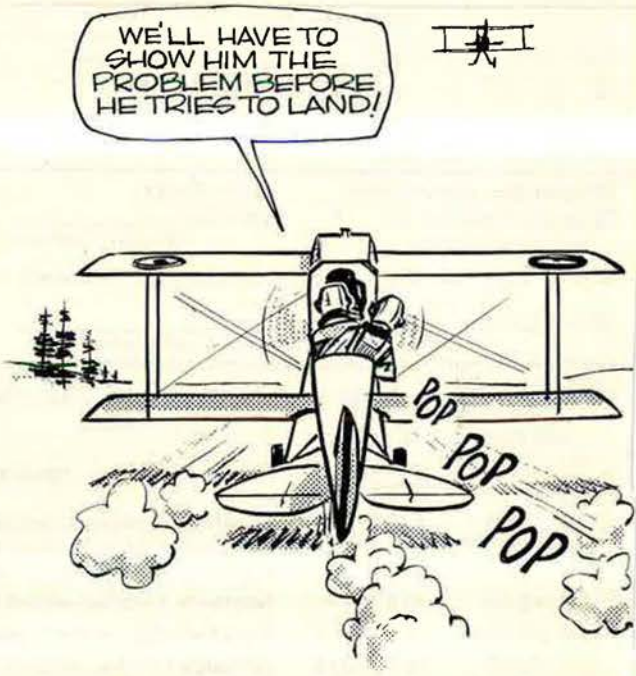
Bob Stevens'

"There I was..."

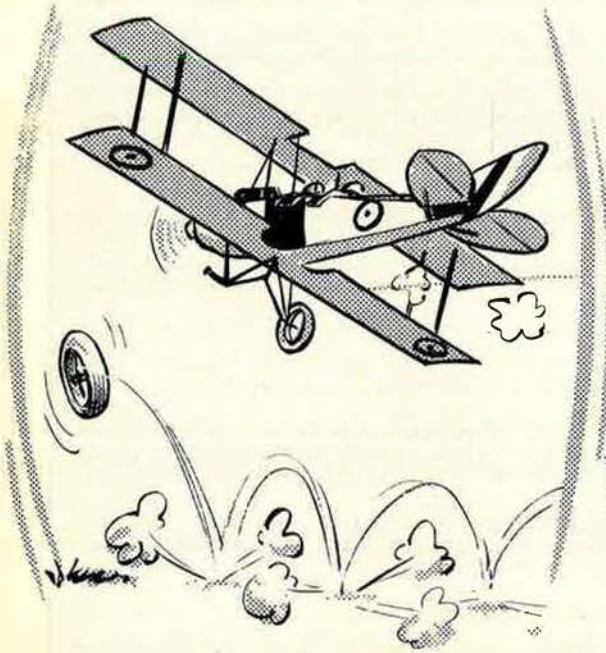
MANY OF OUR NATO ALLIES TOOK THEIR EARLY TRAINING AS WW II PILOTS IN THE VENERABLE BRITISH TIGER MOTH. THESE OTHERWISE STURDY LITTLE BIRDS HAD A PENCHANT FOR SHEDDING A WHEEL ON TAKEOFF... THIS, PLUS NO RADIOS ABOARD, MADE FOR SOME INTERESTING STORIES—

AT A RNAF (ROYAL NETHERLANDS AF) TRAINING BASE—

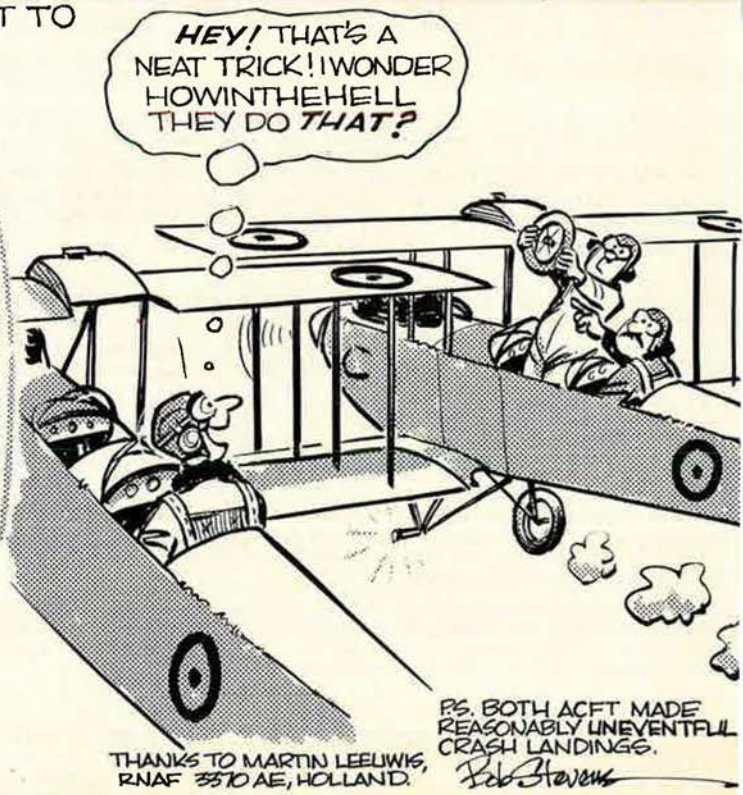
TWO INSTRUCTORS GRAB A SPARE WHEEL and ANOTHER MOTH TO GIVE CHASE.



WOULDN'T YA KNOW! THE INSTRUCTORS' BIRD SHEDS A WHEEL UNBEKNOWNST TO THEM—



FINALLY THEY CATCH THE STUDENT—



THANKS TO MARTIN LEELWIS, RNAF 3510 AE, HOLLAND.

P.S. BOTH ACFT MADE REASONABLY UNEVENTFUL CRASH LANDINGS.

Bob Stevens

Who brings satellite communications down to earth?

Essential national defense messages come through loud and clear, even when sent to individual Naval and Air Force units operating on one side of the earth from National Command Networks based on the other. The U.S. Fleet Satellite Communications system makes the feat possible.

The satellite's receiving subsystem, designed and built by E-Systems, handles over 30 high priority messages simultaneously. To assure the exceptional reliability required for this vital equipment, E-Systems people overcame critical size, weight, and operating power to provide redundancy in each receiver circuit.

The FltSatCom receiver is just one example of E-Systems communications expertise. The company is heavily involved in earth-bound satellite communications terminals, as well as the design and construction of earth station antennas. E-Systems also holds leadership positions in command and control systems, aircraft maintenance and modification, guidance and navigation aids, and electronic warfare.

As a result, E-Systems has more than doubled annual sales in just five years as an independent business organization. For a copy of the brochure that fully describes E-Systems capabilities, write: E-Systems, Inc., P. O. Box 6030, Dallas, Texas 75222.

E-Systems is the answer.

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ACES-II. The High-Technology Ejection Seat selected by the USAF for the F-15, the F-16, and the A-10.

ACES-II will give Air Force fighter crews who have to bail out of their sophisticated planes a far better chance of landing safely, being rescued or evading capture than ever before. For example, the crew can safely escape with ACES-II when inverted only 155′ off the deck.

Our high technology stabilization system makes ACES-II the most stable seat in production today and significantly reduces crew member limb flailing during the entire ejection sequence. Stabilization is accomplished by use of a high speed drogue chute and the unique self-contained STAPAC gyro controlled vernier rocket pitch control system.

By sensing altitude and airspeed, ACES-II utilizes an electronic sequencer to select the appropriate sequence of actions to stabilize, slow, and recover the crewmember from any point within its performance envelope—zero-zero to 600 kts.

ACES-II was designed for maximum reliability and minimum maintenance. Apollo technology thermal batteries power a completely redundant electronic recovery sequencer. Major seat inspection, including recovery parachute repacking, is required only at three-year intervals.

McDonnell Douglas was awarded the ACES-II High Technology Ejection Seat production contract following a "fly-before-buy" competition. ACES-II is our latest development in a 30-year program of designing escape systems for high Mach, high-altitude research vehicles and the production of over 6,800 ejection seats for combat aircraft.

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