AUGUST 1960 / 50¢

AIR FORCE

and SPACE DIGEST

The Magazine of Aerospace Power / Published by the Air Force Association

STRATEGY ON TRIAL

"The big stick grows ever bigger, yet it must now be handled with the delicacy and finesse of a rapier."

MEMO TO MICHAEL:

Your recent letter to the company has been brought to my attention. I am particularly interested in this paragraph,

I am in the fifth grade at Braun School and am very interested in aviation. When I grow up I want to be a aeronautical Engineer if my mother will let me

**

Michael, I certainly hope you keep your desire to make a career in aviation. In my opinion it is one of the most challenging opportunities for the young men of America. The helicopter industry, and aviation in general, is helping to keep our country strong and we look forward to the help that boys like you can give when your time comes. The backbone of the aircraft industry is the engineer. We will always need good engineers with imagination and vision. You have that vision now. Please keep it. I'm sure that you can count on your mother's support when you are ready to take your place among the other young men who are playing a vital role in a vital industry.

Sincerely,

Charles H Kaman

**Facsimile of a letter to the company

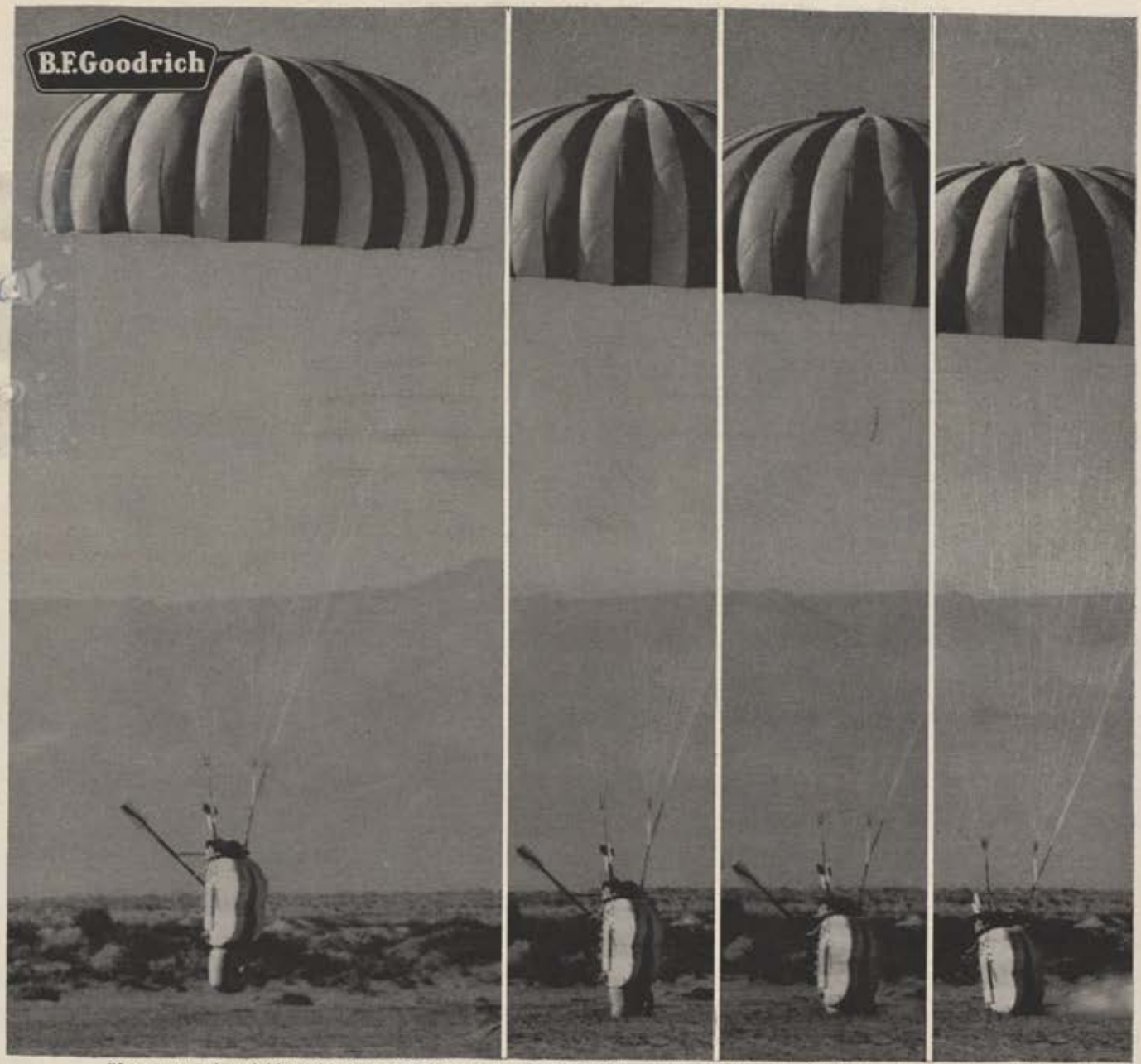

Photo sequence shows initial series of tests of B-70 escape capsule. In last photo note dust raised at right of capsule as air escapes through "blowout" valve.

Engineered "blowout" cushions landing

When this B-70 escape capsule hits the ground, the inflated rubber bag on the bottom absorbs initial impact—then the bag exhausts through a "blowout" valve just at the point of maximum compression to eliminate any bouncing "yo-yo" action. The bag must pack in minimum space, must inflate within 5 seconds.

B.F.Goodrich is equipped to engineer and build shock attenuator systems that meet demanding requirements like this. The systems are complete—comprising the flexible bag, valving and inflation device. Special BFG test facilities aid in engineering the right system to meet the specific requirements of load, approach speed, and tolerable G limits.

If you have a requirement for an engineered shock attenuator system check with *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Department AF-8, Akron, Ohio.*

Use B.F.Goodrich shock attenuator systems on <u>your</u> advanced projects.

- **Space vehicle payload landing**
- **Test missile recovery**
- **Helicopter power failure protection**
- **Capsule and cargo recovery**

B.F.Goodrich aviation products

SOLID STATE RADAR MODULATOR

One of a family of modulators designed, developed and produced by Temco for missile, aircraft and ground equipment installation, both military and commercial. Full use of solid state switching techniques provides high reliability, small size and less than 50 millimicroseconds pulse jitter.

Temco Electronics has designed and developed a family of spiral antennas which cover the frequency spectrum from 30 to 2000 mc. These antennas are contour shaped for flush mounting and can be supplied with a single or double curvature to match skin contours. The uniform response over a wide frequency band, both in impedance and radiation patterns, makes the spiral an extremely versatile element for either transmitting or receiving application.

SPIRAL ANTENNAS

DC TO DC POWER CONVERTER

Designed specifically for telemetry systems, Temco's DC to DC converter is based on a unique method of non-dissipative voltage regulation. This one small unit (3.5" x 5.9" x 2.2"—weight 3 pounds) provides a 250, 150 and 5 volt DC power supply. High efficiency . . 70% at full load . . is combined with extremely accurate voltage regulation.

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■ Temco Electronics is experienced in all phases of systems and component research, development, manufacture and marketing . . for both defense and for industry. But the ultimate judge of capabilities is performance. Temco Electronics has solid proof of performance in the products it has perfected. ■ Some of its notable achievements include the stabilization and control system for the Navy's Corvus air-to-surface missile . . XKDT-1 "Teal" rocket-powered target drone developed and produced for the U. S. Navy . . the READ system of radar echo augmentation for use in drones, missiles and aircraft to enlarge images . . Alpha, airborne transmitting and receiving system which permits simultaneous real-time viewing and video recording of visual TV information during flight . . sophisticated radar systems such as the video correlator . . and a broadband VHF distributed amplifier that fills the 500 to 925 mc gap. ■ Through this proof of performance, Temco Electronics is gaining increasing recognition as a leader in the electronics field. But its capabilities and responsibilities go well beyond "delivering the goods." From development to marketing, Temco stays vitally interested in reducing costs, improving design, speeding deliveries and assuring satisfactory performance after delivery. These Temco plus factors are widely known and appreciated throughout the industry. ■ Send for a copy of our new brochure "This Is Temco Electronics," the story of the coming leader in the electronics field.

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A Division of TEMCO AIRCRAFT CORPORATION • *P.O. Box 6191* • *Dallas 22, Texas*

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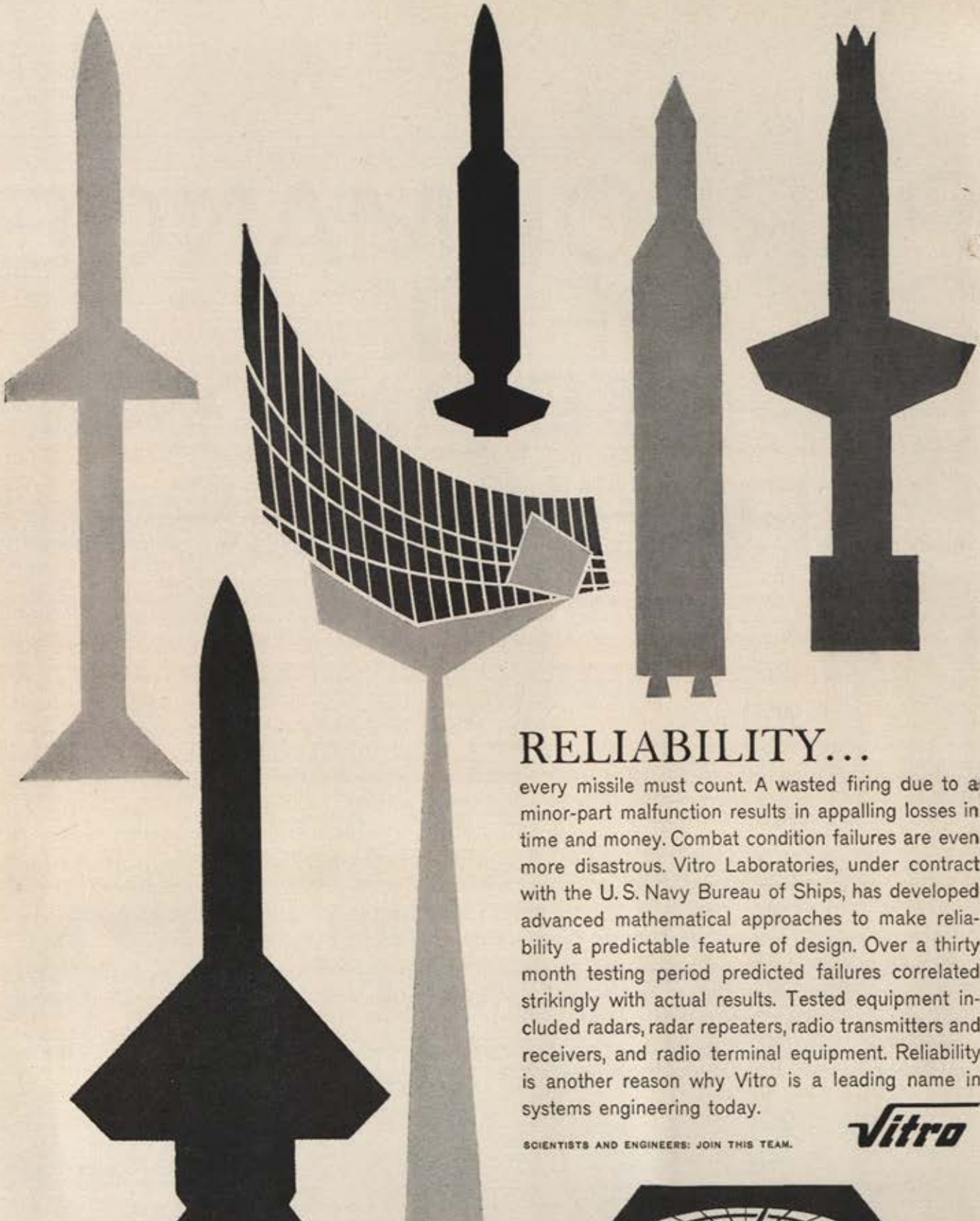

RELIABILITY...

every missile must count. A wasted firing due to a minor-part malfunction results in appalling losses in time and money. Combat condition failures are even more disastrous. Vitro Laboratories, under contract with the U. S. Navy Bureau of Ships, has developed advanced mathematical approaches to make reliability a predictable feature of design. Over a thirty month testing period predicted failures correlated strikingly with actual results. Tested equipment included radars, radar repeaters, radio transmitters and receivers, and radio terminal equipment. Reliability is another reason why Vitro is a leading name in systems engineering today.

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AIR FORCE

THE MAGAZINE OF AEROSPACE POWER

Volume 43, Number 8 • August 1960

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FEATURES

SPACE DIGEST

DEPARTMENTS

An Editorial

Who's Deterring Whom?

John F. Loosbrock, Editor

ANY advocate of the "just-enough" theory of deterrence must be examining his position these days.

For years knowledgeable military men, responsibile civilian commentators, and professional students of military affairs have been warning this nation of the inevitable erosion of its position in the world. Inevitable, that is, if the Communist bloc continues to build its military strength at fever pitch while the United States effort runs at half-throttle.

Now the premise should need no further buttressing. Russia has its rockets, and the evidence is clear that Khrushchev knows how to use them as a threat to gain his ends. This is indeed *deterrence in reverse*, and it becomes high time to ask the embarrassing question: "Who's deterring whom?"

While Western leaders have been telling each other —and Mr. K.—that war is so horrible that it cannot be allowed to occur, the Soviets have been capitalizing on this fear and timidity.

Imagine this headline in tomorrow's papers:

SOVIETS ATTACK US PLANES; 75 AMERICANS DIE

There would be no holding the American people. There would be such a surge of indignation from Hawaii to Maine that the problem would be one of soothing public opinion rather than arousing it.

But we have lost seventy-five American airmen—Air Force and Navy—to Soviet fire over the last ten years. The latest incident was the shooting down of an Air Force RB-47 over the Barents Sea with a loss of four men. When these deaths are spread over ten years, rather than compressed into a single afternoon, they don't stir up much excitement. But the men are just as dead.

Even more indicative of our declining relative power, perhaps, was the shocking incident in early July when Khrushchev rattled his rockets against possible American action in Cuba—an island only ninety miles off our own coast.

True, we have replied that the United States will not be deterred from its responsibilities by threats and that we will not permit any regime dominated by international communism to exist in the western hemisphere. But how we expect to accomplish this without running the risk of all-out war is not made clear.

One thing, however, is clear. The richest and what should be the strongest nation in the world has been openly threatened. It has been placed once more on the defensive—diplomatically and militarily.

The only way to put the brakes on our skidding prestige is to openly acknowledge that we must be prepared to deter: 1) a general war, and 2) Soviet aggressive diplomatic and military ventures short of general war. To accomplish these goals we have to be ready, able, and willing, if need be, to fight and win a general war. Otherwise we will accomplish neither end and will be deterred ourselves from positive counteraction to Soviet aggressive moves.

Fleet Adm. Chester Nimitz, still the Navy's highest ranking officer, put a finger on our national weakness. In a statement in the Los Angeles *Times*, he phrased it this way:

"What is now needed is for every citizen to face up to the grim prospect of war—and while hoping for peace, to be prepared to fight with full knowledge of what we seek to preserve by fighting.

"Far more important than our material readiness to fight is our moral and spiritual readiness. When fully prepared we should speak softly and carry a big stick.

"As horrible as war can be, there are some other things worse—and appeasement is one of them. Indifference to our mounting danger is another."

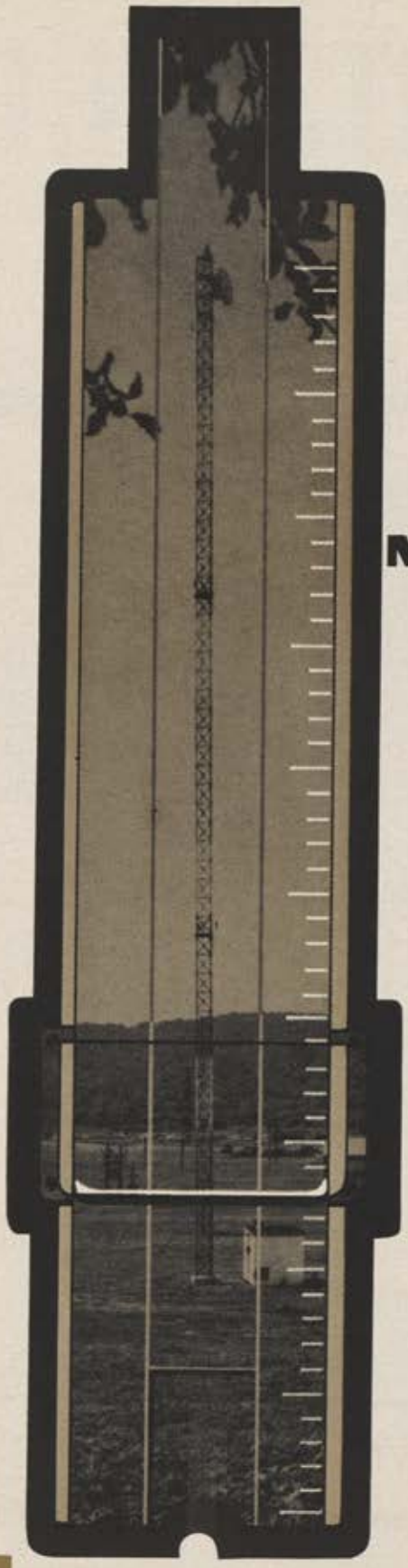
With all this we wholeheartedly agree. But one must round out the picture. It is asking a great deal of the individual citizens "to face up to the grim prospect of war" when his government does not. And it is difficult for a nation to face the same grim prospect when it lacks the means to fight and win. Yet we cannot achieve the means without acknowledging the "grim prospect."

This is where the proponents of bargain-basement deterrence err grievously. They fail to look beyond—to the day when deterrence might fail, or to the day, now upon us, when we ourselves are deterred from the actions needed to preserve our freedoms.

We are being deterred from any more vitally needed U-2 flights. Our allies are being deterred from granting US freedom of action in respect to overseas bases. We are being deterred, at least to outward appearances, from action against an upstart Soviet puppet on our very doorstep. Next we may be deterred from using our satellite detection and reconnaissance systems.

Deterrence has truly become a two-way street. But, in the last analysis, it is not Khrushchev's rockets, nor even his blustering about using them, that is deterring us. It is our own fear of war, and refusal to admit its possibility, which leads us to a refusal to achieve the means to fight one.

In this sense, it is fair to say we are deterring ourselves.—END



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BENDIX REPORTS ON ITS SUPPORT EXPERIENCE

Bendix mobile computer-tester cuts B-58 flight control system checkout time from 2 days to 90 minutes

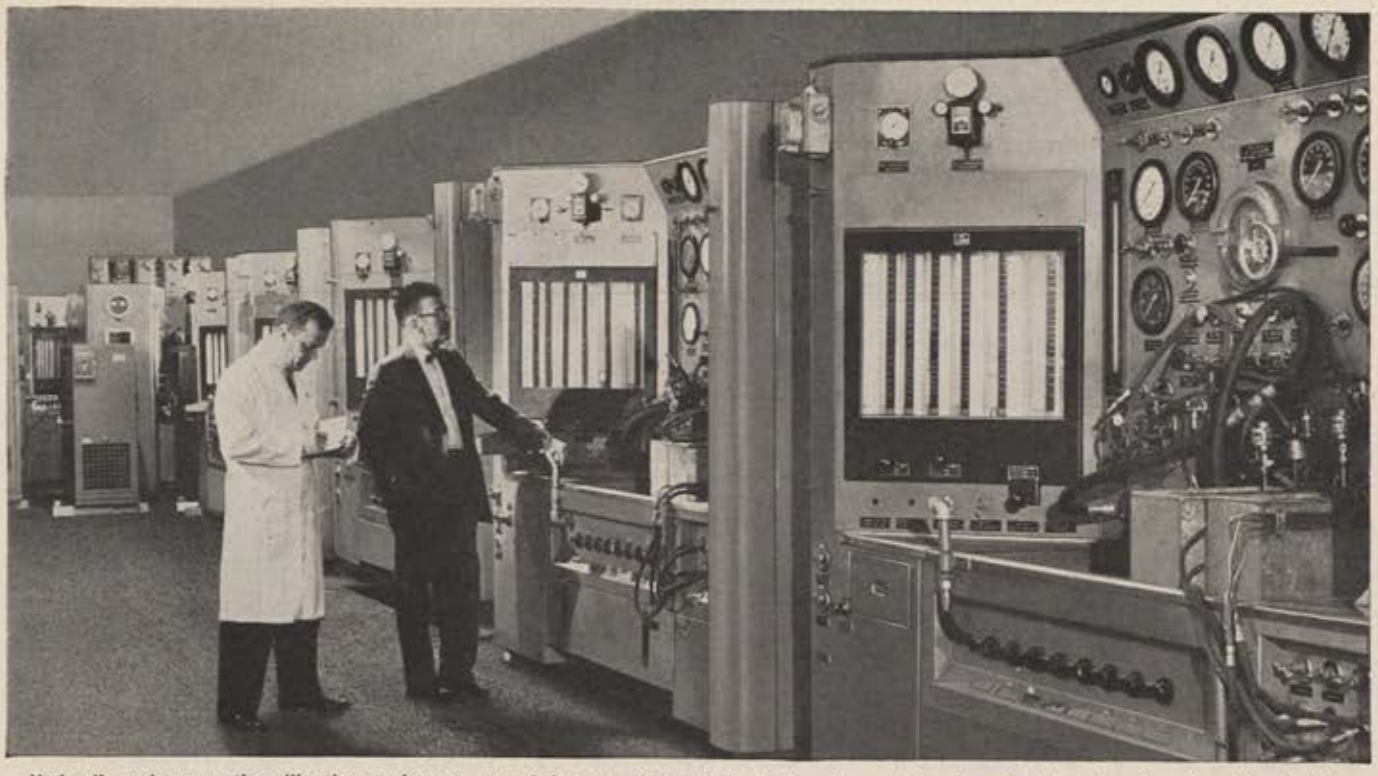
TETERBORO, N. J. — Helping to keep U. S. weapon systems mission-ready is this Bendix computer-on-wheels. It rolls right up to the flight line where, in 90 minutes, it runs through 750 static and dynamic tests on the flight control system as installed on the USAF Convair B-58. By comparison, the previous procedure required two days' work by three men just to make *spot* static tests. This automatic equipment, although designed for the B-58, can be modified to test any other weapon system.

TETERBORO AND SOUTH BEND

Whether your support equipment needs are commercial or military—airborne or ground—you can count on *proved* Bendix experience in systems engineering and analysis, controls, aircraft and missile systems, computer functions, and field service to supply quick, efficient answers.

Bendix Support Equipment-Teterboro—brings over 40 years' such experience to the creation of *electronic* and *electromechanical* support equipment. Specific operating fields include:

BENDIX



Hydraulic and pneumatic calibration equipment, one of the many fields of checkout and support equipment designed and produced by Bendix.

Bendix test stand checks and calibrates fuel control equipment for jet engines

SOUTH BEND, IND.—Bendix fuel control test stands reproduce operating conditions such as RPM, altitude, fuel flow, temperature and pressures required for critical testing and calibration of all propulsion control systems —both systems now in use and planned for the future.

The reliability, versatility and ease of operation inherent in the Bendix test equipment springs from a position of knowledge and experience which is unique in the industry. Since the beginning of the aircraft era, Bendix has actively engaged in the design, development and production of fuel control equipment for all major engine manufacturers. Bendix test stands are now in use at military, airline and commercial installations around the world.

SUPPORT CAPABILITIES EXTEND ACROSS THE BOARD

manual and automatic checkout equipment; adaption equipment; coordinated modules of both checkout and adaption as complete systems; training devices and simulators; and monitoring equipment.

Bendix Support Equipment-South Bend—draws on its 35 years' aviation and automotive experience to produce *hydraulic, pneumatic,* and *mechanical* support equipment. Its operating areas include: silo, above ground, and shipboard launchers; transporter systems and sub-system components; missile erection equipment; handling, hoisting, jacking, and lifting equipment; test equipment and complete test facilities; and hydraulic and pneumatic power generating and supply systems.

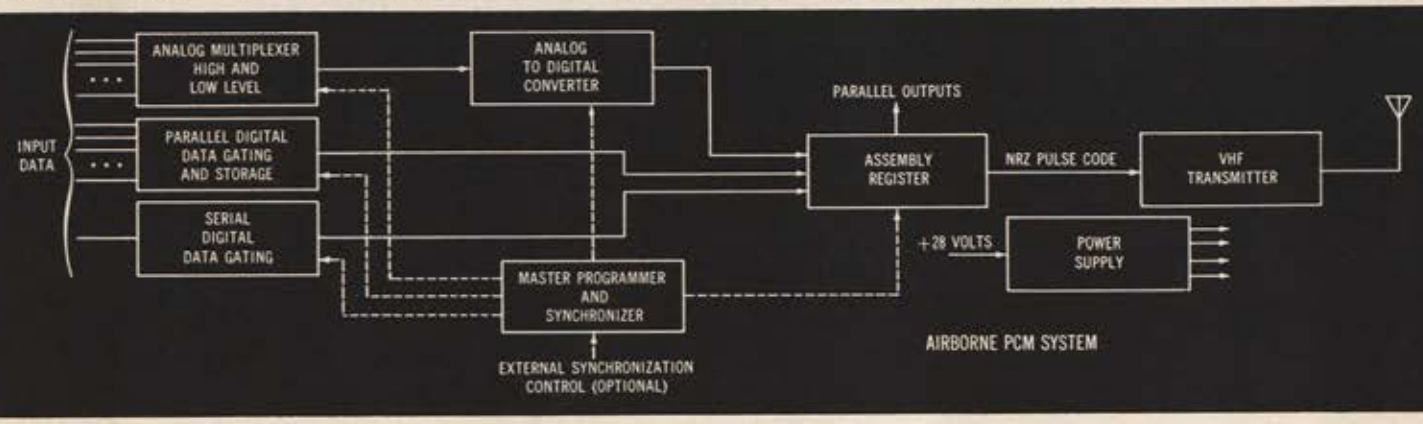
Find out today how this vast array of *proved* systems experience can help solve your specific support problems.

SUPPORT EQUIPMENT

THE Bendix CORPORATION

TETERBORO, N. J. **SOUTH BEND, IND.**

NEW FROM TEXAS INSTRUMENTS!



High capacity, ½ cu ft, PCM telemetry system ...with system drift nulled out!

Now you can get the benefits of digital techniques — accuracy, speed and reliability — in compact pulse code modulation telemetry systems from Texas Instruments. The 25-pound, ½ cubic foot package shown uses only solid state devices, and may be used to drive any of the compact TI transmitters dictated by the application. The system multiplexes and encodes 64 analog channels; and processes five 8-bit parallel digital data channels plus a serial digital data channel at a nominal bit rate of 200 kc.

A key feature of the system is its high-speed analog multiplexer which handles low- and high-level data, or a combination of both, with *only a single low-level amplifier*. Overall accuracy of the system is ±0.25% — made possible by a unique bi-directional servo loop that nulls out system drift. The system is packaged in individual modules so that it can be rapidly modified to fit the needs of other missiles or space vehicles.

PCM is only one of several advanced telemetry projects at Texas Instruments. Others include the development and/or production of analog systems and equipments for Bomarc, Corvus, Pershing, Minuteman, Titan, Centaur, and Project Mercury.

For detailed information about PCM telemetry or other TI missile electronic system capabilities, please contact SERVICE ENGINEERING:

TEXAS INSTRUMENTS
INCORPORATED
APPARATUS DIVISION
6000 LEMMON AVENUE
DALLAS 9, TEXAS

The Master Planner

Gentlemen: Since your article in the June issue, "Khrushchev's Blueprint for Conquest," was unsigned, I assume it came from the staff of the magazine. At any rate, I wish to protest the last paragraph of that article as unworthy of our Association. The implication is direct that any striving for a *modus vivendi* with all the people in the world is, on the one hand, painfully naive, and on the other hand, downright unpatriotic. If this implication be true, and I strongly deny it, then the centuries-long striving of civilized man to learn to get along has gone for naught.

In 1946 General of the Air Force "Hap" Arnold said in a personal letter: "Airpower now is power for an interim peace which we can sustain while the problem of controlling the forces tending toward war is being solved with the patient wisdom it requires. . . . It is my conviction that permanent peace can only be the result of effective international organization."

"Effective international organization" does not mean a fortress America, standing alone, any more than it means the international "togetherness" which you wrongfully imply is the goal of those who seek world order. The goal of law and order in any community is not to bring people together (we have social clubs for that) but to keep them apart—to define and enforce the rules by which they can live their own lives without infringing or being infringed upon.

Pursuing this goal does not in the slightest imply lowering our guard, our military posture, while the search is on. . . . It does mean that while maintaining our defenses we must state and work for the ultimate objective of force under the control of the community, by and for the community, rather than in the hands of the members of the community. The task will require endless patience, and the odds may well prove to be insuperable; but if mankind should fail to pass this test, let it at least be said that it was not due to American intransigence. . . .

When negotiation for right principles and ends becomes dishonorable, then is mankind doomed to go the way of the dinosaurs.

Col. Ronald C. McLaughlin
Minneapolis, Minn.

● *AFA is not parochial, narrow-minded, or war-mongering in any sense of the word. We have a deep and abiding interest in maintaining the peace and believe that purposeful talks between the two power blocs which split the world are necessary. Words in the last paragraph were deliberately placed in quotation marks to indicate that their meaning has been prostituted in international language. An effective international organization cannot be achieved if we blind ourselves to the nature and purposes of the Communist world. There was a tendency to misinterpret the rosy clouds over Camp David last fall and to feel that all was sweetness and light. Perhaps we should have said the "god of false international togetherness" instead of the "false god of international togetherness."*—THE EDITORS

Gentlemen: I read with interest the special report entitled "Khrushchev's Blueprint for Conquest."

One of the most dangerous illusions of our time is the assumption that a hot war between the USA and the USSR must inevitably mean the near annihilation of both nations, and with them much of the rest of the world.

Having made this initial assumption, some people reasonably conclude that only a madman would precipitate a hot war. From this position, it is only a short step to the conclusion that neither the USA nor the USSR is likely to start such a war. . . .

A kind of indifference is the attitude that results from this line of thought. This indifference manifests itself in an unwillingness to exert ourselves in preparation for conflict. If neither great power is going to start a hot war, then we need not worry about such an eventuality. Hence, we need not make preparation for it. . . .

From the assumption that a hot war is bound to be ruinous, other people, also reasonably, conclude that such a conflict must be avoided at any cost. Hence, whenever they feel that international tensions arise which threaten to precipitate war, our leaders should take whatever steps are necessary to reduce these tensions.

A kind of fearfulness is the attitude that results from this line of reasoning. This fearfulness manifests itself in a willingness to retreat when pressed, an eagerness to avoid all cause of conflict. If a hot war must be avoided, then someone must back down from each crisis. If the Soviet Union does not, we must.

The former attitude is likely to let us blunder into such a position that the Soviet Union can hope to start and win a war. The latter attitude is likely to keep us in constant retreat, so that the Soviet Union can ultimately win its objectives without war. Either attitude is likely to defeat us. For this reason, the illusion from which both attitudes spring is a dangerous one.

And it is an illusion. The fact is that a hot war need not encompass the mutual destruction of the combatants. The extent of destruction will depend upon the long-range striking power and the homeland defenses of each nation.

If a hot war between the world's two most powerful nations will not necessarily detroy both nations, then such a hot war is certainly possible. Anyone who believes that the Soviets do not reckon with this possibility should read "Khrushchev's Blueprint for Conquest."

I hope that America will not provoke such a conflict unnecessarily. On the other hand, I hope that we will not be the first to renounce that possibility. Since war is possible, we must maintain our offensive and defensive power, we must be ever vigilant, and we must be ready and willing to fight when necessary. Any other attitude is national suicide.

Donald V. Etz
Dayton, Ohio

Memorial in Stained Glass

Gentlemen: Your June cover was beautifully done. All of us at Head-

(Continued on following page)

quarters Strategic Air Command are grateful for your excellent coverage of our memorial project and the ceremonies on May 29, 1960.

We feel that the windows in the Strategic Air Command Memorial Chapel are magnificent. We were extremely pleased with the work done by the Wallis-Wiley Studio. However, one of the important elements in a memorial project is "telling the story." This you did for us in the best manner possible.

This project is very significant to the members of this Command, and I wish to express for General Power and the members of SAC our deep appreciation for your coverage, which was accomplished in most excellent taste.

Col. George S. Wilson
Command Chaplain
Hq. SAC
Offutt AFB, Neb.

Gentlemen: To see a painting by a leading artist would thrill me, but nothing could compare with the emotion I felt upon viewing the cover of the June AIR FORCE/SPACE DIGEST. Turning immediately to the table of contents, all the lonely days and nights as the wife of a combat crewman seemed but naught as I read "SAC's Combat Crewmen Memorialized in Stained Glass."

Am very sorry to say we missed making a cash contribution for this awe-inspiring memorial window, but my husband's contribution has not been small—from B-17 aircraft commander to the present B-47. . . .

Mrs. Chris Hime
Homestead AFB, Fla.

"Old Reliable"

Gentlemen: Just a line of congratulations for the fine story by William Leavitt on "Thor . . . DC-3 of Spacepower" in June.

The story received many compliments from Douglas personnel. . . .

Harry E. Calkins
Douglas Aircraft Company, Inc.
Santa Monica, Calif.

Report on MATS

Gentlemen: Among the tasks facing me in this new job, certainly one of the most pleasant is congratulating you and Claude Witze on "The Gap in Our Military Transport" in the May issue.

The article's penetrating analysis, typical of Witze's work, made for some interesting and enjoyable reading. Its appearance in a publication whose credibility has been so firmly established over the years adds further to its stature as a piece of solid reporting.

No doubt Senator Thurmond felt the same way when he inserted the article into the *Congressional Record* of May 26.

As you know, the past few years have been critical for MATS, and the support of AIR FORCE Magazine has been most welcome to the people of this command. . . .

Lt. Gen. Joe W. Kelly
Commander, MATS
Scott AFB, Ill.

Name of Author

Gentlemen: We were delighted to note the review of *Amelia Earhart* which appears on page 121 of your June issue. There is, however, one matter which I would like to call to your attention. The author, credited incorrectly as Martin Friedman, is actually Jerry Seibert.

Richard B. Gladstone
Houghton Mifflin Company
Boston, Mass.

Aerospace Education

Gentlemen: It is most gratifying to see the Air Force Association carrying the ball for aviation education in the public schools. The two articles "Teaching Space Age Science," by William I. Harber, and "Speaking of Space," by William Leavitt, in your June issue, are excellent for selling the program to educators. . . .

Two Aerospace Workshops were held in Texas last year. A total of eight have been scheduled for this summer.

Maj. Fred Coleman
Liaison Officer
Texas Wing, CAP
Grand Prairie, Tex.

Russia's Dyna-Soar Threat

Gentlemen: In your feature "What's New With Red Airpower," June 1960 issue, the first article discusses a Russian Dyna-Soar program. . . .

I have believed for a number of years that the Russian Dyna-Soar program poses a very serious threat to the free world, particularly if used during "peacetime" as a weapon of propaganda, blackmail, and coercion. So far this is not an officially recognized threat, thus nothing is being done about it by the Department of Defense or any of the military services.

I personally feel if the Russians have made a success of this venture, the system they employ will be global, not of 12,000-mile range. Because of the nature of the flight profile, altitude, speed, and other factors, even if this country had an operational anti-ICBM system in being, it is unlikely that it would be effective against the Dyna-Soar. Regardless of the nature of the defense problem associated with this system, if this country is to avoid another Sputnik I situation, the actual degree and nature of this threat must be determined and treated with the respect it deserves. We need to be prepared for this system in many ways besides achieving the capability to shoot it down. The latter may be extremely difficult to accomplish in the time remaining.

There is a good possibility that their Dyna-Soar program has progressed to the point where operational status may be achieved in the very near future. Russia claims that their latest satellite weighed four and one half tons and carried an instrumented dummy human. Although my impression is that this might have been a boost-glide system, it is the uncertainty itself which raises the significant point. We need to know and to my knowledge do not. . . .

William C. Walter
Palos Verdes Estates, Calif.

Poetry Corner

Gentlemen: General White is quoted as giving equal weight to national determination to use military force as he does to possession of same. Yet I am unaware of any effort to persuade Americans that some fates are worse than death, and that resistance to the last squeak against domination by Red masters is a matter of simple good sense.

Some possessive mothers (who represent State-ism, in a way) might not agree, but I should be glad to hear kids playing skip-rope to this chant:

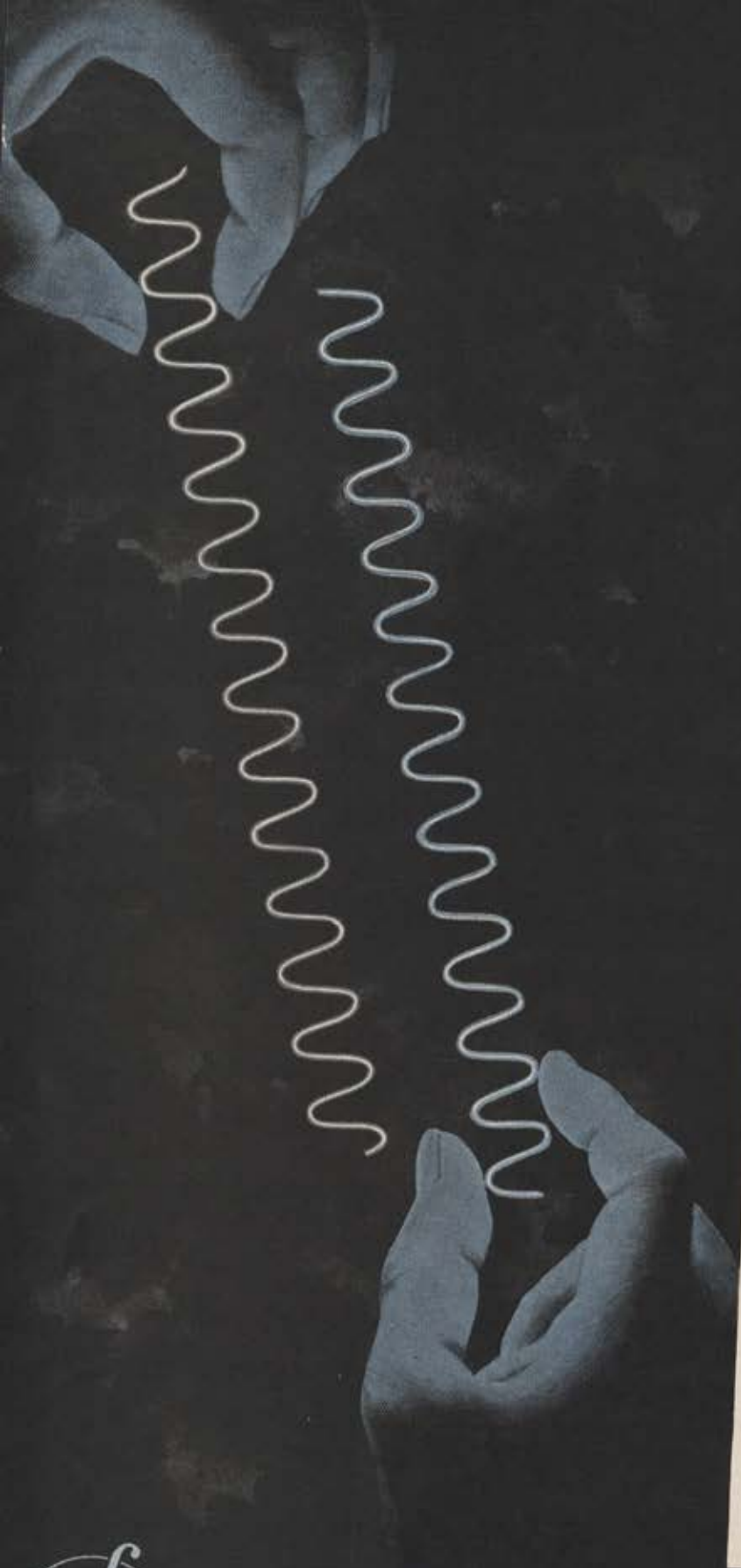
1. Animal trainer,
   Crack your whip.
   Make me crawl
   Whenever you yip.

2. If you can, that is,
   For I won't stand still;
   If I don't get you
   The next purge will.

3. Better be dead than be Red.
   Better be dead than be Red.

I see little more future for fellow-travelers than for their targets. I don't savvy how the malarkey can be sold to any US citizens. But counter-effort seems needed.

H. B. Rorke
Chicago, Ill.



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is experienced
. . . in Microwave
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Precision is a matter of degree. The hand is suitable for many types of measurement, whereas the measurement of Microwave frequencies requires the development of a new realm of precision.

LFE has created means of stabilizing microwave oscillators to one part in 10 billion! Concurrently, the problem of measurement of this degree of stability has required the development of equipment that can measure to one part in 100 billion!

This is an illustration of LFE's interest in Microwave Instrumentation. Such devices are now in production for use in military and industrial equipment.

Further details about LFE Microwave Instrumentation may be had by writing the Vice President of Marketing. Ask for Technical Data Digest No. 6053.

L/E

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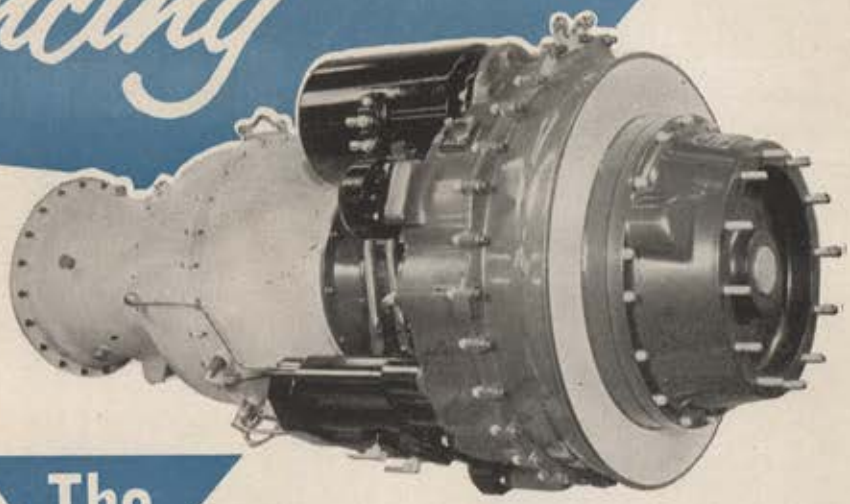

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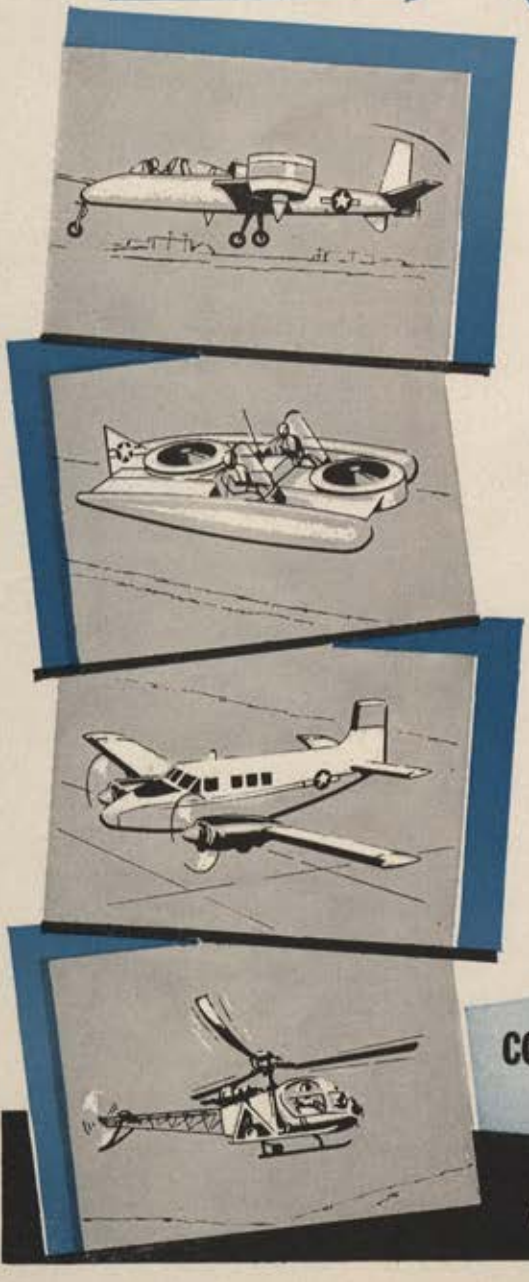

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What's New With ★ RED AIRPOWER

Here's a summary of the latest available information on Soviet air intelligence. Because of the nature of this material, we are not able to disclose our sources, nor document the information beyond assurance that the sources are trustworthy.

The Russians now have a twin-engine turboprop that resembles Fairchild's F-27, itself a European import. A monoplane, it seats thirty-two with plenty of room to spare for freight. Each engine develops 2,000 equivalent shaft horsepower. Designation of the airplane is AN-24. The designer is Oleg Antonov.

• • •

Semyon Lavochkin, well known Russian aircraft designer mentioned in this column last month, has died in Moscow.

Lavochkin rose to prominence in World War II. The Stalinist purges of the 1930s left Russia with a grave shortage in this area when war came. Even Tupolev was imprisoned for a while. With many of his elders dead or out of circulation, the way was open to Lavochkin.

Lack of metals forced Lavochkin to turn to wood and fabric in designing some of his wartime aircraft. His LA-5 became known as the "Little Wooden Saviour of Stalingrad" for its contribution during that epic battle.

Lavochkin was believed to have worked closely with many of the German designers sent to Russia after World War II. Recently he was associated with aerodynamic research related to missiles.

• • •

Following an accident with their VEB-152 (formerly BB-152) jet transport, the East Germans have come up with a slightly modified and improved version of the airplane. They hope to introduce it soon on east European —and perhaps some west European—routes. Powered by four jet engines mounted in a pair of pods near the mid-point of the sweptback wing, the VEB-152 will carry fifty-eight passengers in its standard configuration.

In a tourist-style seating arrangement, it can carry seventy-three. Cruising speed is about 500 mph at 30,000 to 35,000 feet. Maximum range, absolute, is 1,864 miles. Maximum weight is 112,400 pounds. Each engine develops 7,200 pounds of thrust.

• • •

In the wake of the U-2 incident, Moscow revealed that the top commander of its missile forces is a fifty-six-year-old artillery officer, Marshal Mitrofan Ivanovich Nedelin. He apparently has replaced N. D. Yakovlev, long thought to be commander of Russia's missile forces.

Marshal Nedelin is a graduate of the topflight Dzerzhinsky Artillery Academy in Moscow and was artillery adviser to the Loyalists during the Spanish Civil War.

Among Marshal Nedelin's World War II achievements was command of artillery on the Third Ukrainian Front.

Politically, Marshal Nedelin is very safe. He is a candidate member of the Central Committee of the Communist Party of the Soviet Union. This places him among the select elite who run the country.

• • •

Another U-2 postscript. Remember how Khrushchev stressed the allegation that the plane would have exploded if pilot Francis Powers had used his ejection device? This could have been aimed directly at Russian pilots, who must feel acutely the shortage of ejection seats and other safety devices in their own planes. This is especially true in Soviet high-altitude, high-speed flying. There is almost no mention in Soviet literature of escape capsules or special ejection seats. If a Russian pilot must jump, he is expected to do it at low altitude and at a reasonable speed. If that isn't possible, it is just too bad.

This lack of concern for pilot and crew doesn't extend to airborne troops, who get two parachutes to use during a jump. So that they may drop swiftly, the first parachute is smaller and allows the typical trooper to drop at eighty-two feet a second. However, when the trooper gets down to about 3,000 feet he opens a second parachute that reduces his descent to 16.5 feet per second.

Khrushchev, in accenting the supposedly explosive U-2 seat, might well have been saying to his own pilots: "So you think the Americans greatly value each flyer's life? Well, at least we don't intentionally blow you up."

• • •

Little attention has been paid in the West to a Khrushchev proposal to reorganize the Soviet Army along territorial lines. The proposal was made in conjunction with Khrushchev's announcement before the Supreme Soviet of a troop cut and new emphasis on strategic weapons.

Soviet army divisions would be revamped under the proposed territorial system. They would consist of about 13,000 men, only 2,400 of whom would be hard-core professionals. The other 10,600 in a division would be local young men, age nineteen to forty, who would put in two years of preinduction training and five years of actual service before entering the reserves.

The net effect would be further to decentralize the Red Army and reduce the number of career people in uniform.

There has been no indication that this proposal is being implemented. It surely would not find many enthusiastic adherents among Red Army men.

• • •

To handle growing international jet traffic in and out of Moscow, including Boeing 707s flown by foreign airlines, the Russians have opened another airfield there. It has longer, wider runways than long-established Vnukovo Airport. Sheremet'yevo Airfield, a one-time military installation, will handle international traffic only.

The new commercial field is located northwest of Moscow, not far from the main highway between Moscow and Leningrad. Vnukovo, west southwest of Moscow, will be restricted to domestic traffic.

The Soviets say they will supply regular air service, by helicopter or IL-14s, between the two airports.

• • •

You won't find any suggestion boxes for money-saving ideas in Soviet factories. But workers who come up with good ideas are rewarded nonetheless. If a Soviet inventor develops a new labor-saving device, he receives a special reward based on an official estimate of how much money it will save the country over a year's time. He is given about two percent of the amount.

For a simpler innovation, the worker receives about one percent of the annual saving.—END

CAPABILITIES FOR DEFENSE

Solar Corona

Electrifying

If satellites and space vehicles stop "working", they are simply high cost space debris. Reliable power supplies are mandatory.

To meet this requirement, extensive Westinghouse research and development efforts are being applied to perfect reliable, compact, lightweight systems that will convert solar and nuclear energy into unfailing, long-life sources of electric power.

Westinghouse is investigating many new electrical power systems, but primary efforts are directed in six important areas. These are: 1. Thermoelectric; 2. Thermionic; 3. High-efficiency solar cells; 4. Photoemission; 5. Magnetohydrodynamic; 6. Rotating magnetic generation. This work is being performed by the Aircraft Equipment Department, Lima, Ohio, supported by the Central Research Laboratories and the Astronuclear Laboratories, Pittsburgh.

Space power requirements—in not too many years—will be measured not in watts or kilowatts, but in megawatts. This need presents formidable technical problems.

We are making progress toward their solution.

Westinghouse

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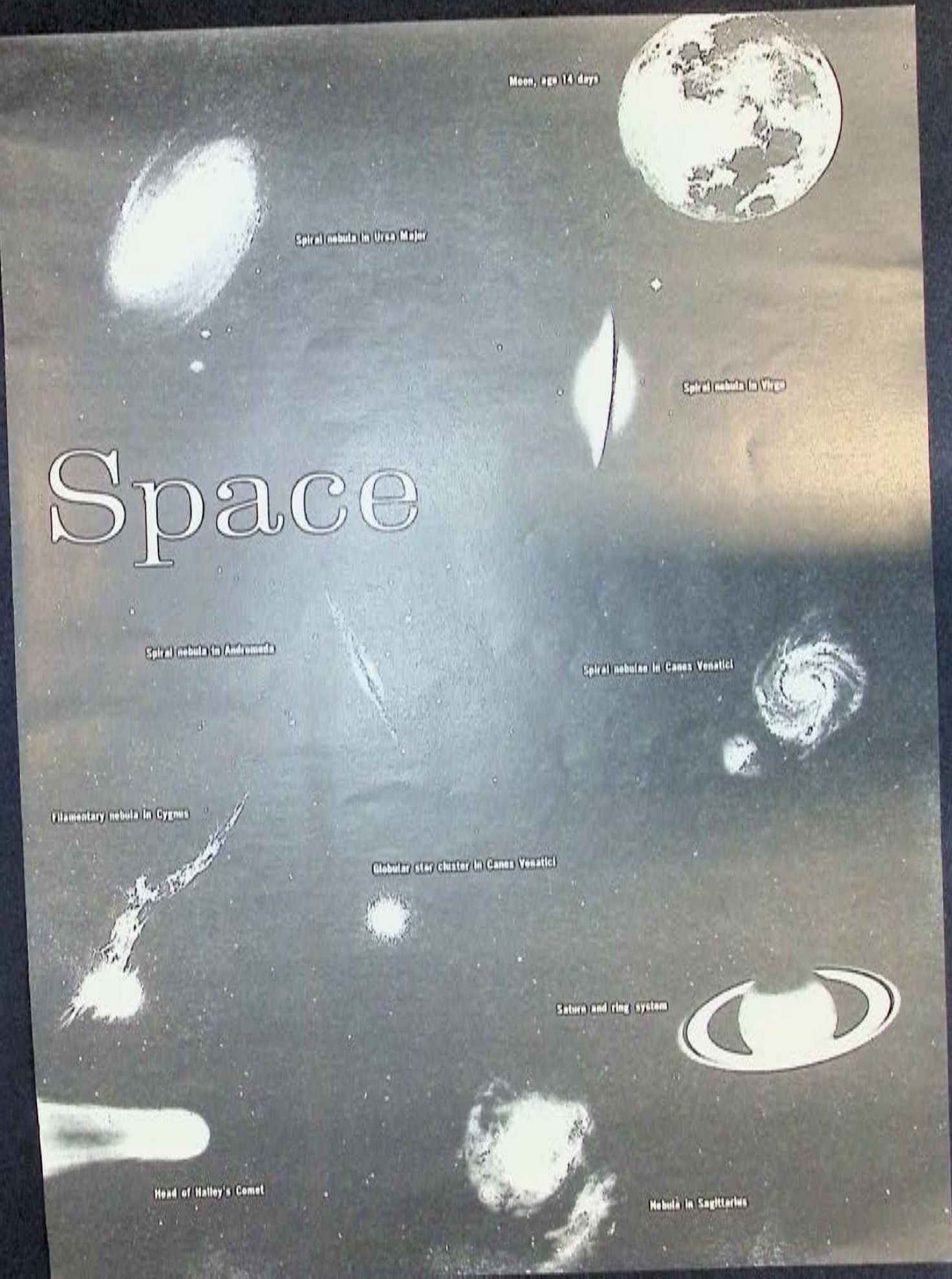
Moon, age 14 days
Spiral nebula in Ursa Major
Spiral nebula in Virgo
Space
Spiral nebula in Andromeda
Spiral nebulae in Canes Venatici
Filamentary nebula in Cygnus
Globular star cluster in Canes Venatici
Saturn and ring system
Head of Halley's Comet
Nebula in Sagittarius

AIRPOWER in the news

Claude Witze
SENIOR EDITOR

The Pulse of the Nation

WASHINGTON, D. C.

At this writing we are between conventions, and the capital is not a lively city. Everybody is reading the papers and waiting for Congress to come back to an extraordinary session, where it now appears the two presidential nominees will face each other in the Senate. There is a good deal of talk about Congress setting off on a spending binge of some kind. It is Jack Kennedy, the presidential nominee, who will be the real leader of his party, and some people, such as the editors of the *Wall Street Journal*, view the young man with alarm. The Democratic platform, says that paper, is "extremely radical," and his Administration, if it gets in, will be "extremely liberal." A few days earlier that paper in effect accused Mr. Kennedy of living in 1935 instead of 1960 because he told a TV audience he would favor higher taxes if necessary to secure the nation's defense. He also said he thought Congress this month should add from $2.5 to $3 billion to the fiscal 1961 defense budget.

Well, the "radical" platform says our military capacity should be shaken up at least in part because our power has declined. This is not a partisan charge, the platform says, but one that is supported by Republican witnesses. The platform calls for maintenance of our deterrent power, balanced conventional forces, and a research and development program to support this stature. Further, it calls for reexamination of the organization of our armed forces with a view to reforming the structure in the light of what has happened in the area of weapons technology. The party promises to reorganize the space program.

There are some stern critics of the Eisenhower defense policies who will lament this platform as not nearly radical enough, and they may be right. Certainly it does not carry the sense of urgency recommended by Walter Lippmann, for example, who says the invulnerability of our military arm should have top priority among public needs. It does not have top priority now, and not even the "radical" Democratic platform promises to give defense that priority. The reason, pointed out in these columns many months ago, is the reluctance of the politician to make defense a national political issue. Certainly the Democratic platform does not reflect the concern of Mr. Lippmann to the degree that Lippmann feels it should. And there are signs that the public shares his concern. One of the pollsters says that the pulse he is feeling shows three out of four Americans are willing to pay for what we need. If Mr. Kennedy raises the question at this month's belated session of Congress the subject of defense may be hurled into the campaign that will follow, but it is hard to believe this can happen without more help from Moscow and its minions.

There has been no presidential election outside of the war years when the mood of the electorate might be more easily deflected by events off the domestic scene. It may be that in Los Angeles the issues of civil rights, urban development and rural prosperity, the growth of the economy, and the national debt look close to home. It also is true that the newspaper editors had a big problem right in the middle of the Democratic imbroglio. They were not sure the news being made by the party was more important than the news being made in Russia, the Congo, the United Nations, and Havana. One day the esteemed New York *Times* led the paper with our denial that an RB-47 was over Russia when the Russians shot it down. With it was the report that Cuba now is a protectorate of the Kremlin, according to Mr. Khrushchev. In secondary place was the convention, where Lyndon Johnson had discovered he couldn't stop Kennedy. The Democratic platform news that morning rated a poor sixth place on page one.

All these things lead to a sensible speculation that the politicians don't know as much as they pretend to know about the mass they address as Fellow Americans. One proof of this was right in Los Angeles, where the Old Guard (yes, the Democrats have one, too) arrived with its cigars and pot bellies and pontifications about how nothing can replace experience. Jack Kennedy, the rash and rich Democrat from Massachusetts, taught 'em different. We have seen a good deal of Mr. Kennedy in this town, and if he becomes President the Old Guard will learn some more: that he will use the power of his office to continue the revolution he started when he set out to capture the White House about four years ago. The most important American to be hit by this steamroller probably was Harry Truman. The next man in the way is Richard Nixon, a Republican with proven agility and the tremendous advantage of the Eisenhower aura. Yet if the pollsters are right—that the major concern of the American people is foreign affairs and they are willing to pay for what is needed in the defense area—it is hard to see how the Republican party leaders can meet the challenge of Kennedy by staying on the track they built eight years ago.

Going to press on the eve of the Republican convention, we are at a serious disadvantage in speculating on the platform you can expect from Chicago, However, it is no secret in Washington that Mr. Nixon, who has to campaign on the Administration's record, is making a deliberate effort to keep himself from being painted in anything like the Eisenhower image. One day soon, somebody will recall that in the hectic days after Sputnik went up in space it was the Vice President alone of the top men in the Administration who saw it as symbolic of a crisis for America, not a silly game of basketball, a bauble in the sky.

The necessary conclusion is that at least some of the changes so vital to our existence and that of the free world are bound to come. In 1960 we may catch up, at least a little bit, with the pace set by technology across the world.

Mr. Douglas & the Scrap-Metal Drive

Senator Paul H. Douglas, a Democrat from Illinois, is a learned man, a Doctor of Philosophy, an author, a

(Continued on page 20)

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former economics professor, and a war hero. But he doesn't know a piece of scrap metal when he sees it. One balmy day in June he showed the Senate a piece of scrap aluminum and announced that it was an ersatz gauge block. He claimed that it cost the Air Force $10, citing this as an example of reckless purchasing and waste of the taxpayer's dollar.

Where Mr. Douglas, who has been described as an economist of renown and an authority on military waste, got this piece of scrap metal was not made clear. He did use it effectively to get some headlines in the nation's press despite the fact that it was not a gauge block and did not cost the Air Force $10. It is true that the Air Force had three *real* aluminum gauge blocks. They were part of $495 worth of special tooling bought under terms of a subcontract with Miller Research Laboratories of Baltimore. They were for use in the preliminary alignment of the shoe and frame of a rocket sled. It was unusual but necessary that they be made of aluminum instead of steel to prevent scoring of the shoe finish.

In his Senate presentation Mr. Douglas made a major point of the fact that the piece of scrap metal he had on exhibit did not have any of the highly accurate attributes of a gauge block, and nobody, not even the Air Force, has disputed him on this. What has friends of the Air Force upset is that a man of Mr. Douglas' stature, offering this misrepresentation on the floor of the Senate, finds so little skepticism in his audience.

There were other equally fatuous examples of "waste" cited by the Senator, who took a few items from surplus materials and shopped around in the local hardware stores looking for similar items. Typical of this was a set of wrenches, an acquisition that the Army has not purchased since World War II. The catalogue list price of this kit in 1957 was $29, and that figure was used for the value, although there are no records to show the actual investment. Senator Douglas found an entirely different and inferior set of wrenches in an auto-supply store for $3.89. He would have known they were different and inferior if he had looked at them, but he did not. Instead, he waved an advertisement at the Senate and set in the record a scathing denunciation of negotiated contracts, concluding that they must be extravagant because hardware stores sell cheap wrenches.

It stands to the credit of the Department of Defense that in addition to its housekeeping it has time to reply to Mr. Douglas, point by point, and prove he is wrong. Speaking of waste, the manpower spent by procurement officials of the Army, Navy, and Air Force digging back in old records to refute this kind of nonsense is staggering. It would pay for three good gauge blocks at more than $10 apiece and buy a lot of wrench sets at $29, minus the government discount which runs from thirty-two to thirty-eight percent. Most economics professors have found a way to make this sort of arithmetic clear, at least to their advanced students. The beginners learn more fundamental lessons, including the idea that you don't start to add, subtract, multiply, or divide until you are sure you have the right figures.

Alas, the Poor Blacksmith

It is no secret that both the harness-makers and the blacksmiths suffered from the advent of the railroad train and the automobile. In much the same fashion the railroads and steamships, in turn, are losing some of their traffic to the airplane. They are not losing it gracefully. The Department of Defense, at long last, has decreed that routine personnel transfers to overseas points no longer will be contracted to commercial steamship lines. The Department will move these men and their families on its own vessels or by air. The reason: economy. In fiscal 1960, which just ended, about 25,000 persons were sent overseas on commercial ships. For fiscal 1961, which just started, the Army, Navy, and Air Force have sharply reduced travel budgets, and they can't afford to continue providing this kind of luxury. There has been no over-all estimate of how much money the taxpayers will save under the new decree, but Perkins McGuire, an Assistant Secretary of Defense, says the cut in expenses will be significant. He has cited the example of a $300 steamship ticket to Hawaii that will be replaced by a contract seat on an airplane at $65.

Another factor, pointed out in this magazine many months ago, is that the armed forces can't afford to keep a man in the pipeline for two weeks if it can move him in two days. Mr. McGuire has pointed out to a House committee that before 1950, when our military jobs were confined mainly to the Caribbean, Hawaii, and the Philippines, we made little use of commercial steamships. Military personnel moved to those areas in military ships. A lot has happened in the ten years just past, while the steamship lines were enjoying this growing cut of the Pentagon transportation melon. There are a lot more airplanes available, and the price of air transportation has gone down.

The reaction of the steamship lines and their maritime workers to this development is more violent than the protestations of the harness-makers and blacksmiths against the inroads of Mr. Ford's gasoline buggy. A couple of union leaders said the "Merchant Marine has been torpedoed by the Department of Defense." In an attack reminiscent of recent assaults on the Military Air Transport Service they accused the Pentagon of "forever encroaching upon private industry" and dominating the steamship companies. Spokesmen for the operators predicted that commercial passenger service to Hawaii may be put out of business. This in turn, they said, may make it impossible for the steamship lines to replace old vessels and keep the merchant fleet ready for troop transport, in case we fight World War II all over again. A New York congressman accuses the Defense Department of undermining US shipping to cover up its own wastefulness. On their side, of course, are the Department of Commerce and the Maritime Administration.

On another front the nation's railroads and Brotherhood of Railway Clerks are making progress in an effort to slow down the mail. For seven years the Post Office has been shipping some first-class mail, which means letters with four-cent stamps, on the airlines when space is available. On this basis it is cheaper than rail transport and, of course, much quicker. It is possible that a contributing factor is the removal from service, since 1953, of more than 1,700 mail-carrying passenger trains.

Well, the antiairlift lobby has been working hard, and the House of Representatives has passed a bill to end all this foolishness. First-class mail must go by rail, the proposed law says, and when Congress reconvenes this month the Senate will be asked to concur in this nineteenth-century opinion. As usual, economics will be a factor, and it will be pointed out that some 5,000,000 letters go by air on a space-available basis every day. This diverts $3.4 million annually from the railroads. That is one percent of what they collect from the Post Office. The blacksmiths had it tough, too.

(Continued on page 23)

There've been some

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Oh, How We Laughed

Last month's serious report in this magazine on USAF's Ballistic Missile Early Warning System (BMEWS) overlooked, by necessity, some of the project's interesting sidelights. One of these is the public relations problem raised in Great Britain. You will recall that the third BMEWS site, now in the planning stage, is at Fylingdales Moor, in Yorkshire, which is not the spooky scene of a story by Conan Doyle. It is a park area on the northeast seacoast of England.

One of our friends who went to the British Isles while we were in Thule reports that the proposal to install tracking radars—not the big stationary detecting antennas located in Greenland and Alaska—has brought hoots of derision and screams of anguish from the more misinformed of our compatriots. It is the British Air Ministry that is receiving the complaints. They come from such interests as:

- The Council for the Preservation of Rural England, which fears that favorite hiking paths will be obliterated and the three radomes, housing tracking antennas, may not be the right color, or "colour." It has been decided they will be duck-egg blue, to match the sky and not brown to match the moor.
- The Ancient Monuments Section of the Ministry of Works, which is on the job to protect any Roman roadways that may be uncovered or marred in the construction of the site. An ancient burial ground is located at the spot.
- The Standing Committee on National Parks questions the choice of Fylingdales Moor as an arbitrary decision that menaces the park program. For the duration of World War II and several years thereafter the spot was used as an artillery impact zone and the committee frowns on any more military occupation.
- The Beekeepers Association, which fears bees will be cooked by radar beams or their nectar spiked by electronics.
- The Special Government Committee on Health Hazards, which has heard that Eskimos have been warned to stay fifteen miles away from the Thule site.
- The Committee on Broadcasting and Communications, which is worried about what will happen to its channels in the ether.

There are other interests, like the nuclear disarmament groups that like to picket such installations, and the anti-Americans. The latter have warned that the three radomes are symbolic: "England in pawn to the universal Uncle."

A review of what has appeared in the press discloses little to properly inform the British public about BMEWS, its purpose and its essentiality to our survival. Then there was the unfortunate announcement in the House of Commons that the site would give information to NATO and provide the English themselves "four minutes warning." This at a cost to Great Britain of $22.4 million and to the US of $98 million.

The four-minute warning, which will be fifteen minutes for the free world's retaliatory forces and England itself, is worse than inaccurate. It has given the witty London columnists a field day to suggest it is time enough to boil an egg or run a mile if your name is Roger Bannister.

Back of all this, it has been pointed out, lies a highly inexpert presentation of the facts about BMEWS. If the British knew the right facts, perhaps fewer of them would show a lack of traditional British good sense on the subject of BMEWS—absolutely indispensable to all of us.—END

Advance Registrations Close

AFA's 1960 CONVENTION

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Secretary of the Air Force

Gen. Thomas D. White

Chief of Staff, United States Air Force

Lt. Gen. William F. McKee

Vice Commander, Air Materiel Command

Gen. Frank F. Everest

Commander, Tactical Air Command

Gen. Laurence S. Kuter

Commander in Chief, North American Air Defense Command

Gen. Thomas S. Power

Commander in Chief, Strategic Air Command

Lt. Gen. Joseph H. Atkinson

Commander, Air Defense Command

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August 15 for . . .

AEROSPACE PANORAMA

San Francisco • September 21-22-23-24-25

THE PROGRAM

• WEDNESDAY, SEPTEMBER 21:

2:00 PM AFA Directors' Meeting
7:30 PM AFA Leaders' Meeting

• THURSDAY, SEPTEMBER 22:

9:00 AM Hq. USAF Briefing
9:00 AM Reserve Forces Seminar
11:00 AM SAC Briefing
12:30 PM Aerospace Luncheon
3:00 PM MATS Briefing
3:00 PM 1st AFA Business Session
5:00 PM NORAD Briefing
7:00 PM Panorama Preview Reception

• FRIDAY, SEPTEMBER 23:

9:00 AM 2d AFA Business Session
9:00 AM Industry Seminar
12:00 N Industry Buffet Luncheon
12:00 N Panorama Open
2:00 PM ARDC Briefing
3:00 PM 3d AFA Business Session
4:00 PM TAC Briefing
7:45 PM Awards Banquet

• SATURDAY, SEPTEMBER 24:

9:00 AM Annual Symposium
12:00 N Panorama Open
9:30 PM Air Force Reunion Party and Ball

• SUNDAY, SEPTEMBER 25:

12:00 N Panorama Open to Public

IF YOU have not already registered in advance for AFA's 1960 Convention in San Francisco, you can use the convenient Advance Registration tear-out form below.

Program highlights will include a briefing by top representatives from Headquarters USAF and additional Command briefings by Strategic Air Command, Military Air Transport Service, North American Air Defense Command, Air Research and Development Command, and Tactical Air Command. Generals Power, Kelly, Kuter, Schriever, and Everest will conduct briefings for their respective Commands. Generals Hall, Atkinson, Kelly, and Everest will be featured at the Reserve Forces Seminar.

The full schedules of past AFA Conventions have not always offered enough free time for delegates to see all sights of the city in which the Convention was being held. The 1960 Convention will give everyone a chance to attend all of the Convention events, the Panorama displays, and see all of the beautiful sights.

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8-60

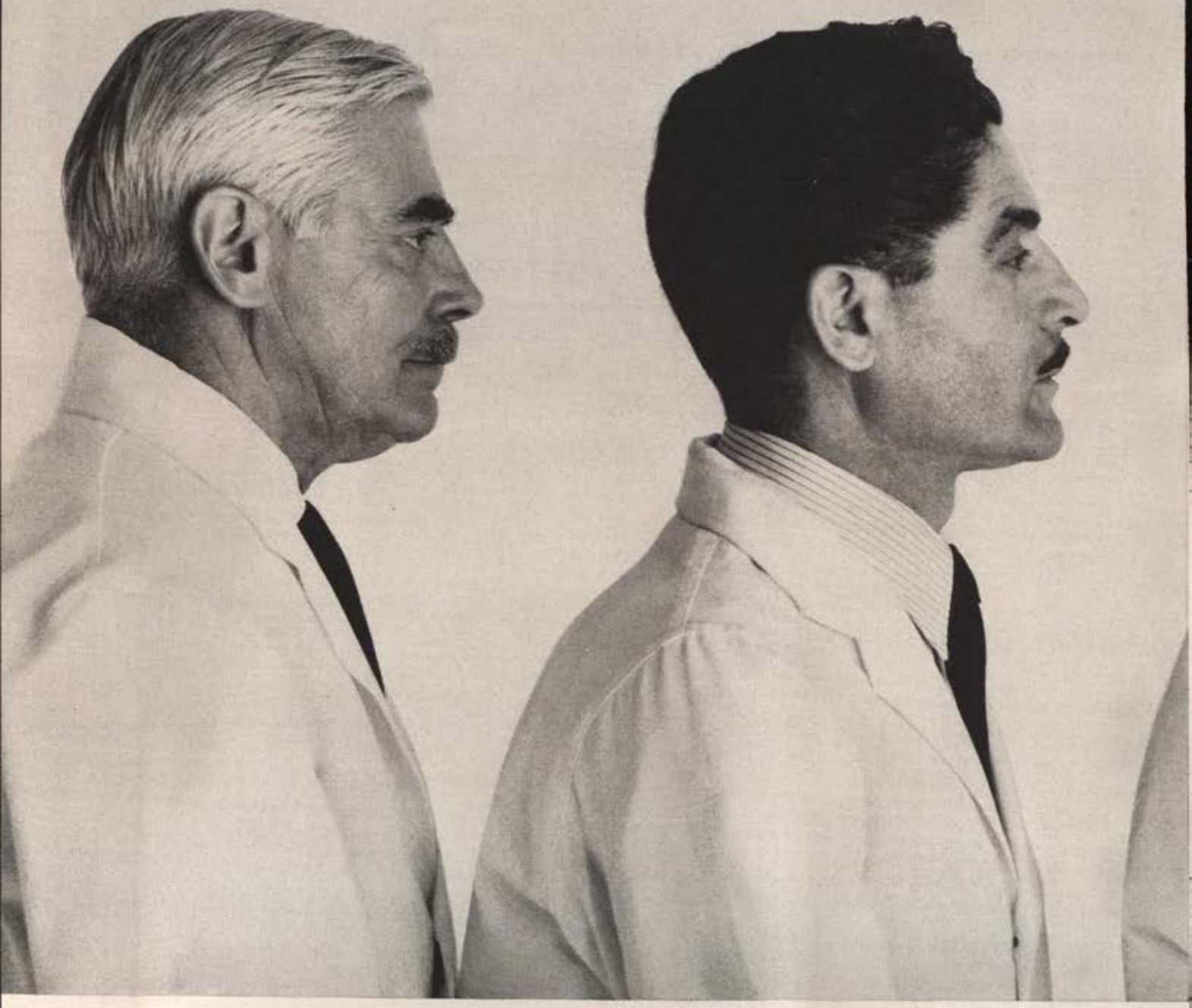
SEE PAGE 123 FOR HOTEL INFORMATION

"Mein Herr, jawohl, durch...

$$\psi(x) = \frac{1}{\sigma(2\pi)^{1/2}} \exp\left(-\frac{1}{2}\ \frac{x^2}{\sigma^2}\right)\ldots"$$

"El próximo año

$$P = \frac{A}{A\text{-}B} E_{N,A} - \frac{B}{A\text{-}B} E_{N,B} \ldots"$$



7200 idea-exchangers in

Each of ITT's 101 plants and laboratories (a total of 136,000 employes) is, by the nature of ITT's farflung organization, a meeting place for the scientific minds of the world. Ideas pour in, rub shoulders, take off, result in: a fully automated post office in Providence, R. I. ... a multiplier tube that detected water vapor on Venus ... a

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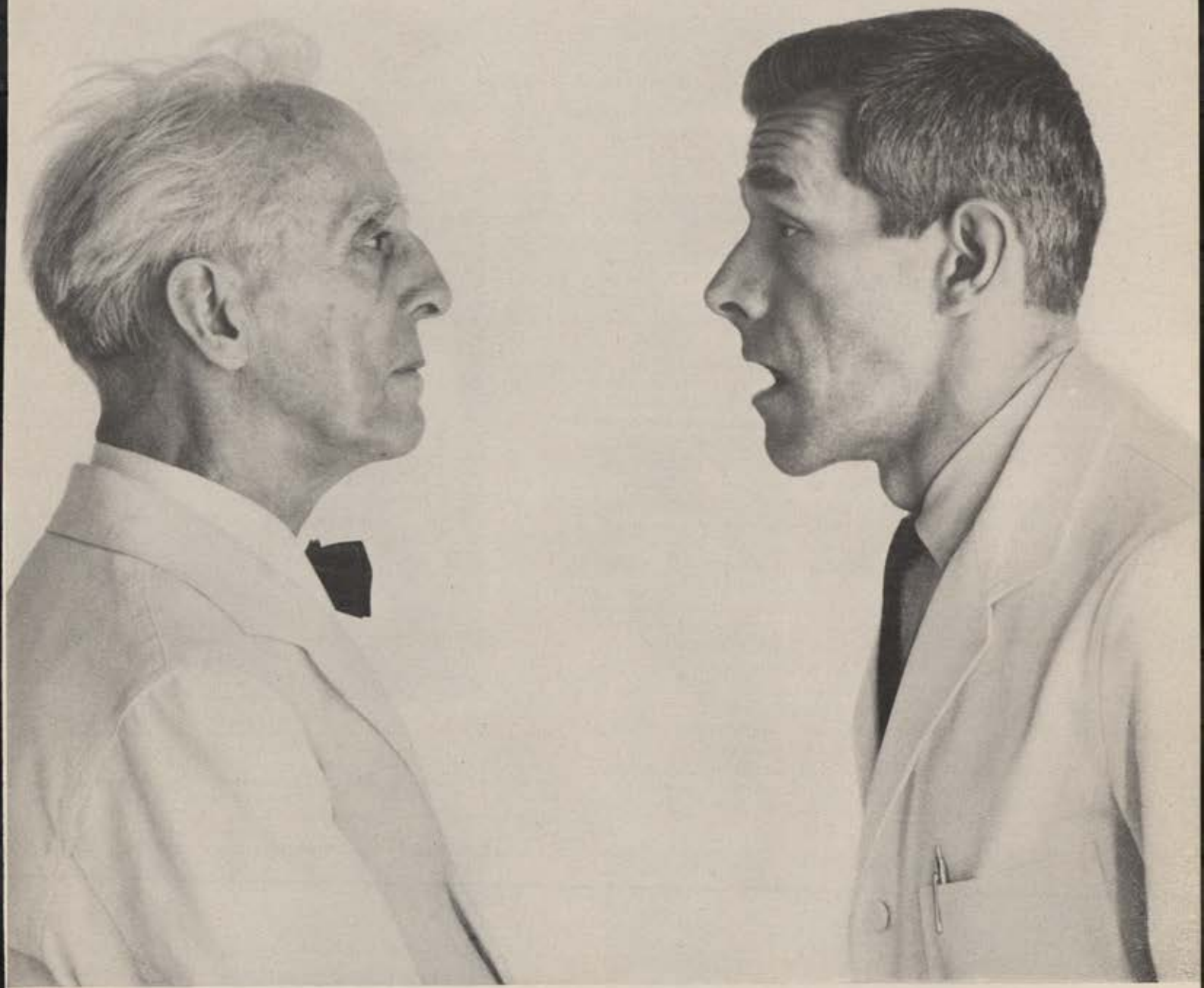
"S'il vous plaît...

$$H(x)=\sum_{i}^{n} p_i \log \frac{1}{p_i} = -\sum_{i}^{n} p_i \log p_i \ldots"$$

"Thank you, gentlemen.
Your experience in
your countries has been
of infinite value to us.
In a few years, I think fully
automated post offices are going
to be as American as apple π."



24 countries work for ITT.

satellite system that could make worldwide TV a matter of a few years. As a signal can be bounced from one planet to another, so can an idea grow in bouncing from one mind to another. International Telephone and Telegraph Corporation, 67 Broad Street, New York 4, N. Y.

ITT

COMMUNICATIONS SYSTEMS / ELECTRON TUBES / DATA PROCESSING / AUTOMATION SYSTEMS / SYSTEM MANAGEMENT / COMPLETE FIELD SERVICES

News,
Views
& Comments

AEROSPACE WORLD

Frederic M. Philips
ASSOCIATE EDITOR

This was the month of the threat.

Nikita Khrushchev, a rocket-rattler with rockets to rattle, early in July provided further notes toward a definition of nuclear blackmail. He warned the United States on July 9 that it could be reached by "Soviet rocket fire" if it "begins intervention against Cuba." Three days later, brushing aside rejection of this warning by President Eisenhower, the Soviet premier expanded on the theme:

"The Monroe Doctrine has outlived its usefulness and has died a natural death."

Khrushchev is a real bear for warnings. His July 9 bluntmanship was reminiscent of rocket-rattling notes to Britain and France at the time of the Anglo-French-Israeli attack on Egypt in 1956. Almost continually, he has exposed smaller nations on Russian borders to threats of nuclear devastation in connection with basing of US or US-supplied weapons on their soil. Most recently, a round of warnings was delivered to countries that might allow US reconnaissance aircraft to take off from their territory to keep an eye on Russian war preparations.

Always, although these admonitions went to our closest allies, we were able to note smugly that only lesser nations received such harsh messages from Moscow. Khrushchev seemed to indicate on July 9 that he was ready to put us at the top of his mailing list.

The warming cold war got even warmer two days later when Russia announced that she had downed another US plane. This time it was a USAF RB-47 photo-recon plane reported by us to have been lost on a research mission over waters north of Norway and the Soviet Union. Russia, charging that the plane was on a "provocative" photo-mission that violated Soviet territory, said a Red Air Force jet shot it down on July 1.

USAF RB-47. Plane of this type was involved in US-Soviet incident in early July. Reds shot plane down, claimed it violated their territory. US angrily rejected the charge.

The US, Khrushchev told newsmen, was trying to set off "a serious military conflict" with this "new, blatant violation." Our government shot back the reply that the Russians attacked the aircraft over open seas "in a delib-

Wide World Photos, Inc.

Dual ceremony at end of June saw Smithsonian Institution posthumous honor go to rocket pioneer Dr. Robert H. Goddard and USAF Atlas, based on early Goddard principles, go to Smithsonian. Below, Senator Clinton P. Anderson of New Mexico, a Smithsonian Regent, presents medal to the scientist's widow. Above, gift Atlas at the presentation.

Wide World Photos, Inc.

erate and reckless attempt to create an international incident," and warned in turn that Russia was courting "serious consequences."

Held by the Russians, they announced, were the two survivors of the six-officer USAF crew of the downed plane. The two joined Francis G. Powers, pilot of the U-2 that went down over the central Soviet Union on May 1, in captivity. Powers has been indicted for spying, the Reds announced in July, but planned date and place of his trial remained unrevealed.

☆

Here at home, the big story came from Cape Canaveral. On June 22, the US put two satellites into orbit with a single rocket shot from a Cape pad—first such double shot in space-launch history.

Included in Uncle Sam's two-pack were the Navy's Transit II-A, second experimental navigation satellite, and a basketball-like aluminum research sphere.

The rocket that did the trick was a USAF-Space Technology Laboratories Thor-Able-Star. It was the booster's second outing. The first time it placed Transit I-B, world's first navigation satellite, in orbit with an April 13 shot.

Transit II-A, 223 pounds and a yard wide, is an advanced I-B. Two or three more Transits were scheduled before the system becomes operational by about 1962. The Applied Physics Laboratory of Johns Hopkins University builds Transits under Navy sponsorship.

The second of the two spheres launched, a moonlet prepared by the Naval Research Laboratory, was crammed with devices to gather solar radiation information.

☆

Doug Douthwaite is the three-year-old son of a USAF captain. A one-in-a-million medical misfortune early in June almost destroyed the sight in his left eye. An after-dark jet flight saved it.

The youngster's difficulties began with a routine smallpox vaccination on June 1 at the USAF Hospital, Eglin AFB, Fla. The vaccination was part of his family's preparations for departure to a new duty station, Okinawa. Within a week, Doug's left eyelid began to swell, and his temperature rose alarmingly. By June 10, the eye was almost shut.

Doctors at the Eglin hospital drew an astonishing conclusion. The primary vaccination in the boy's arm had caused an ugly secondary infection on his eyelid. Immediate treatment with a medicine not stocked at Eglin was required to save the eye.

Closest store of it was found to be at Walter Reed Army Hospital, Washington, D. C. While doctors arranged for the drug to be sent from the hospital out to Andrews AFB near Washington, Capt. John M. Bartlett of Eglin climbed into a T-33 jet. Four hours later, at about midnight on June 10, he completed a round trip to Andrews and returned with the sorely needed package.

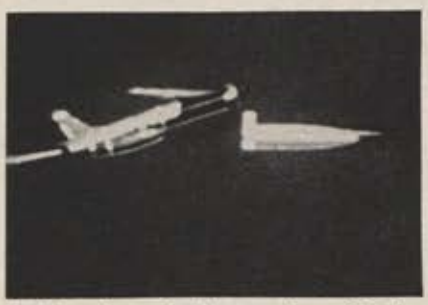
By the next afternoon, Doug was on the road to recovery after a frightening bout with partial blindness.

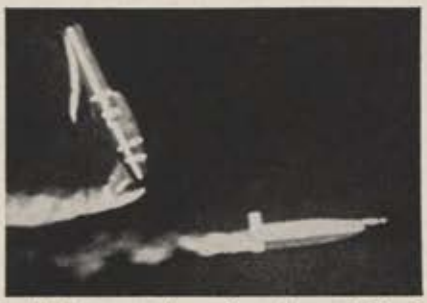
☆

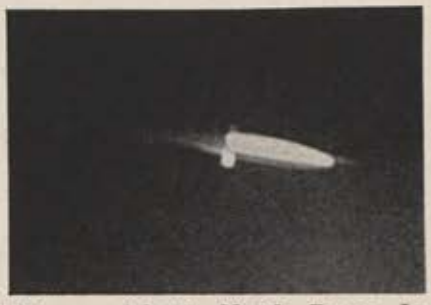
It's almost always warm in Washington. But it's seldom heartwarming. June 28 was a warm and heartwarming day at the capital's Smithsonian Institution.

Before several hundred persons, under a burning sun and sky-blue sky, Secretary Leonard Carmichael of the Smithsonian read a eulogy to the man who founded modern rocketry. In a sense, Dr. Robert H. Goddard, whose memory was thus honored, played the same role in missilry that the Wright brothers did in aviation. Ironically, like the Wrights, his achievements received major recognition abroad before they did in his own country.

Dr. Goddard developed a liquid-propellant rocket motor and theorized on vast potentialities of rocketry forty-one years ago—in the days when aviation itself was barely past the powered-kite stage. He launched the first such rocket in 1926 in Massachusetts, followed it nine years later with a supersonic launch over the New Mexico desert.







Newly released photos show Northrop Snark intercontinental-cruise missile in flight over Atlantic Missile Range. In first frame, nose cone containing dummy warhead separates from missile body. Warhead streaks toward target and the body falls away in second shot. Third view shows it in trajectory toward target. Snark, subsonic, is operational.

Rocket fuels, motors, pumps, stages, the uses of jets for plane propulsion, rocketborne mail and cargo, space travel—all came within the scope of Goddard's pioneer investigations between the two World Wars.

Senator Clinton P. Anderson of New Mexico, a Regent of the Smithsonian, presented its Langley Medal to Mrs. Goddard, the scientist's widow, who assisted in many of his projects. For its part, the Smithsonian could proudly look back on the fact that it supported and encouraged Dr. Goddard from the beginning of his rocket work in 1919 until his death at sixty-three in 1945.

Ultimately, of course, Dr. Goddard's rocket brainchild was destined to evolve into long-distance weapon systems of awesome lethality. The German V-2, used to such deadly effect against Britain late in the war, and today's sophisticated US and Russian missiles all followed in a direct line from Goddard's earlier work.

Fittingly, as a second portion of the proceedings, USAF presented an Atlas ICBM to the Smithsonian National Air Museum for permanent display. The Atlas is the free world's first operational ICBM. Air Force Secretary Dudley C. Sharp made the formal presentation.

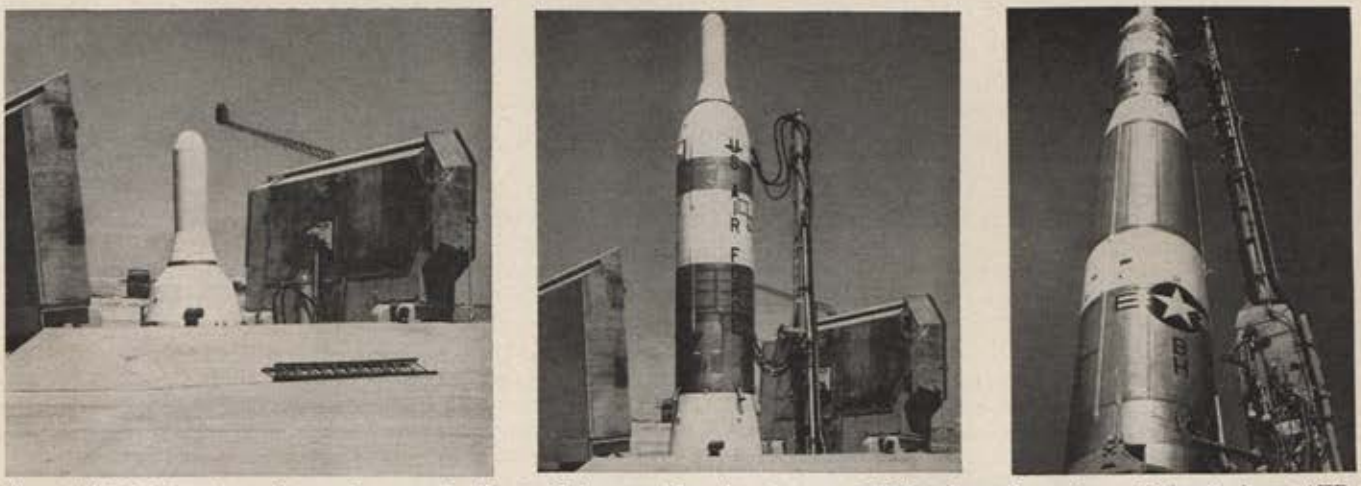
The June 28 ceremony was actually held at the base of the gift Atlas, an eighty-two-foot giant of shining stainless steel. Secretary Carmichael, in introducing Secretary Sharp, glanced up at it and quipped, "I understand we're receiving a large gift."

☆

Meanwhile, here was how the rest of USAF's mixed arsenal fared:

★ An advanced version of Titan known as Titan II

(Continued on following page)

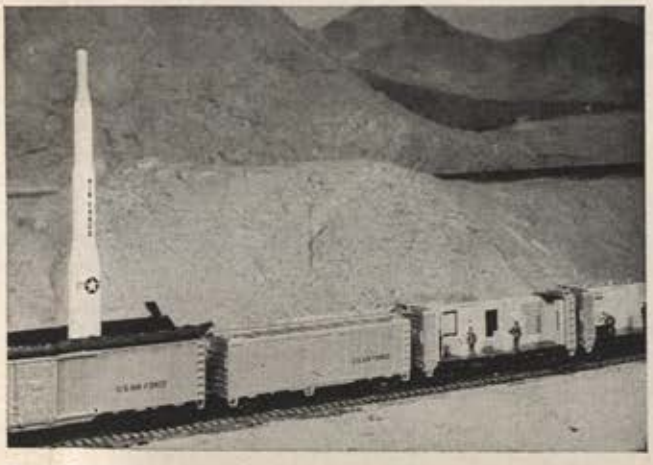


Titan ICBM rises from its underground silo to firing position in test on training launch system at Vandenberg AFB, Calif. Basic Titan will be prepared for launch in silo, raised as here for blastoff. Later version Titan II will be fired right from silo. USAF let contract this month for construction of missile's launch systems. The missile shown in this progression of photographs is not a flight missile. It is used for training, check-outs.

will be produced, according to a June 21 announcement. It will feature longer range, heavier warhead, faster reaction time than Titan I. Titan II's liquid propellant will be prepackaged; consequent ease of handling will allow salvo firing from hardened underground silos. Titan II units were scheduled for Little Rock AFB, Ark., Davis-Monthan AFB, Ariz., McConnell AFB, Kan.

At the same time, Titan I reached a more advanced stage with introduction of the "J" model, said to feature a lighter, simpler engine, and more efficient fuel utilization than the predecessor "G." However, the first test J veered out of control and had to be blown up in a shot at the Cape on July 1, ending a run of six straight successful Titan shots. The final test in the triumphant G string went off as planned June 24.

Late in June, USAF announced a contract with the American Machine and Foundry Company for construction of thirty-six launch systems for Titan. They will equip four squadrons at Ellsworth AFB, S. D., Mountain Home AFB, Idaho, Larson AFB, Wash., and Beale AFB, Calif., with nine systems each. Prototype system is undergoing tests at Vandenberg AFB, Calif., where three training launchers are being built. First eighteen operational launchers, also being provided by AMF, will go to Lowry AFB, Colo. The launchers will be capable of firing either Titan I or II—I after raising from the system's storage silo, II directly from the silo.



Initial test runs of Minuteman ICBM mobile-launch trains have begun. When operational in 1962, second-generation missile will go to trains and hardened, dispersed sites. Initial test trains don't carry "birds." This is a model.

★ Atlas continued to look good shotwise, with a two-for-two record for the month, but facilitieswise the program fell behind to an extent. Secretary of Defense Thomas S. Gates made known early in July that construction of launch facilities for Atlas at Vandenberg, Offutt AFB, Neb., and Warren AFB, Wyo., had fallen some months behind schedule, pushing operational dates back from this summer to the fall. Something under half a dozen Atlases are sited at Vandenberg at present, for purposes of both training and combat readiness. Behind the delays were understood to be three major causes: growing pains in a new area, labor difficulties, and last year's steel strike.

★ A USAF KC-135 jet tanker piloted by Capt. Joseph Blaylock set a new Japan-East Coast speed record by flying from Yokota AB, Japan, to Seymour Johnson AFB, N. C., in twelve hours, thirty-two minutes on June 15. Aboard was CASF Commander Maj. Gen. Henry Viccellio, returning home at the end of CASF Far East deployment exercise Mobile Yoke.

★ On July 1, Representative Melvin Price of Illinois, head of a subcommittee on atomic energy research and development, unveiled before newsmen a model of the probable form America's nuclear-powered airplane will take. He declared that such a craft could do the work of "ten conventional bombers" and called for a stepped-up development program.

★ Minuteman test trains performed week-long runs over lines in the western part of the nation from June 20 to 27 and July 5 to 12, checking out command and control techniques that will be used when Minuteman becomes operational and is mounted aboard trains in 1962. Col. Lucien N. Powell succeeded Col. Virgil M. Cloyd, Jr., as Commander of the SAC task force running the train program from Hill AFB, Utah. A contract for development of hardened Minuteman sites also went to Boeing Aircraft.

★ Snark completed a successful 5,000-mile flight July 8 from the Cape. Quail and Hound Dog launchings continued on schedule at Eglin, where Bomarc-B performed its third successful simulated intercept early in July, and Mace and Matador shots at the Cape and Holloman AFB, N. M.

☆

Famed prewar aviatrix Amelia Earhart mysteriously

(Continued on page 33)

CopterNews from Sikorsky

Navy tests helicopter minesweeping. A new job for helicopters—seeking and destroying enemy mines—was demonstrated by the Navy recently at Panama City, Florida. A Sikorsky S-60 lowered, streamed, towed and retrieved its new lightweight minesweeping gear. The test demonstrated the helicopter's capability as a self-sufficient aerial minesweeper, and it further demonstrated the vast gain in safety that a copter—flying above the explosive range of the mine—can bring to minesweeping operations. The S-60 is the first of a new family of all-purpose transports now under development at Sikorsky. These unique configurations require no conventional cabin to lift cargo, and can carry detachable pods for equipment, personnel or weapons.

Copter catches five out of five as first air-to-air recovery is demonstrated. New possibilities in aerial recovery of nose cones, drones, and reconnaissance missiles were revealed recently by the first demonstration of helicopter air-to-air recovery techniques. Using recovery gear developed by All-American Engineering Company, a Sikorsky S-55 completed five out of five pickups of a package suspended from a descending parachute. The demonstration, before Army, Navy and Air Force personnel, pointed up the copter's maneuverability for this mission. In case of a miss, for example, the copter can make several more passes before the chute hits the water or ground.

Interservice news. Not to be outdone by the remarkable helicopter feats of civilian telephone "pole planters," a Marine HR2S crew transported and planted a series of antenna poles each 92 feet long and 5,000 pounds in weight on California mountain tops. P.S. Mission was actually performed for the Air Force. Credit Marines with big assist on this play!

A New World of Mobility by

SIKORSKY AIRCRAFT

Stratford, Connecticut/A Division of United Aircraft Corporation

ELGIN MICRONICS PRESENTS

BY POPULAR REQUEST a new elapsed time indicator, specially designed for **direct digital read-out** to minimize the possibility of reading error. This new unit incorporates all of the outstanding features . . . minimum size and weight, low power draw and extreme reliability . . . that have made the Elgin Micronics dial type ETI an approved and preferred standard throughout the missile and airborne equipment industries. Production run units may be ordered for test or application. **ELGIN MICRONICS** Division of Elgin National Watch Company, Elgin, Illinois

DIGITAL READ-OUT ELAPSED TIME INDICATOR

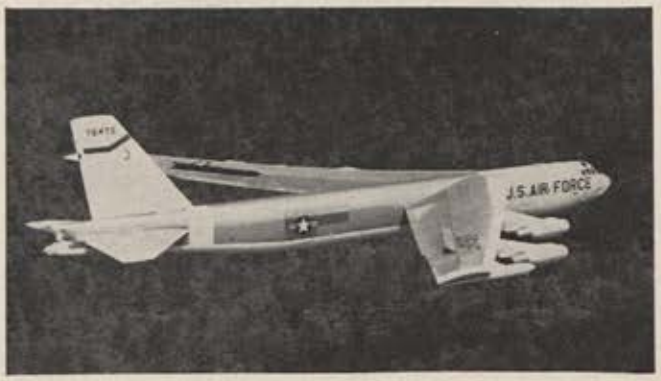
NEW

Shown here twice actual size.

As easy to read as 123.4 yet draws only 1 watt and withstands temperature variation from -65° to 165°F, 20 G vibration at 10-2,000 cps and 15 G 11 ms shock.

Wide World Photos, Inc.

Representative Melvin Price of Illinois displays first model of nation's developmental nuclear-powered plane in press conference at Washington office. He called for stepped-up program in this regard to meet military needs.



Strategic Air Command B-52G on low-altitude flight in Midwest. Flight is part of extensive SAC program with B-47s, B-52s, B-58s to perfect low-level attack capabilities. Such attacks might avoid enemy radar detection.

disappeared in July 1937 on a Pacific leg of a round-the-world flight. The mystery, perennially intriguing since, received an exhaustive but inconclusive airing this month.

ITEM. A new book by an Air Force Academy English instructor, Capt. Paul L. Briand, Jr., provided eyewitness evidence for the theory that Miss Earhart flew badly off course, fell into the hands of Japanese authorities, and was executed. He reported that a young Saipan woman, a child on the Japanese-mandated island at the time, recounted details of the flyer's death to an American during the postwar occupation there. The woman told of seeing Miss Earhart's plane crashland off Saipan, then of watching as she and her navigator, Fred Noonan, were marched into a wood and shot. She and others on the island understood, Captain Briand wrote, that the Japanese could not allow the Americans to live because they had seen and would reveal to the world secret fortifications under construction by the Japanese.

ITEM. Two Air Force officers on Okinawa, Captains Joseph Gervais and Robert Dinger, were understood to have in their possession photographs and seventy-two affidavits from eyewitnesses substantially bearing out this thesis. They were reported to have discovered an Earhart-Noonan burial site on Saipan.

ITEM. A Columbia Broadcasting System team and a reporter from the San Mateo, Calif., *Times* visited Saipan, heard similar accounts from local persons, and located wreckage of what appeared to be a prewar American plane offshore. They brought home the wrecked plane's generator. Its designer said it resembled the one in the Earhart plane; further identification awaited checking.

ITEM. Japanese officials, including a former Imperial Navy captain who headed the bureau charged with executions in 1937, vehemently denied that the two Americans came into Japanese hands and were put to death.

ITEM. The Air Force, studying the data assembled in the unofficial investigations by its officers, labeled it, at this point, "incomplete and inconclusive."

☆

ELSEWHERE IN THE AEROSPACE WORLD:

Col. William T. Smith, Commander of Andrews AFB, Md., announced on June 20 that by 1962 all major fixed-wing operations at nearby Bolling AFB and the Anacostia Navy field will be transferred to Andrews, as will MATS operations at National Airport, Washington.

Navy Rear Adm. William D. Irvin will be first chief of the newly created, joint Army-Navy-USAF Defense Communications Agency, it was announced late in June.

On June 27, in line with the general cold-war heatup, Communist bloc delegates walked out on the months-old disarmament conference at Geneva, charging that the West wasn't negotiating conscientiously.

The same day, USAF announced formation of a new nonprofit organization, the Aerospace Corporation, to

(Continued on following page)

Sikorsky S-62 helicopter, which in July became the first American gas turbine-powered helicopter to be certified by Federal Aviation Agency. New turbocopter is also the world's first amphibious 'copter with flying boat hull.

USAF has ordered five Lockheed Jet Star aircraft to use in checking traffic control facilities for fast, high-flying jets at bases around the world. Lockheed plane is jet utility aircraft with top speed of 600 miles an hour.

Chief of Staff Gen. Thomas D. White presents Cheney Award to MATS Capt. Herbert L. Mattox, Jr., for helicopter rescue of Japanese fishermen. Ceremony took place June 14.

Air Force Secretary Dudley C. Sharp pins command pilot wings on Nevada's Senator Howard Cannon, Reserve colonel, while General White looks on in Pentagon presentation.

Here the Distinguished Service Award, highest USAF award for a civilian, is presented by Secretary Sharp to George Robinson of his office for efforts in housing program.

NATO honors go to Lt. Gen. Ralph P. Swofford, USAF, as he assumes post of Commander, Allied Air Forces, Southern Europe, at Naples, Italy, NATO headquarters complex.

manage over-all R&D of missile-space programs for the ballistic missile division. It will perform duties previously handled by Space Technology Laboratories, a subsidiary of Thompson Ramo Wooldridge Corp. STL retains supervision of Atlas, Titan, Minuteman, due to their advanced state; Aerospace Corp. takes over Discoverer, Midas, Samos. Early in July, STL and other concerns received a NASA contract for design studies of a moonlanding package.

On recommendation from NORAD Commander Gen. Laurence S. Kuter, the Army acted June 28 to place Nike-Hercules batteries on the East and West Coasts and along the Canadian border and cancel their planned installation at SAC bases and the Hanford, Wash., atomic plant.

USAF fired its Discoverer XII satellite at Vandenberg on June 29, but it failed to reach orbit. In other space developments, the Tiros weather satellite stopped sending data back on July 1 after a useful life of three full months; and Pioneer V, the deep-space probe launched March 11, ceased transmitting from a distance of 22.5 million miles out.

Congress recessed for the political conventions in early July after voting a $700 million addition to the Administration defense budget.

USAF fighter planes pull out of Ladd AFB, Alaska, late this summer for economy reasons, the service said in July. At the same time, the decision was made for fighters to go back into Thule AB, Greenland.

Russia fired two more rocket test shots into the Pacific during the first week of July—one 8,700 miles, the other 8,076 miles.

This year's Harmon International Aviation Awards go to two Air Force officers: Capt. Joe B. Jordan for taking an F-104 to an altitude record of 103,395.5 feet last December 14, and Capt. Joseph W. Kittinger, Jr., for ascending to 76,400 feet in an open gondola and then parachuting last November.

The Air Force has won its long battle to get its own medals. From now on, USAF will award the Air Force Cross and Airman's Medal rather than the DSC and Soldier's Medal.

The Department of Defense has announced what it calls "a major revision" in security regulations to ease demands on military contractors in this regard. In the future, DoD said, fewer contractor employees will require clearance, the quantity of classified material will be reduced, and the number of restricted areas cut.

☆

STAFF CHANGES. . . . **Brig. Gen. Gordon H. Austin,** from Commander, 11th Air Division (Defense), AAC, with added duty as Deputy Commander, AAC, to Deputy Director of Operational Requirements, DCS/O, Hq. USAF, Washington, D. C., effective August 1. . . . **Brig. Gen. Robert H. Curtin,** from Deputy Director for Real Property, to Deputy Director for Civil Engineering Operations, DCS/O, Hq. USAF, Washington, D. C. . . . **Maj. Gen. John K. Hester,** from Deputy Director for Operational Forces, to Deputy Director of Operations, DCS/O, Hq. USAF, Washington, D. C. . . . **Brig. Gen. Arthur J. Pierce,** from DCS/Programs, Hq. ADC and NORAD, Ent AFB, Colorado Springs, Colo., to Deputy Commander, Aerospace Technical Intelligence Center, Hq. Command, USAF, Wright-Patterson AFB, Ohio, effective August 8.

RETIRED. . . . Brig. Gen. Frederick E. **Calhoun,** Brig. Gen. John D. **Howe,** Maj. Gen. Harlan **Parks,** Brig. Gen. George F. **Schlatter.**—END

SPLIT—SECOND INFORMATION

An effective Army must have split-second, exact combat intelligence. Republic's Missile Systems Division is working on one means of fulfilling this need for the U. S. Army with the AN/USD-4 Swallow system: a completely integrated ground-airborne information-gathering system.

The SD-4 system includes an all-weather, jet-powered surveillance drone, mobile ground command and information stations, and associated ground support equipment. The drone will be field-launched and employs any of a number of surveillance sensors. This high-performance unit will permit the field army commander to extend his view beyond the horizon to gain up-to-the-minute information. Its mission completed, the SD-4 will return, be recovered and readied for a new mission.

The airborne-ground SD-4 Swallow system was designed and is being developed by Republic's Missile Systems Division under contract to the U. S. Army Signal Corps.

REPUBLIC AVIATION

MISSILE SYSTEMS DIVISION

MINEOLA, LONG ISLAND, N. Y.

HEDGEHOPPING AT MACH 1
Lockheed radar shows pilot how to miss what he can't see

When a pilot hugs the deck traveling a mile *every four seconds,* his route is the world's most dangerous obstacle course. Hills, bridges and other hazards can be in his lap before he has time to maneuver safely over them. He needs information well in advance, particularly in poor visibility or at night.

And now he gets it—from Lockheed Electronics terrain avoidance radar. A compact display shows him obstacles, his position in relation to them, and the maneuvers necessary to avoid them—in time.

Lockheed Electronics systems engineers have created in one group of modules the most versatile airborne radar in flight test today. Equally effective as a mapping, bombing or navigational radar, this lightweight, transistorized unit is typical of the sophisticated equipments developed by Lockheed Electronics to help strengthen the nation's defense.

CAPABILITIES—MILITARY SYSTEMS/STAVID DIVISION

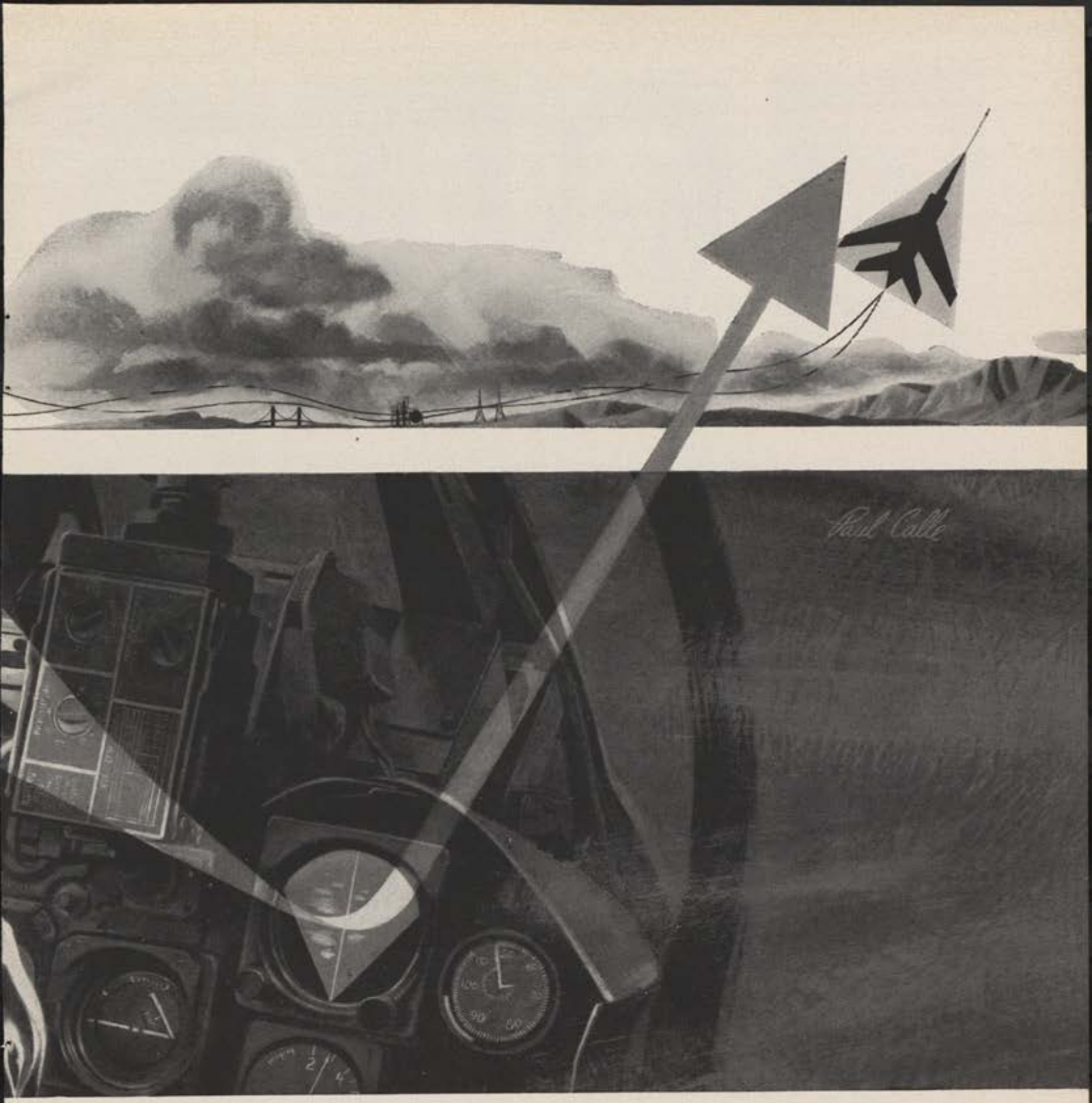
RADAR SYSTEMS—search, bombing, navigation devices and displays, missile guidance and control, automatic detection and data processing

COUNTERMEASURES—ECM, ECCM, active and passive

UNDERSEA WEAPON CONTROL AND DETECTION—ASW, electromagnetic detection, location and communication

SIMULATION AND TRAINING DEVICES

OPERATIONS ANALYSIS—offensive and defensive systems, war operations, undersea warfare, electronics in space



MINDING THE FUTURE

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Stack

Markey

Hardy

Gross

Nominating Committee selects Thomas F. Stack to be next President of the Air Force Association, names other . . .

AFA Nominees for 1960-61

AFA's Nominating Committee has selected **Thomas F. Stack** of San Francisco, prominent attorney and long-time AFA officer in his home state, as its nominee for next President of the Association.

Mr. Stack's name, with those of others named by the Committee for national office, will go before the National Convention in San Francisco in September.

The Committee, at its annual session in Washington, D. C., on June 17, chose outgoing AFA President **Howard T. Markey** for nomination as Chairman of the Board of Directors, succeeding Julian B. Rosenthal.

George D. Hardy and **Jack B. Gross** were selected to be nominated for reelection as Secretary and Treasurer.

Presidential nominee Stack has been Squadron Commander, Wing Commander, Regional Vice President, and member of AFA's Board of Directors. He is also the "most decorated man in AFA"—winner of six national Association awards incuding the "Man of the Year" Trophy in 1956. The year before that, in 1955, he chaired the highly successful 1955 National Convention in San Francisco.

A graduate of the University of San Francisco, Mr. Stack is married and has one child, a three-year-old son.

Mr. Markey is a Chicago patent attorney. Prior to his election as President of AFA at last year's Miami Beach Convention, he served as Vice President of AFA's Great Lakes Region and was Vice Chairman of AFA's Executive Committee.

The committee's nominee as Board Chairman is a brigadier general in the Air Guard and Commander of the ANG's 126th Fighter-Interceptor Wing. He lives in suburban Winnetka, Ill., with his wife and two children.

Mr. Hardy, chosen for a second term as Secretary, has been Squadron and Wing Commander, Regional Vice President, and National Director. He was 1957's "Man of the Year." A food broker with offices in Washington, D. C., and Baltimore, Md., Mr. Hardy lives in Hyattsville, Md., with his wife and their two young children.

Mr. Gross, named for a second term as Treasurer, is another former Squadron Commander. He sat on AFA's Finance Committee for several years before his election at Miami Beach last year. He also has been "Man of the Year," attaining that honor in 1958. Mr. Gross is an automobile dealer and investments counselor in Harrisburg, Pa.

Mr. Rosenthal, Chairman of the Board during the past year, was a member of the group that founded AFA in 1946. He was Secretary for thirteen years, is a New York attorney.

The Committee also nominated nineteen men to serve on the Board of Directors. Fourteen are current Directors. The nineteen are: **Walter T. Bonney,** Silver Spring, Md.; **Roger J. Browne,** Garden City, N. Y.; **J. R. Dempsey,** San Diego, Calif.; **Willard L. Dougherty,** New York, N. Y.; **A. Paul Fonda,** Washington, D. C.; **Joseph J. Foss,** Sioux Falls, S. D.; **J. Wayne Fredericks,** Bronxville, N. Y.; **Carl J. Long,** Pittsburgh, Pa.; **Harvey J. McKay,** Glendale, Calif.; **John B. Montgomery,** Cincinnati, Ohio; **Msgr. William F. Mullally,** St. Louis, Mo.; **O. Donald Olson,** Colorado Springs, Colo.; **Earle E. Partridge,** Colorado Springs, Colo.; **William W. Spruance,** Centreville, Del.; **Arthur C. Storz,** Omaha, Neb.; **Donald J. Strait,** Bedminster, N. J.; **Alden A. West,** DeWitt, N. Y.; **Leonard A. Work,** State College, Pa.; and **Paul S. Zuckerman,** New York, N. Y.—END

NEW MOBILITY FOR THE ARMY NAVY, MARINES AND AIR FORCE

...WITH THE ALL-SERVICE, MULTI-MISSION VERTOL 107

The twin-turbine powered Vertol 107 can efficiently perform the varied missions of the Army, Navy, Marines and Air Force—without changes to the basic aircraft.

Because the Vertol 107 lands and takes off from both water and land, it can sweep mines, perform anti-submarine warfare missions and transport assault troops. This tandem-rotor helicopter provides new air mobility for crew served weapons . . . can, in fact, internally airlift a complete Little John system and crew, permitting fire to be laid on a target 60 miles away 35 minutes after receipt of orders. The Vertol 107 is also capable of around-the-clock, all-weather support of remote, widely dispersed missile launching sites. With equal facility, this one helicopter can perform medical air evacuation, air/sea/land rescues, and even tow ships and tanks.

Contributing to the Vertol 107's across-the-board versatility is its large, unrestricted cargo capacity and straight-in rear ramp loading, which permit loads to be transported internally, externally, or half-in, half-out.

Whatever the service, whatever the mission—the Vertol 107 offers a new magnitude of air mobility.

VERTOL DIVISION
BOEING
MORTON PENNSYLVANIA

Eighteen-foot diameter radome of WSR-57 Stormfinder radar. System operates at S band, has 250-mile range.

Dr. F. W. Reichelderfer, chief of the Weather Bureau, calls this "the best weather radar in the world."*

Raytheon STORMFINDER shows a composite picture of the entire weather front over a 200,000 square mile area. The "weather eye" pinpoints and tracks storms 250 miles away, distinguishes hail, raïn, and snow, probes the heart of a hurricane. It is ground-based . . . and designed, developed and produced specifically for weather detection and analysis.

EQUIPMENT CHARACTERISTICS

Iso-echo feature. Sensitivity Time Control of 20 db between 10-100 miles. Triple display indicator unit: (1) 7″ RHI (range height indicator), (2) 12″ PPI (plan-position indicator), (3) 7″ A/R Scope for storm intensity measurement.

Power output	500 KW	
Frequency	2.7 — 2.9 kmc	
Beamwidth	2.2°	
Elevation	−10° to +45°	@ 6 scans/min
Azimuth	360°	@ 1-4 scans/min

*from testimony before a House Appropriations subcommittee, January 18, 1960.

RAYTHEON EQUIPMENT DIVISION

Excellence in Electronics

For Raytheon Weather Radar Brochure, *Write: Director of Marketing, Equipment Division, Dept. C1, Raytheon Company, West Newton, Mass.*


ARMY
ARMY

Theoretical Concept is Turned into Hardware

Honeywell Develops a Practical

Mr. Robert Maze, Chief Engineer of Honeywell's Marine System Group, is reflected in the highly polished beryllium spherical rotor of Honeywell's new Electrically Suspended Gyro. The Marine System Group is a special Honeywell "task force" assigned to guide the ESG program through its rapid development.

Electrically Suspended Gyro!

Advanced new gyro concept using friction-free spherical rotor will bring greater accuracies to marine and airborne inertial systems, and northfinder systems.

Honeywell's leadership in the field of inertial systems and sensors is further demonstrated with advances on its Electrically Suspended Gyro. Here the company has taken a theoretically superior gyro concept, conceived by Dr. Arnold Nordsieck of the Univ. of Illinois, and turned it into practical development hardware. This new ESG concept is being developed under funding from the Navy Special Projects Office and Wright Air Development Division. Recognizing the unique capabilities of this new device, Honeywell has assigned a special task force group to continue to press the development of the gyro and the inertial system designed to take fullest advantage of the gyro's capabilities. In the near future, the Honeywell inertial system incorporating the ESG will be put into its test phase.

This new gyro has only one moving part, a spherical rotor, electrically suspended in a self-contained, hard vacuum to completely isolate the sensing element. The spherical rotor is made of beryllium, machined and polished to tolerances of a few millionths of an inch! The gyro is brought up to speed by electronic means, then coasts throughout long periods of operation. Reference information is picked off optically.

Honeywell, because of its experience in gyro components and systems, has already solved many problems related to this new gyro concept.

1. **Precision Machining of Problem Metals:**
   In order to take advantage of beryllium's high material stability, Honeywell has developed manufacturing techniques that overcome beryllium's brittleness and toxicity problems.

2. **Precision Ceramics:**
   Honeywell has perfected the techniques for firing and machining the precision ceramic envelope, and for overcoming the difficulties in fabricating the ceramic-to-metal seals.

3. **System Integration:**
   Honeywell, with its advanced system experience, has created a new inertial system to take fullest advantage of the capabilities of this new Electrically Suspended Gyro.

For more information on Honeywell's new products, write to Minneapolis-Honeywell, Dept. AF-8-111, Minneapolis 8, Minn.

Precision ceramic envelope receives a final machining after being fired at a temperature of 1300° C. Diamond grinding and ultrasonic drilling are utilized in finishing the envelope.

Beryllium rotor, after being machined, ground and polished, is checked for sphericity to tolerances of a few millionths of an inch!

Honeywell

H Military Products Group

IN DIAMETERS UP TO 300', Aeronca antennas provide unparalleled accuracy at frequencies of X-Band and higher.

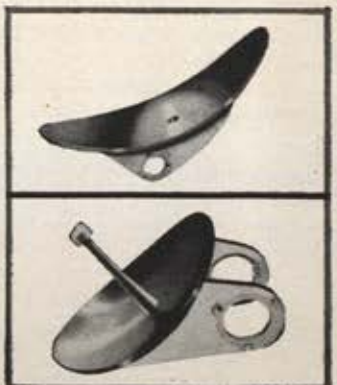
AERONCA designs and produces precision antenna systems for advanced radar complexes

Featuring new concepts in design and construction, Aeronca paraboloid antennas set new standards in precision . . . regardless of size. The principles and accuracy inherent in the 60-foot X-Band dish illustrated above are adaptable to antenna designs of virtually any size or shape.

Aeronca antennas are lightweight high-strength rigid structures of honeycomb sandwich construction. Developed by integrated design-tool-produce capabilities, they are fabricated by advanced techniques that substantially reduce tooling requirements . . . simplify unit design . . . assure low-cost producibility. In addition, Aeronca antennas permit lighter support structures and mechanisms because they weigh 40% to 60% less than conventional designs.

Whatever your antenna problems, Aeronca can supply "packaged" capabilities to meet your requirements and specifications. For details, write for BULLETIN AR-201.

APS-94 ANTENNA SYSTEM included complete design of antenna for airborne side-looking radar.



B-58 BOM-NAV SYSTEM reflectors feature curvature tolerances of ±.005".

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Openings for creative R&D Engineers with Missile-Space experience. Write to O. E. Chandler, Mgr. Professional Employment.

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Now GUARANTEED Flight Pay Insurance!

A brand NEW benefit at no extra cost . . .

Now AFA Flight Pay Insurance is a better investment than ever, because it offers *guaranteed protection*, even against preexisting illnesses, after the first year's coverage.

There's no extra charge for this new, liberal provision and no change in the regular benefits of the policy—

- *Coverage for* both *illnesses and accidents.*
- *Payments for up to 24 months if your grounding is the result of an aviation accident — up to 12 months if for illness or ordinary accident.*

Remember, payment for a single 90-day grounding reimburses you for the whole cost of 10 years' protection.

NOTE:

All policies are dated on the last day of the month in which the application is postmarked, and protection against accidents begins as of that date; protection against groundings due to illnesses begins 30 days later. Of course, coverage cannot be immediately extended to include illnesses which existed prior to the time at which you insured your flight pay, but after 12 months you are fully covered against all illnesses.

To be eligible for protection, you must have passed your last annual physical . . . be presently in flying status . . . and be a member of the Air Force Association.

Most claims are routine. Where a difference of opinion exists, the Air Force Association has the right to request a review of medical records and other claim evidence by appropriate medical authorities—normally the office of the Surgeon General, USAF.

There are also some exclusions that affect your coverage under the Flight Pay Protection Plan. They are designed primarily to protect your investment in the Plan—restrictions that you'd normally expect, such as groundings due to insanity, court-martial, attempted suicide, etc. Here they are in detail:

EXCLUSIONS:

The insurance under the policy shall not cover loss to any Member resulting in whole or in part from or due to any of the following:

1. Criminal act of the Member or from injuries occasioned or occurring while in a state of insanity (temporary or otherwise).
2. "Fear of flying," as officially certified by responsible authority of the Member's Service and approved by the head of the Service in accordance with applicable regulations.
3. Caused by intentional self-injury, attempted suicide, criminal assault committed by the Member, or fighting, except in self-defense.
4. Directly or indirectly caused by war, whether declared or not, if act of an enemy in such war is the direct cause of loss insured hereunder, hostile action, civil war, invasion, or the resulting civil commotions or riots.
5. Failure to meet flying proficiency standards as established by the Member's Service unless caused by or aggravated by or attributed to disease or injuries.
6. Inability of a member to continue to meet physical standards for Hazardous Flight Duty because of a revision in those standards, rather than because of preceding injury or disease causing a change in the physical condition of such member.
7. Mental or nervous disorders.
8. Alcohol, drugs, venereal disease, arrest, or confinement.
9. Willful violation of flying regulations resulting in suspension from flying as a punitive measure, or as adjudged by responsible authority of the Member's Service.
10. Suspension from flying for administrative reasons not due to injuries or disease, even though the Member may have been eligible for or was being reimbursed at the time of the administrative grounding because of a previously established disability.
11. Loss of life shall not be deemed as loss for purposes of this insurance.
12. Primary duty requiring parachute jumping.
13. Voluntary suspension from flying.
14. A disease or disability preexisting the effective date of coverage, or a recurrence of such a disease or disability, whether or not a waiver has been authorized by appropriate medical authority in accordance with regulations or directive of the service concerned, *unless the Member was insured under the master policy issued to the Air Force Association for 12 continuous months immediately prior to the date disability (grounding) commenced.*

Underwritten by Mutual Benefit Health & Accident Association (Mutual of Omaha).

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AFA FLIGHT PAY PROTECTION PLAN

AIR FORCE ASSOCIATION • MILLS BLDG. • WASHINGTON 6, D. C.

Send me my Flight Pay Protection Policy.

BILL ME FOR:

$_____ semiannual premium (1% of annual flight pay, plus $1 service charge)

$_____ for full payment of annual premium (2% of annual flight pay)

I ENCLOSE:

$_____ semiannual premium (1% of annual flight pay, plus $1 service charge). Bill me every 6 months

$_____ in full payment of annual premium (2% of annual flight pay)

This insurance is available for AFA Members only ☐ I am an AFA Member ☐ I enclose $6 for annual AFA membership

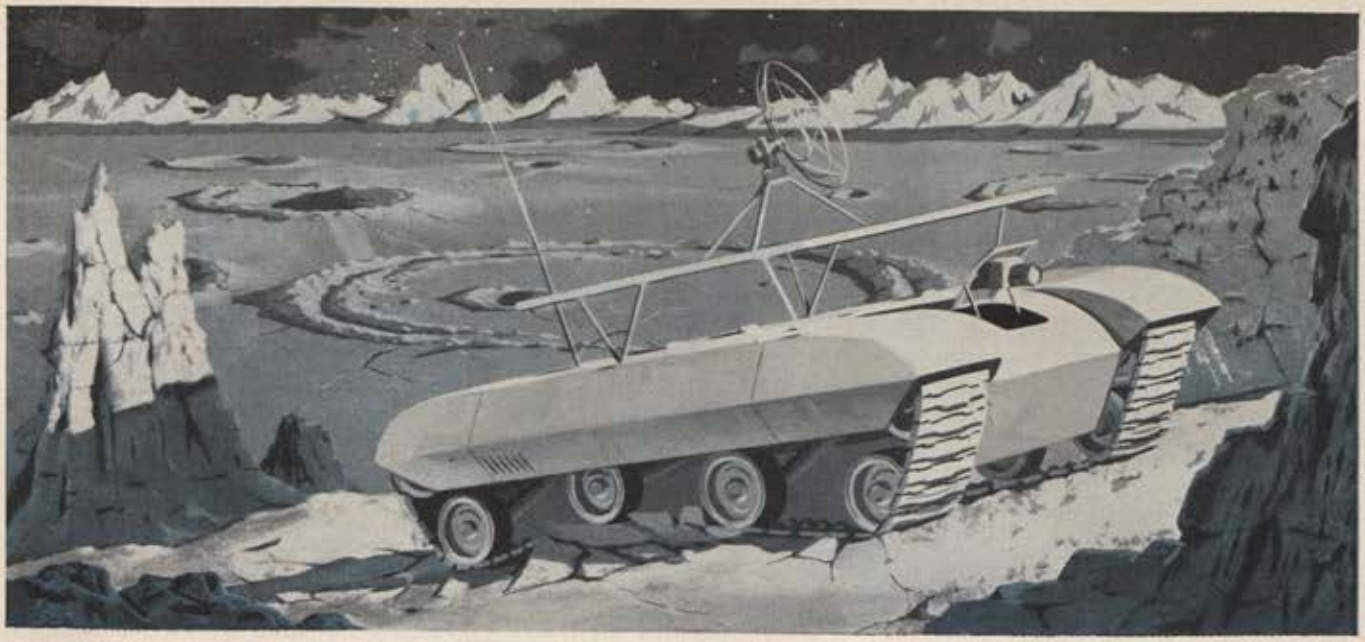
Rank (please print) Name Address

City Zone State $ Annual Flight Pay Years Service for pay purposes

I understand the conditions and exclusions governing AFA's Flight Pay Protection Plan, and I certify that I am currently on flying status and entitled to receive incentive pay and that to the best of my knowledge I am in good health, and no action is pending to remove me from flying status for failure to meet physical standards. I authorize AFA, or AFA representatives, to examine all medical records pertinent to any claim I may submit.

Signature of Applicant Date

Underwritten by Mutual of Omaha 8-60



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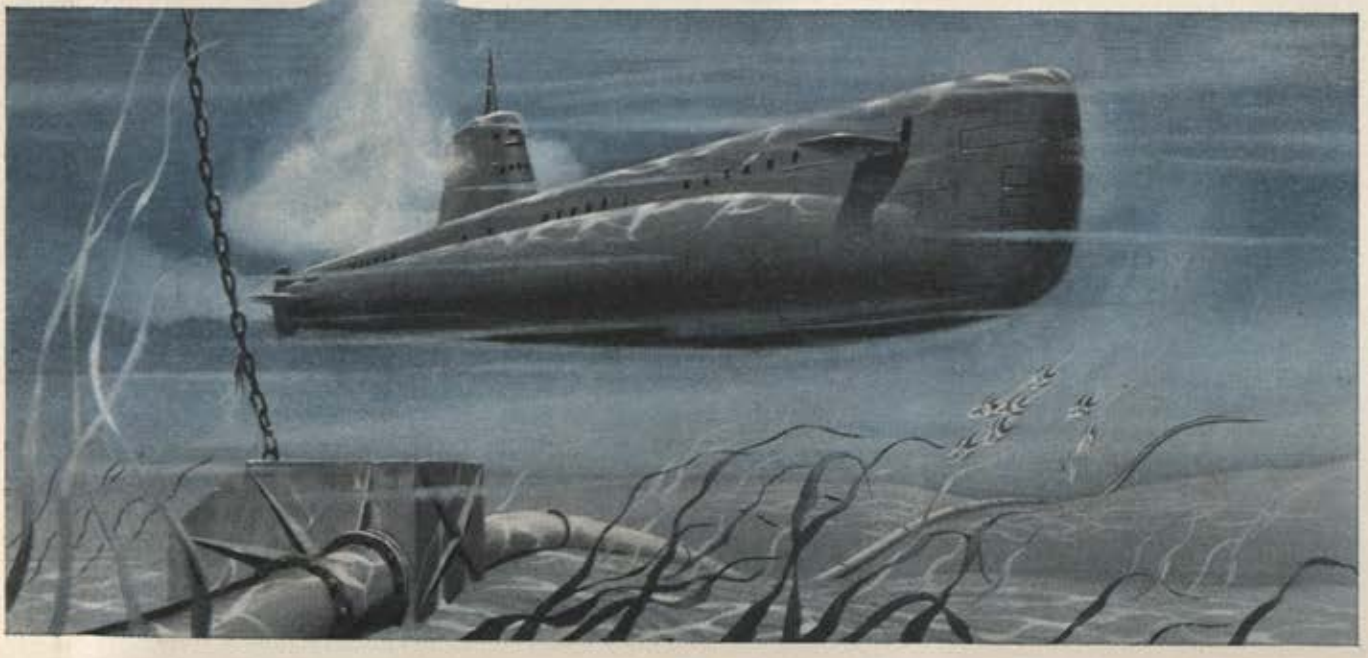


B-52, above, and Atlas, below: Elements of deterrence.

AIR FORCE
AUGUST 1960

The "big stick," the strategic deterrent force, is the *sine qua non* that establishes the military context of our times. In today's world, however, the nature of deterrence and of today's strength changes day by day. The only constant in our current strategy equation is the fact that our planners now have no room for error . . .

1960 STRATEGY ON TRIAL 1970

John F. Loosbrock
EDITOR, AIR FORCE/SPACE DIGEST

This article is from a forthcoming book entitled American Strategy for the Nuclear Age, *edited by Walter F. Hahn and John C. Neff, to be published by Doubleday & Company, Inc., in the fall of 1960. Other contributors include the late Dr. John von Neumann; J. Edgar Hoover; Dr. Stefan T. Possony, Professor of International Politics, Georgetown University; Albert Wohlstetter and Herman Kahn of the RAND Corporation; Dr. Henry A. Kissinger, Center for International Affairs, Harvard University; Prof. W. W. Rostow, Center of International Studies, Massachusetts Institute of Technology; Dean Acheson; and David Sarnoff.*

IT IS A strange paradox that, in a time when science is making profound impacts on the tools and concepts of war, military planners are denied, and happily so, the advantage of the ultimate in scientific procedure—the controlled experiment to determine the validity of their theories. Revolutionary new weapons, strategy, and tactics must now be considered and accepted without prior trial in war. Nor can bets be hedged by retaining the tried and true while adding the new. There are no Indian campaigns, no border skirmishes to blood our forces and try our new weapons. We must choose, now, and accept the risks. We must be prepared at any moment to go with what we have.

This is a hard burden, for coupled with this essentially military problem is a dynamic power struggle between two large blocs of nations, each led by countries almost equally rich in essential elements of military power but with antithetic political ideologies. Thus, in a world which is politically and militarily unstable, military plans must be under constant review. They are conditioned by such factors as national policy, relations with allies, enemy capabilities, technological developments, and, not least, the economic price the nation is willing to pay. Some of these factors can be predicted quite accurately; others cannot. But plans must be laid on the basis of what is known or can be perceived. And we can arrive only at guidelines, not dogmas.

On this basis, three general military requirements appear to be valid for this nation into the 1970s. They are proposed in the interest of deterring a general war through a combination of measures and of deterring, or localizing, lesser conflicts so that the basic position of the free world is not substantially threatened. Should the deterrent posture fail to deter, then the resulting conflict must be won. And, indeed, the weight of evidence indicates that a posture that can win a general war is by its very nature the kind of posture that can deter both it and lesser conflicts.

Within this framework, the first requirement is for strategic delivery forces, able to absorb a surprise attack and still deal a crushing blow. These forces are the heart and core of deterrence, both of general and of limited war, the *sine qua non* which establishes the context in which all other forces and actions must be studied.

The second requirement is for defense measures, both active and passive, should the enemy, either through an irrational act or a wrong evaluation of our offensive power, attempt to overpower us with a massive, surprise onslaught. Active defenses against a determined air attack do not have an encouraging history. The Battle of Britain was won with a defense that was less than ten percent effective, not close to good enough against thermonuclear weapons. Intercontinental missiles have got the problem well-nigh out of control, but there will always be a place for active defense as part of an ante-raising proposition to discourage attack. Passive measures, to protect our retaliatory forces and our civil population, are still another card in the ante raising and one which, by and large, has been neglected.

The combination of offensive and defensive strength which serves to deter the enemy from launching a general war will also discourage lesser forms of military aggression. The small war may get out of control and bring down the full strength of our offensive power upon the enemy homeland. Nevertheless, he may be willing to take that chance, and we must be prepared for such an eventuality.

The third military requirement, therefore, is to be prepared to meet limited aggression, wherever it may occur, quickly and in a manner best suited to achieve our national objectives. The forces to accomplish this must be based on careful consideration of the probable extent and nature of limited war, the weapons which may be used, and the size and nature of the threat to our national objectives.

Since defeat in a general war would mean the end of our free existence as a nation, it is clearly the more serious threat. Likewise, the threat of limited aggression is related directly to the relative general war postures of the United States and the Soviet Union. So long as we maintain a superior general-war capability, so long as we maintain a clearly definable deterrent margin, all forms of Soviet military and political aggression will be inhibited. If the deterrent margin shrinks, or disappears, the Soviet Union will have almost complete freedom of action, militarily and politically.

Our ability as a nation to retaliate swiftly and decisively, then, stands as the keystone of our deterrent philosophy.

In happier, less complicated days, even as recently as a decade ago, the doctrine of deterrence was comparatively simple to enunciate and to carry out. It was not much more involved than Teddy Roosevelt's "walk softly and carry a big stick." Perhaps even less complicated, since during the pre-Korean period the United States not only possessed the only big stick in the world but held a monopoly on the means to deliver it as well.

These days are gone forever. The technological revolution has also exploded behind the Iron Curtain, where it is being exploited shrewdly and with great determination. Deterrence is becoming a two-way street and, with this evolution, has taken on subtle and sophisticated overtones. The big stick grows ever bigger, yet it must now be handled with the delicacy and finesse of a rapier.

One arrives at a complicated equation, not susceptible to the kind of simplification usually resorted to in public debate over "missile gaps." The effectiveness of our retaliatory force, and hence of our deterrent posture, is not just a matter of quantity, nor of quality, although neither factor can be ignored and their relative importance will vary according to the weight of other factors. If the problem can be simplified, perhaps it is fair to say it boils down to survival and

penetration. The force must be able to leave here and get there.

For purposes of discussion the problems of survivability and penetration capability will be considered separately, although even this dichotomy will necessarily be artificial.

One way to ensure the survival of enough of the force to retaliate decisively is through sheer weight of numbers. The more bombers and missiles we have, the more the enemy must destroy in order to cut his homeland damage down to an acceptable level. Numbers will never cease to be important.

Another element of survivability is the state of the active air defense system. Every enemy bomber or missile stopped short of the target adds to the number of weapons delivered on his homeland targets.

A third element is reaction time, which is steadily shrinking under the impact of increasing speeds of delivery systems. If you're gone when he gets there he can't hit you—but you still have the power to hit him.

Dispersal is still another factor in survivability. It multiplies the number of targets which the enemy must destroy before he feels that retaliatory destruction is reduced to a level he can accept. In the case of manned bombers, the ultimate indispersal is the so-called airborne alert—vertical, rather than horizontal, dispersal.

Still another method of reducing the vulnerability of the retaliatory force is through hardening—placing weapons and their command and control systems far enough underground that almost a direct hit is needed to put them out of commission.

Mobility—landborne, seaborne, airborne—also is a key method of reducing vulnerability and one that is taking on increasing importance.

But in an age of intercontinental missiles, with thirty minutes' travel time from launch to a target 6,000 miles away, perhaps the most single significant element in reducing vulnerability lies in the field of warning against surprise attack—both tactical warning that an attack is actually on the way, and strategic warning of signs that an attack is imminent. The latter truly encompasses the broad field of intelligence.

Thus it is seen that technology has introduced no radically new elements into the survival equation. One increases the size of his forces, one either digs in or moves about, one learns all he can of both the enemy's capabilities and his intentions so as to survive and counterattack. What technology has done is, in effect, to turn the entire world into a battlefield, with room for error eliminated for all practical purposes. There are no opportunities for muddling through. Either you're right or you are dead.

Through a combination of all or part of the above measures a substantial part of the retaliatory force will be spared in even a surprise attack and will be dispatched against enemy targets. The effectiveness of this measure will be measured in terms of its penetration capability—how many warheads get through to how many targets and with what degree of accuracy. Looking to the future once more, the advent of the intercontinental ballistic missile has simplified the penetration problem, inasmuch as, at the moment, there is small prospect of an active defense system that can detect, identify, intercept, and destroy a warhead before it reaches its target. Likewise the manned bomber, using the so-called standoff missile or air-launched ballistic missile, is less likely to have to fight its way through active defenses to the target. The thermonuclear warhead has an area of destruction which puts a much lower premium on accuracy than in the past although both US and Soviet achievements in missile accuracy have been little short of phenomenal. This latter factor, incidentally, is important because 1) it reduces the number of missiles required to inflict an unacceptable level of damage and 2) it makes of the intercontinental missile a truly counterforce weapon rather than a city-destroying instrument of vengeance.

Technological developments of the past two decades, then, have vastly increased and complicated the problems of survivability of the retaliatory force while vastly easing the problems of penetration to target. The pendulum of advantage has swung far in favor of attack versus defense and concomitantly, in the political context of the times, has given the potential aggressor, with the twin advantages of surprise and initiative, a well-nigh incalculable degree of superiority, all else being equal.

On the brighter side, however, the same technological successes which have brought us to this impasse may well carry within themselves the seeds for solutions to the very problems which they have created. More on this later.

In terms of hardware, our strategic forces are in a period of transition from a manned bomber force to one composed of both missiles and bombers. The mixed force will give a flexibility of employment above that of either an all-bomber or an all-missile force. Through this decade the mix will be progressively weighted in favor of missiles until by 1970 substantially more than half of the long-range delivery forces will be equipped with Atlas, Titan, Minuteman, and later-generation intercontinental ballistic missiles, reinforced by intermediate-range ballistic missiles in the hands of our west European allies. If the logic of survivability is followed, these weapons will be securely housed in hardened sites and dispersed both within the continental limits of the United States and in overseas bases. In addition, the mobility element will be introduced, with Polaris intermediate-range ballistic missiles in submarines at sea, and with Minuteman and its follow-on missiles which are designed for landborne mobility.

An unforeseeable fraction of the force will be invested in spaceborne systems within the decade, if not in delivery systems as such, then at least in early-warning, surveillance, and command and control sys-

(Continued on following page)

tems. No one can predict with accuracy all of the military applications that will result from exploitation of space technology. However, it appears that the advent of space vehicles, manned and unmanned, will provide the ultimate in target accessibility, intelligence, and early warning.

In the period under discussion there will continue to be tasks which manned bombers can perform better than missiles. Among these are the destruction of mobile or ill-defined targets which require extreme accuracy, combat patrol missions, exploitation of an enemy defense system which has been degraded through missile attacks, and missions which require on-the-spot human judgment. The latter, of course, has to do with the great advantage of having part of your retaliatory force subject to recall in case of false alarm or concessions on the part of the enemy. It is highly dubious that we will ever wish to stake all on a missile system that must continue on to target once launched. The stakes are too high and the danger of war through accident or miscalculation too great.

The strategic progression of the United States and Russia over the next decade, short of general war, appears to be toward the development of two mutually invulnerable strategic delivery systems, forces which can wreak unacceptable damage upon the other nation regardless of who starts what, or when, or how. In such a case, a true nuclear stalemate will have been reached, and there are many who feel that such a stalemate is the only chance for world stability.

But stalemates do not last forever, and the rewards for breaking one of this magnitude will be high, high enough to tempt an aggressor into actions designed to do so. As a result it will be to our advantage to explore methods of reducing the mutuality of deterrence, placing us once more in a position where our deterrent factor is positive and measurable, as it was when we possessed a monopoly of nuclear weapons and their delivery systems.

There are several ways through which this goal may be pursued, and while their pursuit should not divert us from our quest for an invulnerable retaliatory force, neither should their importance be sloughed off as incidental to the main problem. They must be sought in addition to, and coincidentally with, the achievement of invulnerability. Indeed, they may be said to contribute directly and indirectly to our over-all deterrent posture.

One of these is the development of an improved limited-war capability above that provided by the protective umbrella of the retaliatory force. This is essentially a tactical job, with forces designed for quick reaction, global mobility, and selective application of power to include nonnuclear weapons if the situation should so dictate. It includes a modernized airlift capability for small numbers of ground troops to act as the "starch in the collar" for indigenous forces, hopefully to be supplied by the enlightened self-interest of our allies.

A second field for exploitation is that of protection of our military and civil population against fallout and other radiation hazards, provision of continuity of government on local, state, and national levels, and insurance of national economic recovery following a general war. Herein would appear to lie a fruitful and purposeful mission for the bulk of our reserve forces.

The third field for exploitation in the stalemate lies in space. Actually, the need for military space vehicles is part and parcel of our guarantee of invulnerability of the force, but it has been selected for separate discussion because 1) the ramifications and implications project far beyond the time period under discussion and 2) because the potential for peace-seeking objectives in essentially military space systems has largely been overlooked.

Warning against surprise attack is the key to invulnerability. That is why we disperse our aircraft and place them on airborne alert; why we harden our missile sites and extend our radar; why we seek mobility in our missile systems. But mainly it is a problem of getting high enough and seeing far enough.

Up to now, our line of sight has been limited technically by restrictions imposed by airborne vehicles and politically by the existence, recognized in international law, of national frontiers in the atmosphere—frontiers which cannot be violated with impunity. Now our progress in ballistic-missile technology can be coupled with what some term "the electronic revolution" to allow us to keep sensitive warning, surveillance, and command and control devices in orbit to provide constant warning and control of aggression wherever in the world it might occur. Positive warning coupled with positive retaliation may indeed offer the world its first hope for intelligent, purposeful control of arms on a practical, rather than an idealistic, basis. Disarmament has long been a goal of well meaning people, in the mistaken belief that disarmament was synonymous with peace. Now it is possible realistically to think of peace under positive control by weapons of war, leading in the end to practical reductions in the world's crushing arms burden without opening the door of weakness to an aggressor.

It becomes obvious that we cannot do all that is to be done in the forthcoming decade within the economic restrictions currently imposed on military budgets. We are lagging behind in many fields. Granted, there is waste and duplication of effort imposed by the current defense organization, with its artificial lines of demarkation between service interests and responsibilities. We can immeasurably ease the economic burden by an organization which can concentrate resources where they are needed most.

But above and beyond this must come a realization that peace is not a penny-ante affair, that the competition will get rougher all the way along the line, and that we must make an investment large enough to ensure our security beyond a peradventure of a doubt—or the billions we have invested to date will be a total loss.

Our strategy of deterrence cannot be a matter of trial and error. It is constantly on trial, and there can be no room for error.—END

The development of a Mach 3 transport aircraft would require all-out government-industry effort. But it would be in the best interests of this nation and the free world. Only through concerted action now or in the near future are we likely to win . . .

THE COMING RACE FOR A MACH 3 TRANSPORT

Claude Witze
SENIOR EDITOR

DEVELOPMENT of a supersonic transport airplane has become a pressing economic and cold-war necessity for the United States.

The project may represent the biggest single challenge to the state of the aeronautical art since the Wright brothers first warped a wing to achieve stability in flight. It needs about a billion dollars of public money, high national priority, and firm leadership. Without them we face a loss of prestige second only to the technological defeat symbolized by Sputnik.

This demand on our pocketbook, our technology, and our national determination comes at a period when, for the first time in half a century, there is no adequate backlog of advances in military aviation on which the commercial development can lean. The existing military program in the realms of supersonic flight will continue to make contributions, but there is more required than can possibly come out of the fallout from requirements for Mach 2 and Mach 3 fighters and bombers.

On top of this there is an incipient and possibly fatal reappearance of the tug-of-war approach that marred our entrance into the space and missile era. The military, which means the US Air Force in this case, has the capability to conduct the complete development effort. It is the only agency of the government that has got it. Neither the airlines nor the aircraft manufacturers can afford to undertake the program. It is estimated that the entire world market for supersonic commercial transports would not run more than 150 units. Cost per aircraft: $10 million to $15 million.

So far as industry is concerned, both individual companies and spokesmen for the Aerospace Industries Association have made it clear there is no single firm or team approach possible without federal financing, at least of the research and development effort. First government office to recognize this appears to be the Federal Aviation Agency, which approached the National Aeronautics and Space Administration for a review of technological background on the feasibility of the supersonic commercial transport. This work has been done at NASA's Langley Research Center in Virginia, which came up with the conclusion that the supersonic transport is: 1) technologically

(Continued on following page)

feasible, 2) "of major importance to our survival" in the cold war, and 3) that it calls for "joint effort by the commercial operators and the US government under the FAA leadership." The law creating FAA gave it the responsibility and power to assume this leadership.

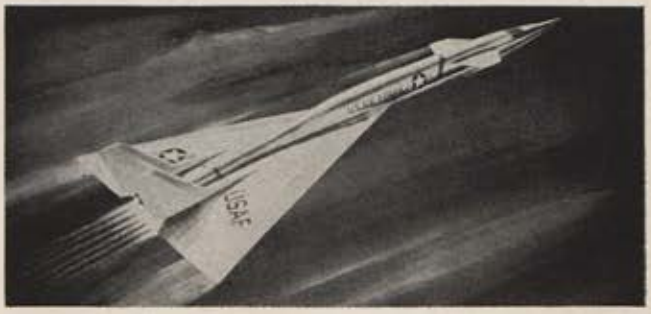
On top of this there has appeared the recommendation of a special subcommittee of the House Committee on Science and Astronautics, headed by Rep. Overton Brooks (D-La.). This group, which claims power of legislative oversight over the conduct of NASA, has come out bluntly for the vestment of "management functions" for the supersonic transport project in that agency. After a week of hearings the subcommittee concluded that NASA should take "immediate steps to assume leadership in devising an appropriate program for the development of a supersonic transport. It is the committee's considered view that NASA should be the management agency for any future program."

The report then went further. It gave an order: "The committee directs that NASA submit its detailed proposals to the Congress as they are developed together with recommendations for appropriate legislation. NASA is enjoined to maintain close contact with the committee and keep it fully informed of developments."

In directing NASA to take these steps the committee has ignored FAA's responsibility, NASA's reluctance and inability to assume development management, industry's experience, and USAF's existing machinery, well exercised in the development of weapon systems.

So far, there has been no open conflict or outspoken effort to provide proper leadership and a straightforward program leading to a supersonic transport. It is not likely there will be until the Administration changes next year. It is known that competent technical members of the NASA staff feel their agency should provide topnotch technical advice for the project. Since NASA's conversion to the space age from the old National Advisory Committee for Aeronautics, there has been a neglect of aeronautical areas, cited in testimony by airline and aircraft manufacturing witnesses, but the basic competence remains. NASA never has concerned itself with the management of aeronautical development projects. If given the task for the supersonic transport, it is estimated that it would take the agency about three years to obtain the necessary staff and train personnel for the work.

There is unspoken sentiment, on the other hand, for permitting FAA to assume the leadership with NASA in its traditional role as a technical consultant. Actual management of the development project, in this case, probably would be turned over to USAF's Air Research and Development Command, operating as an executive agent for FAA. ARDC, it is presumed, would set up a Weapon System Project Office (WSPO) or its equivalent, utilizing its staff, laboratories, and test facilities to press development of the airplane in the shortest possible time. Just as a military



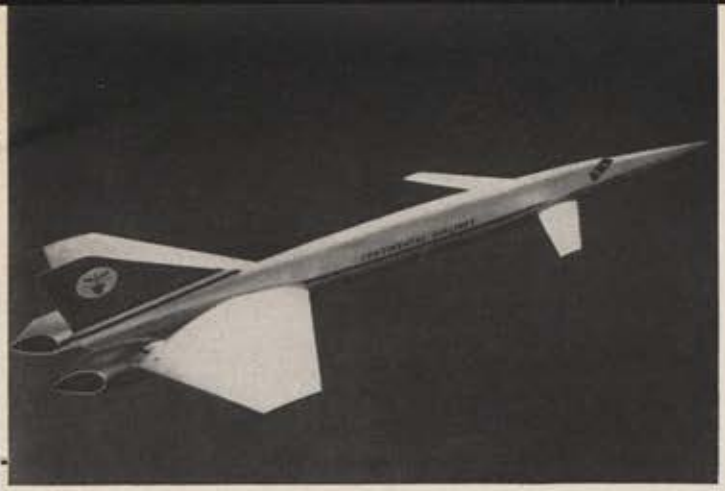
North American Aviation says it can incorporate major design advances of its B-70 bomber into a transport for commercial use. USAF looks upon the bomber as essential.

WSPO includes representatives of every command or agency concerned, so would this plan call for membership in the management group for FAA, NASA, the airlines, the aircraft manufacturers, airport operators, air traffic control experts, and others concerned with the myriad design, development, production, and operational problems.

With all of the current military interest in 2,000-mph and better aircraft, there is some tendency to assume that the supersonic transport can be a modified bomber, just as the Boeing 707 drew so many of its merits out of the history of the B-47, the B-52, and the KC-135 jet tanker. The supersonic transport cannot follow this pattern for many reasons, some of which go back to the cold-war competition we are in. The threat is from Russia, which is expected to attack on a new front, bringing a clash for both prestige and the hard business of selling airplanes and air transportation. Federal officials, airline executives, aircraft manufacturers, and other experts are almost unanimous in the opinion that the Reds will not hold back on the cost or the effort.

The most pessimistic predict Russia will fly a supersonic transport in 1964 and have the airplane on the international market not many years later. The most optimistic say that if we go into a sound program and do it quickly we can win. Our object will be to develop a Mach 3 transport. It is anticipated that the initial Moscow effort will be a Mach 2 airplane that will have more value as a propaganda tool—a Sputnik in the aeronautical race—than as a substantial advance in the aeronautical sciences.

There are sound technological reasons why the supersonic transport should be designed for cruising at Mach 3 or more. One of them is that a Mach 2 transport, made of aluminum and employing conventional aerodynamics, has no growth potential. The next step is the big one, through the heat barrier, and both the material and the configuration of the Mach 2 airplane will be outmoded for further application. Another little-recognized fact of life is that, even at Mach 2, we don't know much about the fatigue life of aluminum. USAF's B-58 bomber is capable of Mach 2 speeds for short periods of time only and in its brief life has flown at this speed only a few hundred hours. One of the great unknowns is how it would survive sustained Mach 2 flight and the constant stress and temperature changes it would encounter on two or



Continental Airlines is eager to put this supersonic transport on the run to Hawaii by 1967. It expects the airplane will be four times as productive as today's jets.

three round trips daily between New York and Paris. The design life of the supersonic transport will have to lie somewhere between 30,000 and 50,000 hours, many times that of a military airplane.

This need for flight experience is one of the critical factors now under consideration by the nation's top aviation experts. Both in industry and NASA it is accepted that new standards of reliability will be needed in Mach 3 passenger equipment.

In current industry discussions, including testimony before the House Committee on Science and Astronautics, there has been a good deal of talk about contributions to the supersonic transport concept by USAF's B-58 and B-70 bomber programs. They have helped to advance the state of the art, but the remaining problems, peculiar in many respects to design of a plane for commercial service, represent a frontier that has not been assaulted. The B-58's flight time, at supersonic speed, is negligible. The B-70 has yet to fly.

NASA, in a report prepared for FAA, has pointed out that the Mach 3 cruise part of a passenger aircraft design is not the major problem. Once the airplane is at its cruising altitude—about 70,000 feet—it will be just as efficient as present subsonic jet airplanes. It is the "off-design" areas that provide the headaches.

"The position in terms of state of the art might be briefly summarized," the NASA report says, "by saying that if the mission involved only flight at design supersonic speed and altitude, and no emergencies occurred, intercontinental ranges of commercial interest and importance could be readily achieved.

"The ladders by which the airplane climbs to its supersonic cruise speed and altitude and descends therefrom, however, have broken or weak rungs."

To the weak rungs of performance in takeoff, climb-out, inflight emergencies, and landing is added the sonic boom. The supersonic transport must be held to subsonic speeds until it gets to 35,000 or 40,000 feet altitude, and from there—upward and onward—it will have to pick a flight path that will ease if not eliminate cries of an indignant citizenry on the ground below.

Basically, the other weak rungs involve over-all flexibility of the design. While the airplane is designed to cruise at Mach 3, it must be capable of control and safe flight at lower speeds. The flight plan for a projected Mach 3 transport on the nearly ideal New York to Paris run calls for use of the afterburner for one minute at takeoff. Then the plane climbs at high subsonic speed with normal rated power out of its turbofan engines. At 25,000 feet the rate of climb will begin to drop off, and the afterburner will be turned on again to carry the plane through the sound barrier and to 65,000 feet, prepared to cruise above that level at Mach 3. This phase of the flight will take half an hour, cover 365 nautical miles, and will eat up one-third of the total fuel on board.

The airplane will cruise at Mach 3 with reduced afterburner temperature for about an hour and a half with the altitude increasing to about 73,000 feet. When letdown is started the engines will give minimum thrust and the plane set for maximum glide angle. It will decelerate to subsonic speed at 59,000 feet. Hold altitude is set at 35,000 feet; if it were moved to 5,000 feet the aircraft would require an extra fuel reserve of one ton, which would eliminate twelve passengers if taken out of the payload.

A flight plan like this, possible in the present state of the art, clearly calls for new developments in basic airframe and engine configurations. It also needs improvements in flight controls, communications, and meteorology. The airplane would carry 100 passengers and a crew of six. It would weigh 375,000 pounds, and fifty-five percent of the takeoff weight would be fuel.

The changes in airframe configurations probably will involve variable-sweep wings. This means that the pilot will be able to fly with them extended or in a sweptback position, providing a delta shape. They may be at the rear of the fuselage, with a smaller canard lift surface nearer the nose. So far as engines are concerned, none of those in being or in design has all the characteristics needed for the supersonic transport mission. It is possible that a new engine—a turbofan with new internal dimensions to change the bypass ratio—can be developed to provide better performance and more operating flexibility.

There are other problems, such as the necessity for 100 percent reliability in the cabin pressurization system, the one-engine-out emergency, and the fantastic cost of fabricating steel airplanes with present manufacturing methods. Traffic control will be complicated by the fact that the supersonic transport will be much like a bullet. "Once fired," says NASA, "it must proceed along a very precisely controlled flight path with little or no delay and with a large degree of dependence on automatic flight control and stabilization systems and rapid automatic traffic control over the entire route."

The magnitude of this technical job, which has even more ramifications, is what has staggered the industry and led it to agree unanimously on a new approach involving full government sponsorship of the research and development program.

"Our supremacy as a producer of the world's civil transport aircraft is an enviable position, of great importance to our economy and to our national prestige," declares FAA Administrator E. R. "Pete" Quesada. "It goes without saying that foreign competition in production of aircraft is earnestly and effectively striving to make inroads on our position."

Our task is one that calls for good leadership and the best possible utilization of our talent and facilities. Anything less can bring defeat on another front in the cold war.—END

Disarmament, a worthy end, is often viewed through rosy glasses. Here, a special report by the National Planning Association spells out

THE CRUSHING BURDEN

Over the years, the proponents of peace through disarmament have held out the hope that some day the world may be relieved of the "crushing burden of armament," and all sorts of rosy plans have been proposed as to how best to spend the money thus saved. Lately, however, it is being recognized that, perhaps, those who know something about arms and their uses might have something to contribute to the thinking about methods of controlling armament.

Largely as a result of these new inputs, the icy winds of reality are beginning to disperse the rosy clouds of naivete. It is becoming quite clear that there is no cheap road to peace and that, indeed the world might eventually have to face up to what one could call the "crushing burden of disarmament."

It is an ill-kept secret that the Coolidge Committee Report on disarmament problems, not yet made public, started from the premise that the road to arms control lay, paradoxically, in achieving a much stronger national military posture, which would mean spending more money right off the bat. Further, supposing that a workable arms-control agreement could be achieved, the cost of the hardware and personnel needed to police such an agreement might well equal or exceed present arms expenditures for an extended period of time. For this reason, it is highly unlikely that a budget-minded Administration will see fit to release the Coolidge Report.

Private groups, however, are not hampered by official secretiveness. A recent conference at Arden House, Harriman, N. Y., tacitly accepted the premise that we must start our arms control effort from a position of strength through a diversified deterrent force, protected through a combination of early-warning and reconnaissance measures, mobility, and hardening—a sort of unilateral keeper of international order. The conference went on to recommend increased governmental and private activity air research and planning of arms control measures and emphasized the necessity of a permanent staff within the government to specialize in these problems.

Buttressing this point of view is an even more recent report by the Special Committee on Security Through Arms Control of the National Planning Association. The report decries our lack of organized preparedness for disarmament conferences in the past, stating that the United States has consistently approached the conference table with "jerry-built policies and hastily recruited personnel." The report discusses the problems that must be resolved to make our arms control efforts meaningful.

The concluding section, on the operational aspects of arms control, contains much food for thought for military men, who tend to be innately distrustful of arms control proposals—and for good historical reasons. No matter how thin you slice it, however, the operational aspects of arms control boils down to a military mission, and discussion of them desperately needs the contributions of thinking military men.

Following is the pertinent section of the National Planning Association report.—THE EDITORS

OF DISARMAMENT

AFTER a disarmament treaty has been adopted, there will be new tasks concerned primarily with enforcement, inspection, maintenance of records, and preparation of reports.

A treaty may provide that the nations, individually or in groups, shall inspect each other, or it may set up an impartial international inspection agency or one composed of national contingents. Such an international agency would have its own problems of recruitment, record keeping, ascertainment of information, and receipt and verification of data. It would operate inspection stations, involving technological, scientific, and transport facilities. It might conduct laboratory projects for the improvement of detection methods. It would possess detection equipment, aircraft, and data-processing machinery.

But, regardless of the type of inspection organ that comes into being, additional jobs will fall on the shoulders of the individual participating governments. Each government, under the reciprocal rights and duties created by an arms control treaty, will acquire some new functions as a *controllee* and some new functions as a *controller.*

As *controllee,* the government will be obliged to take certain actions and to make reports thereon. It will accord controllers access and safe conduct and will answer interrogatories or charges of violation. For this purpose it will establish channels of liaison.

As *controller,* a government would maintain relations with the central office of the control body, and participate in its direction, attending meetings of a governing body and of committees. To the extent provided in the treaty, the government would participate in the recruitment, screening, and management of personnel. It would also arrange for any direct participation by its own personnel.

And, parallel to its controller interest, a government would continue certain lawful independent operations to detect violations and to satisfy itself of the reliability of the control. Now, for example, the United States has substantial machinery for the detection of nuclear tests and missile tests anywhere in the world.

These activities will obviously not be abandoned because they are also performed by an international inspectorate. Their continuance will have the dual value of: 1) checking on other countries, and 2) checking on the reliability of the control organ. And obviously all governments will pursue a similar practice.

The operating responsibilities that would arise under a treaty are different from the decisions and planning of the pretreaty phase. They will require a large organization, including personnel who will provide transport facilities, perform liaison functions between American military and the inspectors, and operate the kind of technical equipment that is now being used to perform similar tasks.

In brief, these are the tasks that must be performed by the operating agency:

1) Contributions to *policy planning*
2) *A headquarters to control inspection operations*
3) *Liaison units in the field to perform the obligations of the controllee and maintain relations with the control organization*

(Continued on page 57)

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4) *Inspection units in the field* and liaison units with control organ headquarters
5) *Research and development* to maintain progress in detection methods

There are a number of places in the United States government where these operations could be located.

As we have seen, some have suggested the creation of a new "peace agency," which would have responsibility for all matters connected with disarmament.

On the other hand there is a close similarity between many control functions and many functions now performed by the military. These could be duplicated only at great expense. The armed services will be prepared to perform liaison services and to supply transportation and machinery.

The tools of inspection will be many, complicated, and expensive, and will often be the same tools that are now being built by military establishments. Examples are reconnaissance satellites, inspection aircraft, air sampling, and seismic detection devices.

In terms of discipline, behavior, organizational procedures, institutions, and system, the military is much better constituted for carrying out routine inspection operations than are civilian agencies.

The work will require extended duty in remote outposts. The Acheson-Lilienthal Report said, in commenting on the difficulty of recruiting scientists as disarmament inspectors:

> The difficulty of recruiting enforcement officers having only a function of prohibiting, detecting, and suppressing is obvious. Such a job does not appeal to the imagination. Its future opportunities are obviously circumscribed.

But men who elect the military life have accepted such hardships, and have entered a system that has provided the necessary incentives and compensations.

The Russians will probably delegate these tasks to the military, and a parity of personnel will make for smoother relations.

Against the suspicion that the military, traditionally negative toward arms control, would be reluctant and uninspired in its management of arms control operations, must be balanced the argument that the Department of Defense should be given an opportunity to learn that arms control is an essential ingredient of a security system and should acquire a vested interest in supporting arms control, rather than in opposing it. It is to be hoped that military officers who take a broad view of their functions will inevitably tend to see arms control as an indispensible element in the security mix.

When a treaty is adopted, the military will probably be ready with the equipment and personnel to perform the job immediately, while any alternative arrangement will involve duplication of activity and difficult organization problems.

The primary need in the arms control field is constructive and well planned action. For fifteen years our disarmament effort has been unable to get off dead center. Meanwhile, the problem is growing increasingly difficult and some developments have made control almost impossible. Soviet intransigence has on many past occasions tended to exonerate us before the bar of world opinion, but the threat of modern warfare remains. Our problem is not merely to win a debate or to gain the support of world opinion—it is how to achieve a solution that will prevent world catastrophe.

Our greatest need is the capacity to study alternative policies, to make decisions on positions, and then to negotiate them. This means being flexible toward proposed alternatives or compromises when they are steps directed to desired goals; it means resisting them firmly and self-assuredly when they are not.

We are dealing with an issue in which the stakes are so high that there is a natural reluctance to take positions. We are also dealing with an issue of which different branches of government take different views. Our problem is not to suppress these views but to establish a government organization and procedure through which they can be fully considered so that valid arguments can be separated from invalid ones, risks can be balanced, and policies can be evaluated.

We need a permanently based body of experts who know the subject well, and who know how to relate it to all germane subjects. We need a flow of reliable information on political and scientific matters. And we need a staff that can present facts, issues, and alternative proposals to the President for decision.

We need positions that derive from clear-cut policy. Without firm policy decisions, negotiators are hamstrung and inflexible. On the one hand, their attitude may be overly negative; on the other hand, it may be too easily influenced by proposals of the opposite side that exploit world attitudes or domestic political situations. If negotiators do not have a broad policy behind the specific proposals, they cannot decide whether a new formulation is in accord with American policy or not.

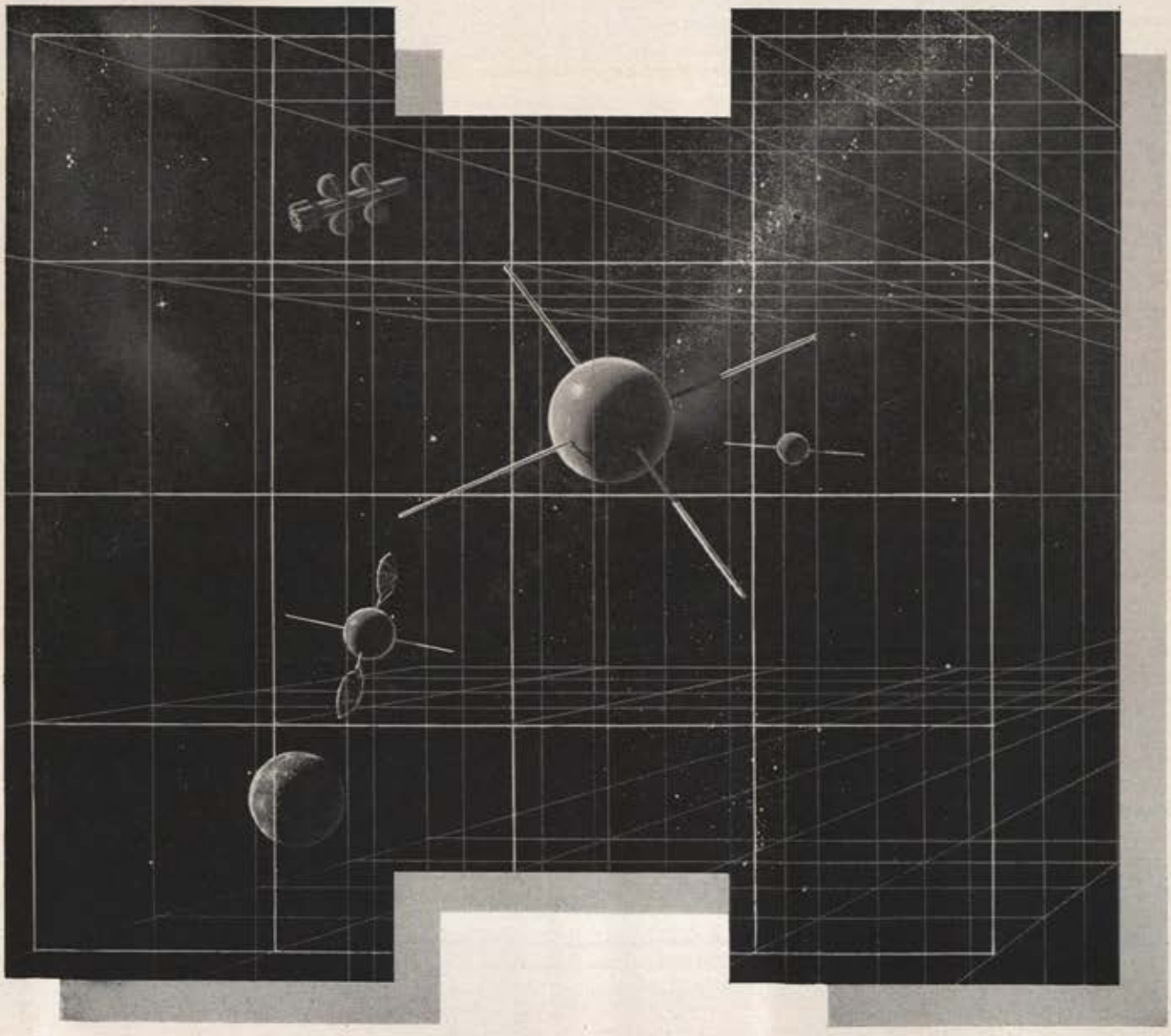
We need negotiators who are equipped to pursue the issue with knowledge and with persistence, who have clear access to the sources of decisions, and who have the full confidence of their administration.

A good administrative plan will not suppress bureaucratic differences, but will assist in clarifying and resolving them. It will not reduce the work load of the President, but will make it more fruitful. It will not revise the intentions of the Communists, but will enable us to exploit more effectively whatever opportunities can be discovered through persistent effort.

Finally, it should be noted that an informed Congress and an informed public opinion are indispensable to the policy-making process. The Senate Disarmament Subcommittee has performed useful work in exposing the Congress and the public to the many problems and issues which confront the disarmament planner, and there can be no question that its support and prodding has caused the executive branch to give increased emphasis to arms control work. This congressional interest has been of tremendous importance, and should be continued.

In short, we should proceed now to strengthen the government's capability to deal with the problems of arms control vigorously, dynamically, and continuously.—END

How to take a satellite



census

At present rates, man will soon have space cluttered with numerous orbiting objects. These objects are creating a major space-age problem.

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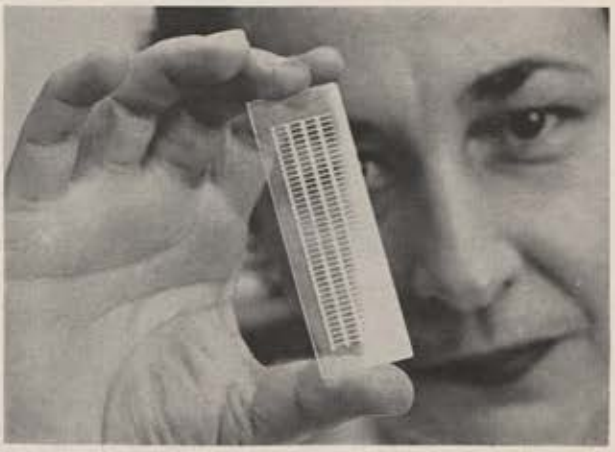

These capabilities require a new beam-scanning technique, a major step beyond frequency or phase control of arrays. This kind of advance is typical of the work done by Hughes in radar.

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USAF's Korean War experiences produced a new generation of combat flyers and aircraft. One byproduct is today's F-104 Starfighter, record-setting follow-on to the F-86 of Korean fame. Here a top jet ace of the Korean air war, recalling the lessons of MIG Alley, cites the F-104 as . . .

Above, the F-104, a "new approach to a superiority fighter" that resulted from Korean fighting.

A FIGHTER PILOT'S AIRPLANE

Lt. Col. James Jabara, USAF

COMMANDER, 337th FIGHTER-INTERCEPTOR SQUADRON

ON DECEMBER 18, 1950, an F-86 Sabrejet in its first combat over Korea shot down a Russian-built MIG-15. The North American jet which, at the time, held the official world speed record of 670.981 miles an hour, was the best air-superiority fighter possessed by the free world during that period.

We can certainly be thankful that we had this machine in our inventory, for we would have fared rather badly trying to fight MIG-15s with F-51s, F-80s, and F-84s.

However, by way of contrast, today's F-104 Starfighter is the only airplane in history that has simultaneously held all three official world's records—speed, altitude, and rate of climb. We have, in other words, come some distance since the day of the Sabre. I will here attempt to analyze the aircraft concerned from a fighter pilot's viewpoint.

Much has been written and said in comparing the performance capabilities of the F-86 and the MIG-15. Certainly most fighter pilots felt that the MIG was a higher-performance airplane above 30,000 feet. Only in the latter stages of the Korean War, when we received the F-86F, could we raise this altitude factor to 35,000 feet.

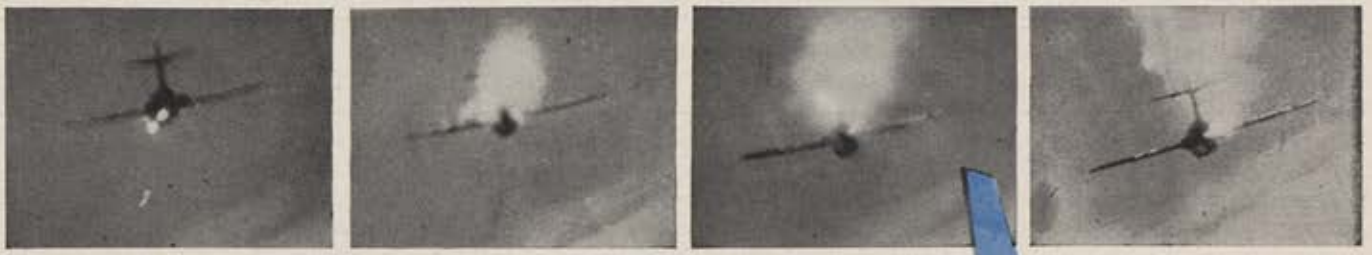
However, this increase in ceiling was offset by the fact that when we did receive the F model, most of our initial contacts with the MIG were above 40,000 feet. To say the least, it was both highly impressive and yet extremely depressing to see a MIG pilot loop his aircraft at 51,000 when we could barely stay in the air at that altitude. I am certainly not trying to downgrade the fighting qualities of the F-86; it had many advantages over the MIG—in fire control, range, diving ability, and ruggedness—all of them vitally important in the business of shooting down airplanes.

The Sabre was certainly a credit to its designers and manufacturers, but the fact remains, the MIG could outperform the F-86 at any altitude, except in a dive, and was a better fighting machine at the higher altitudes. The answer, of course, to our huge success over the MIG lay in the aggressiveness, discipline, training, and leadership of the USAF fighter pilot. We've all heard the phrase "guts will take the place of skill" in fighter combat. This is true. Nevertheless, superior aircraft performance can take the place of both. If you can fly higher and faster than your opponent and want to get the job done badly enough, then you're going to win.

Under the outstanding leadership of World War II flyers such as Brig. Gen. (then Colonel) John C. Meyer, Col. Glenn T. Eagleston, Col. Francis S. Gabreski, Col. Walker M. Mahurin, and Col. James K. Johnson, we adapted both ourselves and our training from World War II tactics and experiences to the 700-mile-per-hour capability of the F-86.

Always, aircraft performance was a primary factor in deciding the tactics to be used. This was especially true during the last six months of the war when most of the fighting was carried out on the MIG pilot's terms, since many of the initial contacts were made above 45,000 feet.

The original fire-control system of the F-86 was one of our greatest deficiencies. We had a World War II gunsight and World War II guns. Hitting a MIG at angles off of more than fifteen degrees and range of 1,500 feet was nearly impossible with the short firing time available in high-speed jet combat. Our primary advantage was the high rate of fire of the .50-caliber gun, even though the destructive power of our ammunition could not compare, projectile for projectile, with the 37-mm and 23-mm cannon shell of the enemy.



An F-86 Sabrejet scores a kill on a Russian-built MIG-15 in air war over Korea. In many ways, the MIG was superior to the best that the free world could send into the air during the Korean War. But USAF pilots and the Sabres they flew racked up top-heavy score against Reds despite odds, other factors.

The later acquisition of the radar gunsight in the F-86 was probably the greatest single improvement of the airplane during the Korean War. Expert gunners such as Lt. Col. Vermont Garrison and Maj. Manuel J. Fernandez could hit a MIG at 3,000 feet and high angles off with the radar gunsight, and the shooting problem was also considerably lessened for the more inexperienced pilot.

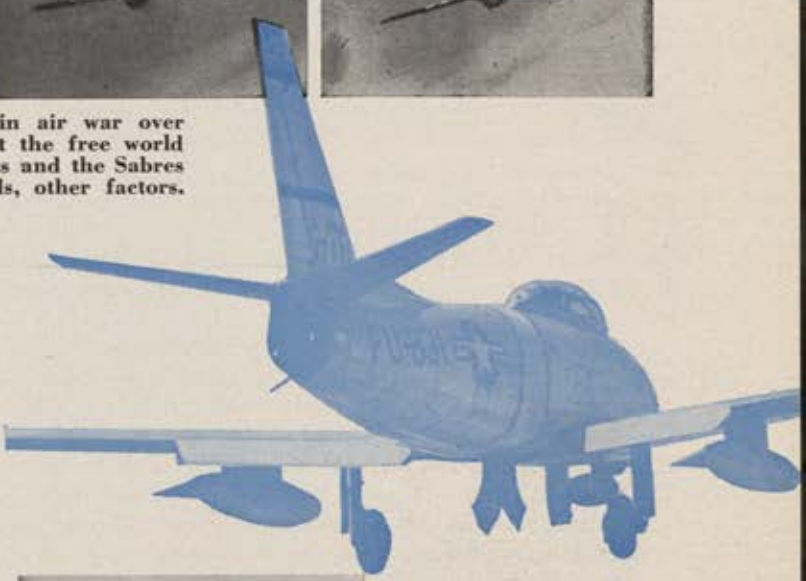
Probably the MIG airplane's greatest deficiency was the lack of an effective fire-control system. The superior flying performance was considerably offset by this problem. Its slow-firing, long-range cannon proved very effective against the B-29s, for which it was designed, but it proved less effective against fighters when split-second accuracy was required. Most pilots preferred the F-86 armament but generally agreed that we needed a fast-firing cannon with enough destructive power to make it possible for one hit to do the job. Except for the gunsight itself then, we fought the Korean War with World War II armament.

Safety equipment in the F-86 imposed a weight penalty in combat. However, our pilots believed that we had a better fighting airplane, considering all aspects, even though we were outperformed. The weight of the MIG airplane remained light through elimination of unnecessary weight. The MIG had armor plate, an ejection seat, and a German high-speed ribbon parachute. In addition to these conventional safety features, the Sabre had an emergency fuel system and an alternate hydraulic system. Weight conservation was not a primary consideration in designing systems and parts.

You will get a variety of opinions from fighter pilots on the subject of safety gadgets, and the resultant weight penalty, but the one fact remains, the greatest safety factor in combat is a superior performing airplane.

As in the case of Spitfires during the Battle of Britain, F-86s were fighting against heavy odds in Korea. Approximately 800 MIGs were based in Manchuria and China. The Soviet Union had supplied China with more sweptwing fighters than the United States had even produced. It was common to encounter 150 or more MIG-15s twice a day against no more than thirty-two Sabres. The 4th Fighter Wing, with a World War II record of 1,016½ enemy aircraft destroyed, had fought steadily rising odds, eventually reaching as high as ten to one. When the 51st Fighter Wing converted to the F-86, these odds dropped to seven to one.

Korea was a valuable training ground. Many of our pilots were getting their first taste of combat. Eleven of the initial 4th Fighter Wing aces were in World War II, but even the "old pros" had not received the necessary training to stay proficient. Targets and ranges for adequate gunnery training were not available in the States. Some of the younger pilots fired their guns for the first time on actual combat missions.



Colonel Jabara became the first jet ace in history in the skies over Korea at the controls of a F-86. At war's close he was a triple jet ace, one of the world's top pilots.

(Continued on following page)

Recommendations for training in gunnery and high-speed tactics were sent back to Stateside units and to the USAF Weapons School. The need for more as well as better training was apparent. As Korean veterans filtered home for instructor duties, training programs were changed to incorporate the newly acquired lessons. Eventually, replacement fighter pilots were an excellently trained group.

Experienced pilots, however, wanted a new approach to a superiority fighter. There were many grumblings about our disadvantages, from Korean returnees, especially in regard to aircraft performance. The late Gen. Hoyt S. Vandenberg personally heard these tales of woe.

He was quite upset that his fighter pilots could not fly higher and faster than the Communists. He had personally directed the accelerated development and procurement of the radar gunsight. General Vandenberg now gathered together an experienced group of fighter pilots and discussed with them the requirements which they felt were necessary to produce the finest fighter we could envision, a "fighter pilot's airplane."

Lockheed Aircraft Corp. stepped up to meet the challenge. The year was 1951. The need was for a lightweight, high-performance fighter. It was to be light, fast, easy to fly, and simple to maintain. It would provide a Mach 2 superiority weapon, have flexibility of armament and mission without major airframe modification, and be a weapon suitable for global or brush-fire wars.

The single-place, supersonic F-104 Starfighter was the result. On February 27, 1954, the first prototype became airborne on a high-speed taxi run at Edwards AFB, Calif., followed by a flight on March 4, 1954.

Lockheed experience with the X-7 ramjet, together with wind-tunnel tests, and studies of various wing plans revealed that an airplane with Mach 2 speeds coupled with a high thrust-to-weight ratio, required a thin, short wing. Being light, short, thin, and strong, the wing inherently helped boost the F-104 to ultrasonic speeds. Boundary layer control was developed to reduce landing speed. This was accomplished by directing high-velocity compressed air from the engine into the wing and out over the upper surface of the trailing-edge flap. Acting like vanes of air, these streams smooth the airflow over the wing and hold it to the wing surface. The resulting increase in lift decreased the landing speed by as much as twenty miles per hour.

In the early period of jet engine development, greater thrust meant larger, heavier engines. A big engine was not a guarantee of maximum speed since thrust gained in this manner can easily be more than offset by a weight penalty and the accompanying increase in drag. The need had therefore become critical for a small but powerful jet engine. General Electric met this requirement with their J79, a high-thrust, low-weight, axial-flow engine. While the J79 is not the highest thrust engine produced by American manufacturers, it is unprecedented in its thrust-to-weight ratio.

Lockheed armament engineers tested the M-61 Vulcan cannon, and recommended it as the best match for the performance predicted of the F-104. The Vulcan, named after the Roman god of fire, had borrowed two design features from the famous old Gatling gun. Each has a rotating cluster of barrels and is externally driven. This became the world's fastest firing gun, blasting some 6,000 rounds of 20-mm ammunition per minute, ten times the power of World War II machine guns.

The infrared guided missile was also in an advanced stage of development. The Starfighter was designed to carry both. Conceived and developed by scientists at the Naval Ordnance Test Station, China Lake, Calif., the GAR-8 (guided aerial rocket) Sidewinder is a homing missile, guided by an infrared heat-seeking device.

ADC interceptors carry one Sidewinder on each wingtip. The Vulcan gun actually becomes a secondary system because of the capabilities of the GAR-8 missile.

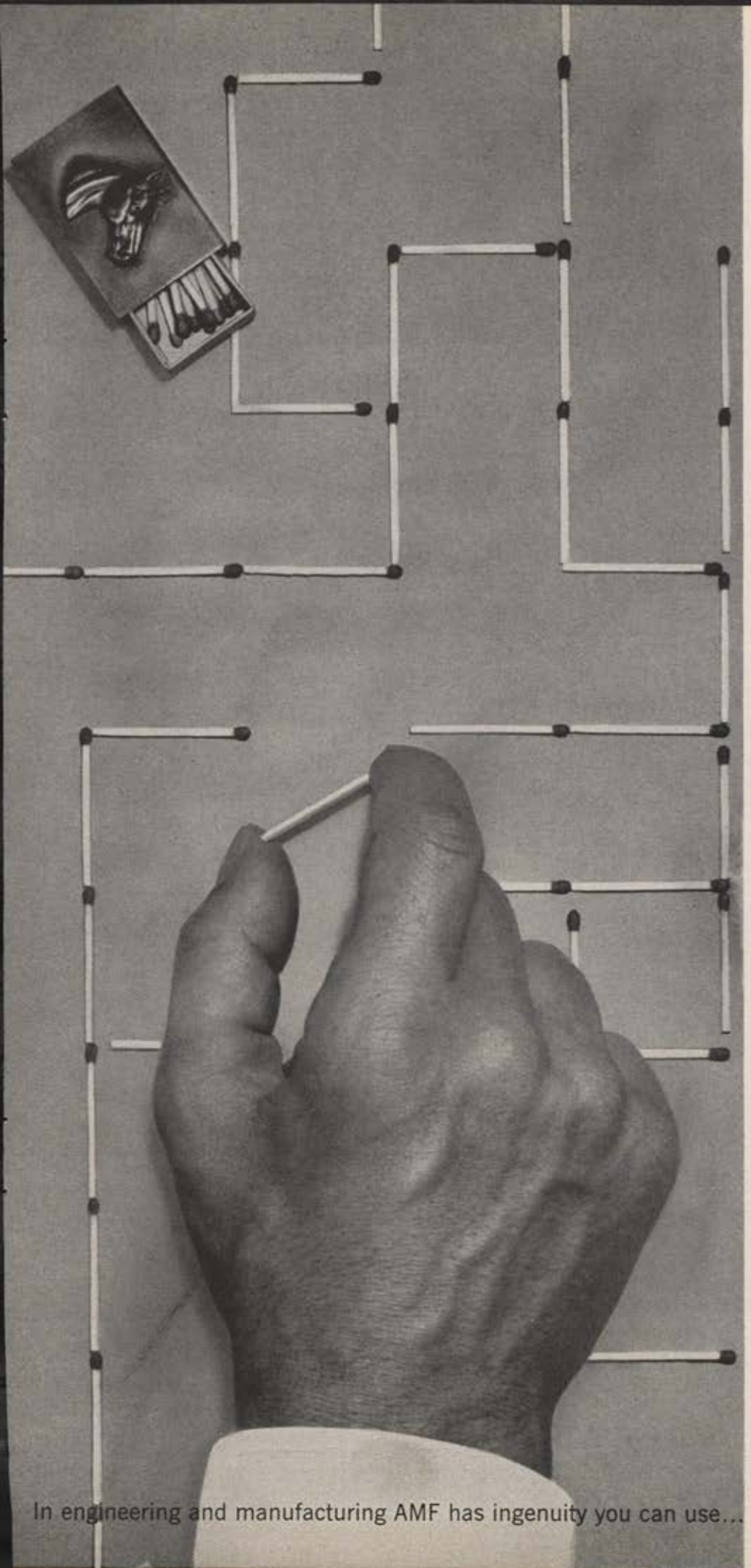
One of the most marked improvements in the F-104 as a superiority fighter is the search radar capability. Without a focal point in space, targets are difficult to see at high altitudes. The radar system in the F-104 detects the target, measures range, and steers the fighter into position for a missile attack on a source of heat.

The radar capability gives us the means of converting head-on or beam detection into curve of pursuit firing attacks—a capability we've never had before, and one that would pay off enormously in combat.

In designing the cockpit, fighter pilots and Lockheed engineers worked together to attain efficiency, simplicity, safety. The design turned out so well that the

(Continued on page 64)

Lt. Col. James Jabara, USAF, who today commands the 337th Fighter-Interceptor Squadron, ADC at Westover AFB, Mass., can look back on a distinguished air combat record. He won his wings in 1943, and during World War II flew 108 combat missions in the European theater, earning "kill" credits against five and a half enemy craft in the air and four on the ground. He became the first US jet ace during the Korean War, earning a "kill" total of fifteen MIGs in two separate combat tours, assigned to the second tour at his own request. During World War II, he received the Distinguished Flying Cross with one Oak Leaf Cluster and the Air Medal with eighteen Oak Leaf Clusters. In Korea, he earned the Distinguished Service Cross with cluster and another Oak Leaf Cluster to add to his DFC.



He designed a new interchange for radio traffic

This AMF engineer, part of an AMF-U.S. Army team, solved the problem of traffic delays and personal danger in manual re-connection of jumpers when interchanging R.F. transmitters and antennas.

His solution is a push-button-operated, coaxial crossbar switching system, using vacuum switches for circuit selection. A typical system consists of 4 transmitter inputs, 7 antenna outputs plus a dummy load, in a 4 x 8 matrix that can be mounted in a 19" rack. It can be controlled locally or remotely over any type of communication network having a bandwidth of at least 200 cycles.

AMF's coaxial crossbar switching system provides 100% flexibility in circuit path selection and accommodates power levels as high as 500,000 watts and frequencies up to 30 megacycles. It allows 100% utilization of all transmitting equipment. Stubs are automatically eliminated.

To insure fail-safe operation, power is required for the vacuum switches *only* during change of condition. Selection rate: 1 per second. Operating transmitters are safety-interlocked to insure a load. There are no hazards from open wires or inadvertent application of power to dead-lined antennas.

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In engineering and manufacturing AMF has ingenuity you can use...

Sleek Sabrejets lift off the runway on high-altitude combat patrol during Korean War. Without the F-86, the United Nations forces would have been hard-pressed to take on Russian-built planes flown by Communist pilots.

Right, the F-104 Starfighter, a world record holder in three categories at present. Starfighter was flown to Formosa to strengthen the free world's hand in 1958 crisis on that island. It is a multimission, top-performance plane.

F-104 pilot really feels as if he were part of the machine.

Systems throughout the airplane were designed with the idea that for a given pound of additional weight of a part, the airplane increases ten pounds over-all. The nonproductive pound requires additional strength and weight in all supporting structures, plus additional fuel for range.

The easier a fighter is to maintain, the more combat capability achieved by a given number of maintenance personnel. The F-104 was designed to meet in-commission requirements in combat. The ability to fly and fight when needed is the reason-for-being of any combat airplane.

Keynoting ease of maintenance features, all major systems are located in easy-to-reach service bays. With the service center concept, systems are so placed that they can be worked on simultaneously by technicians and ground maintenance personnel. Time required for carrying out separate maintenance, as well as mission turn-arounds, is cut to a minimum.

Fighter pilots must be aggressive, with good judgment, to be effective in aerial combat. They are trained to be professionals. Graduates of the advanced flying schools proceed directly to F-104 squadrons. The F-104B, a two-place version, permits the instructor pilot to exercise close supervision.

The transition and combat crew training program is monitored for the purpose of standardizing procedures and observing techniques. A high level of instrument proficiency is maintained with the advantage of the two-place fighter. Weapons Training Centers enable the pilot to train and fire the weapon on airborne targets. This results in a trained and disciplined pilot, capable of fulfilling his mission.

Ten years have brought changes in ground-control-intercept capability. The initial stages in Korea proved ground radar stations to be of little value because of equipment limitations. The Sabres flew a combat tactical formation in mutual support. In the area of the Yalu River only traces of radar returns were available.

Often a train of unknowns would be called out indicating that a large formation of MIGs was proceeding south. However, the radar coverage was not adequate for close-control intercepts on these aircraft. The ground direction centers had the capability of controlling twelve airplanes. As higher speeds and altitudes were attained, control facilities were inadequate. As intermediate advancement, the GPA 37 radar improved control of interceptors three to one over manual control.

Subsequent to the delivery of the first F-104s to the Air Defense Command on February 20, 1958, the F-104C became a member of the Tactical Air Command. A type of F-104 is now scheduled to make its appearance in 1960 with the West German Air Force. Canada, Japan, and the Netherlands have also contracted for the "Super" Starfighter. It is an improved and advanced single-seat multimission fighter for twenty-four-hour defense in any kind of weather.

In flight test the F-104 has proven its capability to carry rockets, missiles, the gun, atomic bombs, and other nuclear weaponry.

The F-104 carries its own intelligence. Having this nonmechanized advantage over missiles, it anticipates error, completes the mission, and returns to fight again.

Conceived initially to fill the need for a high-performance day fighter, the Starfighter's design flexibility, I believe, lends itself to a multimission aircraft—day fighter, all-weather interceptor, fighter-bomber, or nuclear weapon platform. In my opinion the F-104 has the potential to fulfill all missions in the fighter field.

During the Formosa crisis of 1958, probably for the first time in the history of American military aviation, fighter pilots were equipped with an airplane that was better in every respect than equipment possessed by a potential enemy. It was a wonderful feeling.—END

THE SPACE AGE IN PERSPECTIVE

SPACE DIGEST

VOLUME 3, NUMBER 8 • AUGUST 1960

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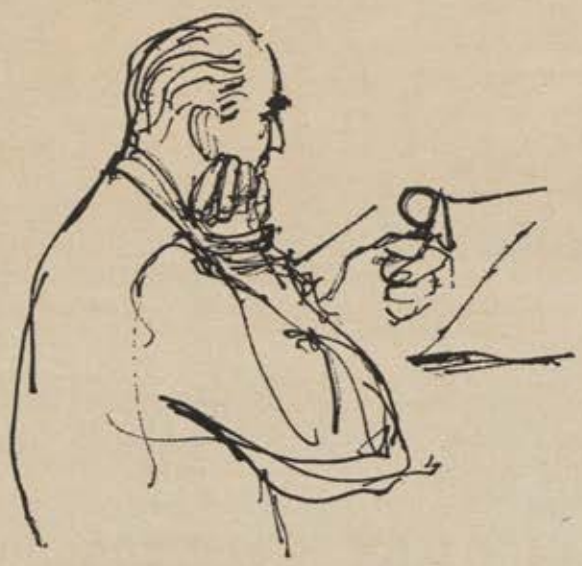
Technological information is accumulating so rapidly on so many decision-makers' desks that it's getting harder and harder to make decisions. An aerospace industry leader asks . . .



How can we understand what we know?

J. R. DEMPSEY

TECHNOLOGICAL events are moving so fast—and information about them is moving so prodigiously—that making decisions based on the new technology has become most difficult for responsible government officials, educators, and businessmen.

J. Lewis Powell once compressed 50,000 years of mankind's recorded history into fifty years, and developed the following chronology: 1) Ten years ago, man left his cave for other kinds of dwellings; 2) five years ago, an unknown genius invented the first writing; 3) two years ago, Christianity appeared; 4) fifteen months ago, Gutenberg developed movable type; 5) ten days ago, electricity was discovered; 6) yesterday morning, the airplane was invented; 7) last night, radio; 8) this morning, television; 9) the [commercial] jet airplane was invented less than a minute ago.

This very rapid rate of advance in technology has brought with it hordes of specialists. Each has a vast knowledge of his own particular specialty, but that represents a very thin slice of the total spectrum of technical knowledge. As a result, people in decision-making positions get nervous because they can't possibly know as much about all fields as each specialist does about his own.

So we have the spreading disease of decision by committees and boards of consultants—or perhaps more accurately, the *lack* of decision by committee. Rather than decisions, we get diffusions of problems and a spreading of the blame of the consequences. In the end, we're all more nervous than before.

Arnold Toynbee puts it rather well when he says: "It is always a test of character to be baffled and 'up against it,' but the test is particularly severe when the adversity comes suddenly at the noon of a halcyon day which one has fatuously expected to endure to eternity." That's a remarkably perceptive statement of the condition of American intellect today—and in fact of the intellectual condition of our entire world civilization.

If we examine this tidal wave of technology, we find certain significant elements . . . specifically, the changes due to greatly increased speed of transmission—transmission of things, people, and information. It is here that technology has caused the greatest mischief in our intellectual affairs.

The speed with which we can now transmit *things* has shrunken the globe to a fraction of its former size, has literally moved us all closer together. That, in turn, has increased the human

friction that results from crowded circumstances. It has also made great changes in our commercial and political existence.

Time was when the corner baker produced "an honest loaf" and purveyed his "baker's dozen" because he was in direct contact with his customers, had pride in his work, and heard directly from his customers if his product was unsatisfactory. Today, bakery products are produced far from the point of consumption; technology has taught us how to make the loaf feel fresh indefinitely, how to pump back in, synthetically, the natural components that technology takes out in the milling and manufacturing process. The bakery head is fully as conscientious as the old neighborhood baker but is far removed from his customers and misses the direct contact desperately. So he hires marketing experts and motivation researchers to try to bridge this gap. But I contend that he's still more nervous about the whole thing than the old neighborhood baker.

In Texas, the Fort Worth Division of Convair builds the B-58 Hustler, which travels more than twice the speed of sound. The next-earlier bomber, the B-52, flies under the speed of sound. The increase in speed between these two bombers took place in the span of a few years —yet it represented a bigger speed jump than the B-52 over the Wright brothers' airplane—a jump that took us fifty years to make.

That's not all. The Atlas intercontinental ballistic missile, which we make at Convair-Astronautics, can move its atomic warhead some 9,000 statute miles in about the time that it takes to get from Love Field to a downtown Dallas hotel at rush hour.

So our ability to transmit things rapidly has remarkably increased the complexity of our existence.

Next, the increase in speed of transmission of *people*. When the Constitution of the United States was written, it took a good while for a man to travel from New York or Boston or Philadelphia to Washington on the back of his horse. As a result, a man didn't undertake the journey unless he had something pretty important to attend to. Conversely, he wasn't asked to come to Washington lightly.

Now it's only a few hours between Washington and any of the fifty states. We go there on the slightest provocation, and they summon us to testify there almost as lightheartedly. So, Washington has become the intellectual center of the country.

I am not contending that Washington is the new Athens of the West. But with our high degree of specialization, and swift technological development, the only structure we inherited to bring some sort of order to our affairs has been the political one and in that sense, our political center has also become our intellectual center. And what sort of center of the intellect is Washington? It is a comic opera in which many men of sound character and great intelligence struggle against formidable odds. Bureaus wrangle for places in the sun. Behind them are strung out their trains of gray files and gray people, waging smaller tactical wars amongst themselves at each level of prerogative. Rumor is mistaken for fact, opportunism for character. Office hours frequently are used only to reequip and retrain for the real skirmishing at cocktail parties and long lunches, in the newspapers and on television.

Turning to the speed of transmission of *information*, we find things equally frustrating.

Paul Revere waited for the lantern signal from the church tower, then galloped his horse with a cry of alarm. Samuel Morse speeded things up. Then came Marconi, de Forest, and high-speed printing presses which—combined with new speeds of transmission—put weekly news magazines into remote hamlets the day they appear in the great cities of America and Europe.

Now information streams into our heads almost as rapidly as oxygen does into our lungs. One large advertising agency states that the average adult American is barraged with around 1,400 "appeals to action" each day.

Knowledge, of course, does not necessarily result from this torrent of information. A message falling upon deaf ears can *offer* much information, but until that information penetrates the listener's mind, no communication has taken place. So without *communication*, there is no knowledge.

Without knowledge—without a means of systematically organizing and appraising these fruits of our technology . . . is it any wonder we are nervous?

A means of selecting meaningful information, placing it in perspective, and acting upon it offers our only real chance to keep the wave of technology from overwhelming us.

Here are some suggestions in that direction.

I think we need to make a *quantum jump* in behalf of the human intellect—where we somehow find the insight necessary to jump ahead to a new plateau of understanding.

First I propose that we seek a quantum jump

in classifying, sorting, and communicating our information. It is ironic that through centuries filled with discourse between human beings, nobody stopped talking long enough to define the information we were trying to pass. Then, in the late twenties, Hartley proposed an information theory, later expanded by others.

The irony is that these men weren't worrying especially about human discourse. They were developing telecommunication equipment and the digital computer!

Nevertheless, information theory and computers can serve as effective information "scouts." Preliminary indexing of a body of information can be done mechanically by the computer; the human then steps in, scans the index, rejects elements in which he is not interested. With the remaining elements, he asks the computer to predict what will happen if the human takes certain courses of action, based on the indexed facts. The human then can make his decision.

This the computers can do for us now, but at some expense of time and dollars. It needs to be made easier. More importantly, we need to apply some real philosophical power to the latent capabilities of computers to obtain a quantum jump.

The second main area needing a quantum jump is the field of intellectual honesty.

We Americans pride ourselves on our being a moral society . . . a tradition going back to Puritan days. We kid ourselves into thinking this is still our moral standard, although we have abandoned some moral traditions before finding other ethics to guide us.

It is not difficult to find excuses for this. The pressures of technological advance themselves can be blamed, as can business, politics, and communism. But I submit that every time we slip our standards of intellectual honesty, we thrust ourselves one bit more into the mercy of the technological machine. Technology, you see, has no judgment. Only humans have judgment.

The temptations to intellectual dishonesty are great. In our specialized, close-knit society, where decisions are thrust off on specialists and committees, few of us can grasp the true significance of our affairs. We grasp at straws. We give status and attention to those who first expose us to tiny nuggets of specialized information. In so doing, we encourage the seeking of nuggets, downgrading, perhaps, the more thoughtful man who waits to map out the whole vein. Thus we fall to unseemly skirmishing for meaningless information, grasping it by thievery, if necessary, out of the mind or work of another.

Which brings us to the most important quantum jump—the only means by which we can recognize the intellectual thief—our ability to seek, and cling to, concepts and principles.

Man has always struggled to understand his physical environment. His social progress is a series of climbs and plateaus.

In past climbs, I suspect men were as confused as we are today. They saw nothing ahead but more of the same difficult routes they had just traversed.

But the physical laws of nature teach us that a steeply ascending curve must eventually smooth out into a plateau.

Few of us are willing to wait for the curve to smooth out on its own. We strive to change our complex jungle into a level, verdant intellectual valley where ulcers are unknown.

Just as man always has sought to understand, so do we today. And I can think of no quicker, more permanent solution than to find and adhere to principles which serve as beacons of understanding and insight in the intellectual storm of technology.

It is here where our universities must excel—in teaching those basic principles of human knowledge. These can arm us with the strategic principles that give perspective on tactical problems of everyday existence.

All of us try to keep updated in our particular fields by reading specialized technical or business journals, even by taking specialized courses. Perhaps we are making a mistake. Instead, I think we should go back to the philosophers, poets, historians, theologians, and theoretical technicians.

Man is a vain creature; each of us thinks his particular problems are greater than anybody else's and that the time in which he lives is unique and without precedent.

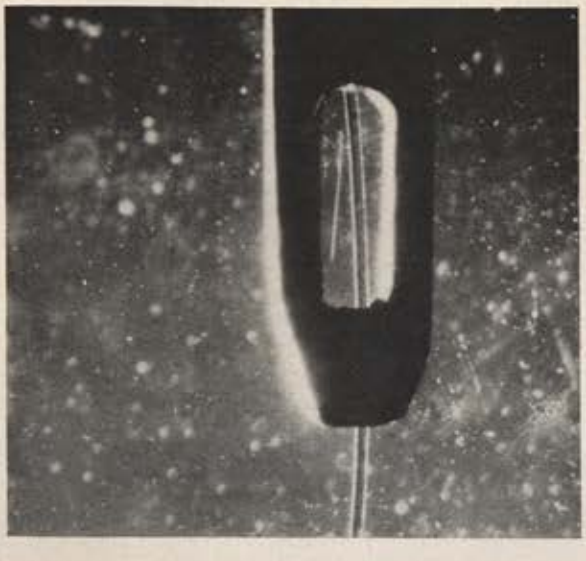
This of course is not true. The classical technicians, philosophers, poets—and men of the cloth—know it. They are prepared to tell us why, if we will just listen.—END

Vice President, Convair Division, General Dynamics Corp., and Manager, Convair-Astronautics, J. R. Dempsey has headed his company's Atlas ICBM program since 1954. The above is condensed from a recent address to the Distinguished Alumni Awards Dinner at Southern Methodist University at Dallas, Tex.

Slightly larger than actual size, iron whisker formation is shown in this photograph of the ceramic reaction "boat," in which experiments are performed at materials laboratories at Wright-Patterson AFB.

An intriguing possibility for superstrong space-age materials involves understanding the long-known phenomenon of . . .

WHISKERS . . .



Whisker as seen through magnified eye of needle. Long line extending past needle's end is human hair. Whisker is shorter white line at left of the hair.

EILEEN B. KRESS

THIS IS no treatise on shaveable hair or the advantages of a straightedge razor; it is a report on the fascinating phenomenon of metallic crystals, so tiny and hairlike that they are called "whiskers." These minute slivers, which can barely be seen with the naked eye, have an amazing tensile strength, sometimes as much as fifteen times the strength of a pure iron bar. Scientists attribute the high-strength qualities of metallic whiskers to their essential freedom from imperfection as compared with bulk metals.

In the space age, new demands are constantly being placed on materials. Increased strength in metals is one of the important new technological needs, and basic research is being conducted at the Wright Air Development Division Materials

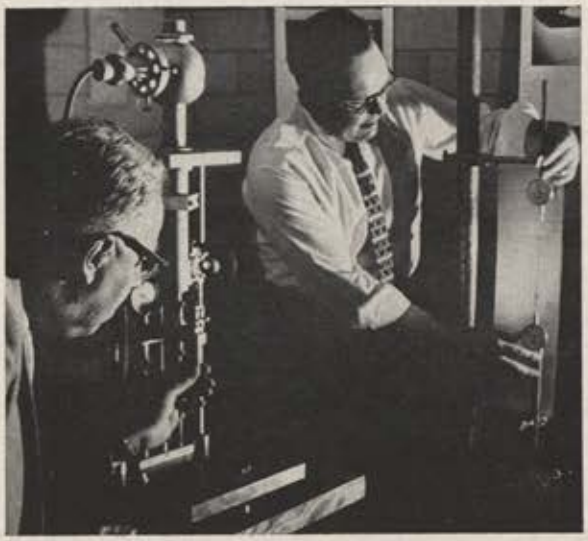
Central at Wright-Patterson AFB, Ohio, to investigate the growth and structure of metallic whiskers—in the hope that this knowledge can be applied to improve strength and reliability qualities of bulk metals.

Metallic whiskers are nothing new—observations of the fibrous growth of thin metal crystals were recorded as early as the Middle Ages. Military interest in metallic whiskers developed before World War II when malfunction of electronic parts was explained by the growth of metallic whiskers in equipment. Such natural growth of whiskers is caused by atmospheric conditions, including heat, internal stress, humidity, or surrounding gases.

Under direction of Wright-Patterson's Drs. Helmut Weik and Albrecht Herzog, methods have been devised whereby metallic whiskers can be grown in the laboratory and can be produced in

Dr. Helmut Weik watches whiskers grow, through a microscope mounted on a homemade furnace, while James J. Niles checks instrument readings.

But Not on Your Face



Dr. Albrecht Herzog and John Emrick run elongation and tensile strength tests on whiskers, magnified images of which are projected on a screen.

Delicacy in whisker handling is underscored by this operation in which glue is applied by hypodermic needle to enable placing whisker in holder.

a matter of minutes as compared with months or years for the natural growth of whiskers. Variations in strength and shape of whiskers is dependent on the temperature, purity of the metals, and atmospheric conditions. Attempts to produce larger whiskers have shown that whiskers tend to lose their high-strength qualities as they increase in diameter, probably because the tendency toward imperfection increases. Tests are being conducted to determine what variation of properties or conditions are required to produce consistently high-strength whiskers of increased size, how to control these properties, and how such knowledge could eventually be applied to production metals.

Whiskers can be grown from a number of metals; however, research in the Materials Central is primarily on iron. Such whiskers are grown under controlled conditions of pressure and temperature by the reduction of iron chloride with hydrogen, which causes a systematic arrangement of atoms to form a single crystal. To effect this reduction, a ceramic boat containing ferrous chloride is placed in the furnace.

The heat causes the ferrous chloride to pass from a solid state to a gaseous state, and this combined with the hydrogen results in a vapor which deposits on the surface of the ceramic boat a systematic spiral layering of atoms, leaving no weakening misfits. The mystery yet to be solved is why the atoms collect in this perfectly systematic fashion. If and when this secret is discovered, a revolutionary new technology will be made available to the metallurgist.

Testing of whiskers is extremely difficult because of the delicate handling required on these very fine hair-thin metal filaments. Virtually all of the testing must be done under a microscope. When whisker studies were begun, equipment for handling such minute particles was nonexistent, and all equipment used has been built or improvised by the people in the laboratory. To study the growth of metallic whiskers it is necessary actually to watch them in the growing stage—this was impossible with an ordinary type furnace. Partially to solve this problem, a specially designed furnace with a peephole was constructed—admittedly crude but it serves the purpose. An additional problem is that the temperature of the furnace is so high (approximately 1,200° F) that it is difficult to mount a microscope close enough for proper viewing. Heat shields and cooling agents are being tested as possible solutions.

In order to test the strength and elongation of whiskers, a strange conglomeration of equipment is employed. To avoid scratching the surface of the whisker, pigs' eyelashes, glued to the end of probes, are used for handling. Pigs' eyelashes are particularly suitable because they are free from scales. Whiskers are mounted on a specially designed device for holding the whisker known as a whisker fixture. To mount the whiskers, which are in the range of 1/1000 of an inch in diameter, an eyebrow tweezer is used to hold the whisker in place, and glue is then applied with a hypodermic needle to attach the whisker to the grips in the fixture. Dr. Weik started mechanical testing by suspending an aluminum foil basket from the specimen which had been mounted on a whisker fixture, and then systematically adding metal powder to the basket until the whisker broke. This was a primitive but exacting method. Because of the need for a faster method, eventually a new tensile machine based on applying a load by a calibrated spring was developed by John Emrick. Thus the search continues for improved methods of testing.

When the elongation and the load can be measured accurately, a stress-strain curve will be provided which will add more knowledge toward completely describing the behavior of the whisker under a tensile test. This curve, together with increased knowledge concerning structural imperfections caused by variations in temperature, purity of the metals, and atmospheric conditions, will assist the scientist in determining what properties produce the unique qualities prevalent in metallic whiskers, and may help explain why they are very strong or very weak.

Should a growth mechanism be found that can produce a larger single crystal with the same high purity and freedom from imperfection, it might be feasible to spin whiskers into strands like textile fibers, to give us bridge cables like piano wire. Woven into metallic sheets up to twenty times stronger than ordinary metals, of less weight and increased reliability, such whisker-based material could find important use in the satellites and weapon systems of tomorrow.—END

Currently secretary to the Chief of Materials Central, Wright Air Development Division, Wright-Patterson AFB, Ohio, Eileen Kress has previously served with Air Technical Intelligence Command European Liaison Office, London, and in other overseas posts.

Public-school education in the US has from the start been a standardized product, ungeared to the gifted, writes a distinguished educator who warns that in the space age we must be willing to pay the price of . . .

SURVIVAL OF THE FITTEST . . . STUDENTS

DR. WALTER W. COOK

THE STRUGGLE to develop a free and efficient public-school system in America open to all and extending from the nursery school through the university has been constant, incessant, and bitter. This struggle has been fought anew in every generation. The clash and din of this battle has been especially loud during the fifties and reached a high crescendo following the first Sputnik. In the foreseeable future the struggle will grow even more desperate.

In 1840 the total amount of education received by the average citizen of the United States during his entire lifetime was *208 days*. According to present standards, this nation, educationally speaking, was in 1840 a low-second-grade nation. The soldiers of the American Revolution and of the War of 1812 were academically low second graders.

By 1870 the total amount of schooling received by the average citizen had been increased to *582 days*. At the close of the Civil War we had reached a new level, the level of the *third grade*, that is, between 1840 and 1870, in a period of thirty years, we had gained almost two years in the average amount of schooling.

In 1917 the average citizen received a little less than *1,100 days of schooling*. The average recruit in World War I had a sixth-grade education; during the forty-seven years between 1870 and 1917 we had gained three years of schooling.

By the early 1940s, at the outbreak of World War II, the average citizen had approximately *1,800 days* of schooling. We had reached the tenth-grade level. The average recruit in World War II was found to have tenth-grade reading ability. When the Army Alpha Intelligence Test, which had been administered to the recruits in World War I, was administered to the recruits in World War II, it was found that the score which had been exceeded by fifty percent of World War I recruits was exceeded by eighty-four percent of World War II recruits. Thus during the twenty-two years between World War I and World War II, the average American gained four years in his academic level from grade six to grade ten.

The fact that the American people over the years have developed the educational system which we know today, with its comprehensive

high schools and its comprehensive universities relatively free of religious control, relatively free of partisan political control, that great universities could be voted and paid for by the people, is a tribute to the moral and spiritual qualities of the common man.

If the nation as a whole in 1940 stood at the tenth-grade level in academic achievement, what has happened to the advance of education in twenty years since 1940? Certainly the advance is not as great as the four years of academic standing which took place between 1920 and 1940. Obviously, we have not reached an average of the sophomore college year. It seems we have had to fight hard to stay even.

The social prophets of 1940 predicted a continuing decline in the rate of population growth. They believed that by the 1970s we would reach a plateau, and that there actually might be a decrease in population. No one told us in 1940 that within ten years the age of marriage would be lowered by approximately five years and that the birth rate would almost double.

During the past ten years the population of the elementary schools has doubled and even quadrupled in urban and suburban areas. Within the next four years the high school population will double again, and within eight years the population of our universities and colleges will double. During the past ten years the percentage of college-age youth in college has increased approximately one percent per year. For us to keep the educational level of the United States merely constant, to hold our own with this tidal wave of students, unstinting federal support of public education *must* be forthcoming. The possible dangers of one or another program of federal support are not to be overlooked, but given careful design, I believe a program of federal support can be salutary.

Today, in attempting to glimpse what may happen to education between now and the twenty-first century (and we should remember that the twenty-first century is closer to us today than is the end of World War I) the single most important fact is the amount of money being spent on research.

It is interesting to note that the Hoover Committee on Recent Social Trends in 1930 measured scientific discoveries and technological advancement in terms of patents issued by five-year periods. For example, in 1850 the number of patents issued over a period of five years was 3,000; by 1875 it had reached 61,000; by 1900, 112,000; by 1925, 204,000.

In those days the cost of research and invention was expressed in thousands of dollars. Today, it is expressed in terms of billions of dollars. Last year the total expenditure on research in this country exceeded $6 billion. It is expected that by 1965 we shall be spending $10 billion each year on research and development. So effective is this research in increasing production per man hour that during the first half of this century the gross national product moved from $50 billion in 1900 to $250 billion in 1950, and the average income of the American citizen tripled in purchasing power. Since 1950 the gross national product has almost doubled again. From $250 billion per year we are approaching the mark of $500 billion in 1960.

Yet today we are spending less than four percent of our gross national product for education at all levels. We spend more than that for liquor and tobacco. We spend twice that amount for our private automobiles. We are most niggardly in the support of that institution on which depend invention, technical development, social progress, and the ultimate defense of this nation—which is education.

Schools are organized the way they are in America today, not because it is the best way to educate children, but because it is the cheapest way. The first assembly line established in America was not in Mr. Ford's Model T factory. It was that of the graded elementary school in the 1830s and '40s. The first standardized product in America was not the Colt revolver but the eighth-grade graduate. The first set of graded textbooks in America, the *McGuffey Readers,* came from the press in 1837. In 1848 the first school building was constructed to house a graded elementary school in Quincy, Mass. By 1870 all the schools of the United States, even the one-room rural schools, had been graded.

The most important single factor in shaping our attitudes and policies in education is the graded textbook. American schools are predominantly "textbook" schools. The majority of teachers feel lost without a uniform textbook in the hands of every pupil. Education is conceived by many as a process of memorizing the content of textbooks. Limited goals are set in terms of the content of textbooks. Examinations are based upon the content of textbooks. Educational progress is measured in terms of pages covered in the textbook, and the intellectual ability required for success at a given grade level or in a given subject is determined by the textbook.

The basic assumption underlying textbook pro-

cedure is that pupils can be classified into homogeneous groups and taught uniform material by a standardized procedure. These assumptions and attitudes inhibit the process of making "schooling" truly educational.

We have known for over thirty years that the typical range of ability in a sixth-grade class is eight years. This is true whether the class is made up entirely of eleven-year-olds through automatic promotion, or whether it is made up of pupils varying as much as six years in chronological age through the practice of failure and acceleration. We know that the typical sixth-grade pupil varies more than six years from his highest ability to his lowest ability, yet most schools continue to operate with uniform textbooks on the assumption that all children are created equal.

Schools remain the way they are because textbooks are written the way they are, and because teachers are prepared the way they are. *Teacher training institutions* prepare teachers the way they do because schools are the way they are, and textbooks are the way they are. *Textbooks are written* the way they are because schools are the way they are, and teachers are prepared the way they are. The three corners of this rigid triangle (textbook publishers, teacher training institutions, and the schools) are each under independent control. There is a lack of authority for introducing flexibility into this rigid triangle.

Let me conjecture a bit. The instructional materials of the school of the future will be a library and a laboratory rather than uniform textbooks. The schools of the future may be built without windows in order to have complete atmospheric and light control; the saving of building costs will make completely controlled air-conditioning and lighting possible. The four walls of the classroom can all be used for instructional purposes.

A complete set of maps—political, geographic, historical, economic—is possible in every room on slides occupying no greater space than a shoebox. Such maps can be projected on the wall on such a scale that the smallest geographic features can be seen from across the room.

Microfilm and microcards may make possible the bringing into the classroom of appropriate journals and other basic, historical, and scientific materials, allowing for a sixth grader to do original research.

The schools may have classes for *all* age groups in the community. This is already true in certain Florida communities where senior citizens go to live out their retirement. Last year, for example, in one public school in Florida a retired Presbyterian minister 101 years of age registered for a course in typing and a course in psychology.

In schools of the future, there will be a great deal of team teaching. Since 1952 our ten-quarter-hour junior course, *Introduction to Secondary School Teaching* at the University of Minnesota, has been taught by a team numbering at times as many as forty. One lecturer and his assistant are responsible for two lectures per week to the total group of 450 college juniors. There are seventeen laboratory instructors responsible for directing the observation of high school teaching and discussion, representing the several subject-matter areas. There are perhaps thirty social agencies throughout the cities in which these students work with youth groups. Once each week they observe a master teacher in the University High School over closed-circuit television, in order that they may all observe and discuss the same teaching. The closed-circuit television crew consists of not less than four members with two cameras. There is the high school master teacher and the high school students, plus the librarians. This is quite a team and indicates one direction in which education of the future may move.

In considering the changes that make take place in education during the next forty years, it is well that we consider at any given time *what is probable, what is possible, what is practicable, AND WHAT IS FEASIBLE.* In a democratic, free-enterprise society, such as ours, handicapped by tradition, vested interests, ignorance, and lack of foresight, the lag between the possible and the practicable is sometimes very great. We might have put a satellite in orbit two years before we did, but the powers that controlled the enterprise did not think it practicable. Today it is possible to build a supersonic jet airliner to carry 150 passengers to any place on the globe within twelve hours, but it will be the decision of our air-age economists, our entrepreneurs, and financiers to determine when it is practicable, in other words, when it will yield a satisfactory return.—END

Dr. Cook, a veteran observer of trends and techniques on the American educational scene, is the Dean of the College of Education of the University of Minnesota. The article above is condensed from remarks at a symposium on space-age education held at the University May 7, cosponsored by the University, the Minnesota Wing of the Air Force Association, and the Civil Air Patrol.

Nuclear power offers versatile capability —from the ground up—for aerospace vehicles. An engineer outlines some of its unique advantages and suggests a program for . . .

Nuclear Cycling into Space

THOMAS SZEKELY

WITH EACH chemical rocket firing, the need for enormous amounts of power becomes more evident. At present nuclear power is the preeminent means of supplying tremendous quantities of power in small packages. Therefore, nuclear propulsion is recognized today as a logical next step in the development of rockets for space—just as nuclear propulsion has been recognized as a logical next step in the development of aircraft propulsion. Indeed, there is a continuity in the problems and solutions for both nuclear aircraft and nuclear rocket propulsion. This continuity yields advantages that enable the design of aerospace nuclear propulsion systems and devices as proposed in this article.

Numerous propulsion devices have been proposed, chemical, nuclear, and hybrid combinations of the two. Each has been more sophisticated than its predecessor (although not always better), and aerospace technology has grown into a very sophisticated and highly confusing science. Therefore, a brief review of the fundamentals of chemical and nuclear propulsion methods serves as a useful preface to comparing the systems. First, we might touch on points of similarity.

All systems which now seem practical rely on the escape (or ejection) of particles to supply a thrust. The high-thrust devices use gases. The gases are heated, either by chemical or nuclear means, and then accelerate themselves out of the vehicle. Low-thrust devices using charged particles (ion and plasma propulsion) have also been proposed. In these the particles are accelerated by electrical or electromagnetic means. The electricity, in turn, is supplied by (presumably) fission-type, nuclear power plants. Some further discussion, stressing the differences, is in order.

- *Chemical propulsion*—Chemical energy is released in the rocket propellant, for example, through the combining of hydrogen and oxygen; the propellant gases develop heat and expand with increasing velocity through a jet nozzle. A reaction thrust is developed.
- *Nuclear propulsion*—Continuous nuclear fission is maintained through a chain reaction in a critical uranium or plutonium assembly; the fission energy, released mostly in the form of fission fragments, is locally deposited as heat in the reactor fuel elements. This heat energy is passed to a propellant; for example, hydrogen gas (or to swallowed air in the case of a nuclear turbojet or ramjet flying within the atmosphere) as it flows over the fuel elements. After the gas is heated it expands through a jet nozzle and a reaction thrust is developed.

Indirect nuclear cycle—In addition to the direct cycle, a multitude of indirect reactor cycles has been proposed. These variations of the basic and direct cycle are intended to accomplish one or more of the following:

- Reduce shield weight, fuel inventory, and/or the development cost of high-temperature fuel element materials;
- Enable certain special purpose flight missions, as for gravity-free environment, using low-thrust ion-propulsion systems;
- Obtain higher-efficiency reactive thrust through the use of auxiliary electrical generating equipment and the application of exceedingly high temperatures or high pressures (as in the arc-plasma systems).

When crews of SAC's 1st Missile Division successfully launched the USAF ICBM Atlas from Vandenberg Air Force Base, September 9, 1959, the world became aware that the United States had brought into being a formidable retaliatory power for peace. Within four months after the first operational launch, the Air Force doubly underlined this missile's capability. On a single day, January 26, 1960, the 16th and 17th consecutive successful Atlases were fired intercontinental ranges to predetermined targets from both Atlantic and Pacific bases.

After only five years of intensive development, including concurrent research, testing and fabrication under this nation's top military priority, Atlas is extremely versatile as well as powerful. It was the Project Score satellite vehicle and is scheduled for use in Project Mercury, the Man in Space Program, and in other space exploration missions. Thus, used as a booster for space projects, Atlas provides the nation with a key capability in scientific as well as military applications.

Space Technology Laboratories provides the systems engineering and technical direction for the Atlas as well as other portions of the Air Force Ballistic Missile Program. Much of what was learned in building Atlas has helped cut the lead-time in the development of such other Air Force Ballistic Missiles as Thor, Titan and Minuteman.

Among the industrial organizations which have worked in concert in developing Atlas are such major contractors as: Convair, Division of General Dynamics Corp. for airframe, assembly and test; General Electric Co. and Burroughs Corp. for radio guidance; Arma, Division of American Bosch and Arma Corp. for inertial guidance; Rocketdyne Division of North American Aviation, Inc., for propulsion; General Electric Co. for re-entry vehicle; Acoustica Associates for propellant utilization.

America's first intercontinental ballistic missile...is helping to bear the burden of today's power for peace

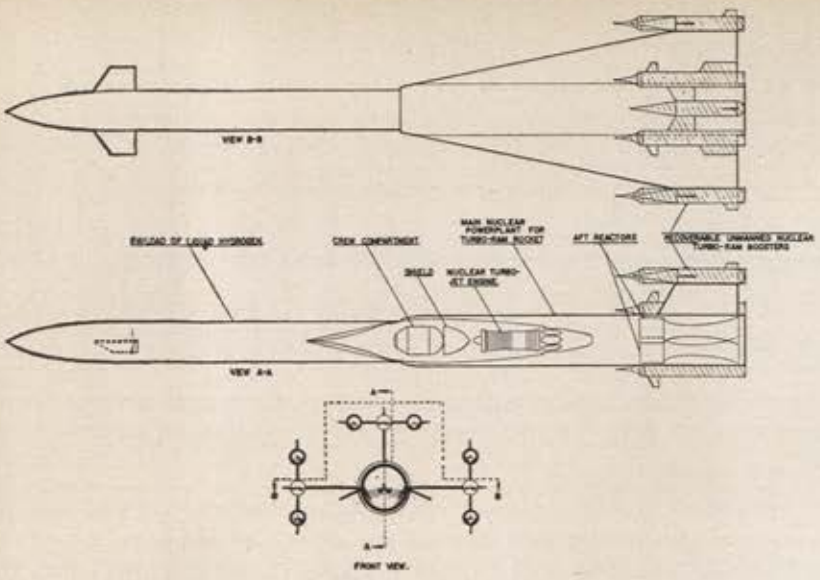
ATLAS

The continuing development of Atlas as well as other USAF missiles and related space probes, has created important positions on STL's technical staff for scientists and engineers with outstanding capabilities in: thermodynamics, aerodynamics, electronics, propulsion systems, structures, physics, computer technology, telemetry, and instrumentation. If you believe you can contribute in these or related fields and disciplines, you are invited to send your resume to:

SPACE TECHNOLOGY LABORATORIES, INC.

P. O. Box 95004, Los Angeles 45, California, Attention: Richard A. Holliday

Los Angeles • San Diego
Santa Maria • Sacramento • Denver • Cheyenne • Cape Canaveral • Washington, D.C. • Manchester, England • Singapore • Hawaii



Author's design sketch of nuclear-powered turboram rocket. At right are recoverable nuclear boosters to take vehicle through heavier portion of atmosphere where greatest thrust is needed. Center, nuclear turboram rocket system, which would take vehicle and hydrogen payload toward orbit. Note shielding, crew quarters right of payload.

Although the development problems associated with indirect nuclear cycles are formidable, most such systems are meritorious in principle and worthy of further consideration. However, with sufficient aerothermodynamic and materials development, the direct-heat-transfer nuclear cycle appears more practical today and offers more potential for early development than do indirect cycles.

Based on energy release per pound of fuel, the potential for nuclear fission energy is prominently ahead of that for chemical energy. For example, total energy release available in a hydrogen-oxygen combustion system is about 1.33×10^{11} ergs per gram. In a reactor with only one percent useful burnup of uranium fuel the energy release by fission becomes 7×10^{15} ergs per gram. Therefore, the reactor develops at least 50,000 times more energy per gram of fuel than the chemical system does. Even with the *ultimate* potential from chemical energy, i.e., energy from free-radical reactions, assuming a successful method could be found to retain free-radical stability, the fission reactor could develop 3,000 times more energy per gram of fuel.

Although a comparison of fission-energy potential to chemical-energy potential weighs greatly in favor of the reactor system, the radiation shield weight requirements for the reactor reduce these over-all advantages. However, shielding may be required during transit through the Van Allen radiation belts and at times of solar flareup. The crew compartment of a reactor-powered system would already be shielded. If a weighty crew shield is added to the chemical rocket the net result in shield weight considerations alone might then favor the nuclear system.

Assuming that a shield is required only because of the reactor, the reduction in over-all advantages due to shield weight becomes less for long-mission space systems where the fixed reactor and shield weight represent a smaller fraction of total vehicle weight because of the increased fraction of propellant. However, if the reactor fission energy is passed through several subsystems in addition to direct heating, i.e., systems of turbomachinery, electric and magnetic field generator equipment for ion drive, etc., the reactor system reliability is apt to be reduced. In fact, the reactor-powered system may even be at a disadvantage compared to the chemical system where combustion of propellants is very direct.

Based on these considerations, the direct-cycle heat-transfer reactor system becomes the favorite development for space travel.

If we confine ourselves to direct-cycle nuclear propulsion, a certain continuity in problems for takeoff, boost, and escape become possible and advantageous. These include recoverability of all vehicles, the use of the same heat sources (reactors) for several applications, and a great reduction in the difficulties of atmospheric reentry. Furthermore, it becomes possible to employ the only practical means of atmospheric travel on [oxygen-lacking] planets to be visited—nuclear propulsion.

Except for minor differences, the requirements from the direct-cycle heat-transfer reactor are the same for the atmospheric aircraft turbojet (takeoff), ramjet (boost), and the space rocket power plant (escape and interplanetary transit). These requirements include:

- Long life (high burnup) capabilities.
- High fuel element materials temperature.
- Large void volumes and surface areas for heat transfer to airflow or hydrogen propellant flow.
- Tolerable radiation without excessive shield weight.

The major difference between the air-breathing and the hydrogen-breathing reactors is the requirement from fuel element materials. In the air-breathing reactor the materials must be able to resist oxidation; in the hydrogen-breathing reactor the materials must resist reaction with hydrogen (reduction). There are certain temperature-resistant ceramic-type materials that indicate

they may be developed to satisfy both of these requirements.

These materials would be used in fast-spectrum reactors. Their application in moderate (thermal or intermediate energy) reactors would require excessive fuel inventories to yield criticality since temperature-resistant materials are characterized by high cross sections for absorption of thermal-energy neutrons. Unlike thermal reactors, fast-spectrum reactors would not be as adversely affected when fueled with these materials and would be capable of containing the large quantities of fuel dictated by high burnup requirements. In addition to this compatibility of fast-spectrum reactors with temperature-resistant, albeit relatively poisonous, materials, they yield an added propulsion advantage that would be derived from an increase in volumetric efficiency due to removal of moderator material; the moderator produces virtually no energy and blocks useful flow volume.

When materials of the direct cycle reactor are developed to enable high-temperature operation and the transfer of heat to either air or hydrogen, the reactor may be employed in transitional-type flight vehicles. These vehicles would use nuclear turbojets from ground takeoff to altitudes and flight speeds where the turbojet configurations would undergo gradual transition to ramjet configurations. The ramjet configurations would be used to attain higher altitudes and higher flight speeds and would then undergo further transformation to become a nuclear rocket. This, at the outer fringes of the atmosphere, would accelerate as a reactor-heated, hydrogen-propelled rocket, carrying a heavy cargo of hydrogen into orbit. Several trips would be made to build up an orbiting fuel station with a plentiful supply of hydrogen so that on the last trip a departure can be made from orbit for high-velocity interplanetary flight. The same reactor or group of reactors may be used throughout the flight spectrum.

The immediate advantage of this system over the rocket-only system is that staging is unnecessary. The atmosphere is used to assist rather than hinder propulsion during transit to orbit. Valuable hydrogen propellant is conserved for use in space. The requirements on variable configuration for the vehicle would depend upon aerodynamic developments, but they are consistent with present development efforts aimed at obtaining higher atmospheric flight speeds. Turbojets are today capable of development for flight speeds to Mach 3.0 (the J93 engine that would power the B-70 airplane, for example); nuclear-powered ramjets for speeds from Mach 3.0 to Mach 6.0 are also not unrealistic.

At Mach 6.0, the inlet air is at nearly 3,000° F due to ram heating and, for at least a brief time interval, severe temperature requirements would be imposed on the reactors. However, if typical nuclear airplane requirements of long life expectancy from fuel elements and extreme containment of fission products are partially reduced and if sufficient materials development effort is exerted, it is felt that the required reactor temperature of approximately 4,500° F can be achieved to supply the energy for useful thrust at Mach 6.0. This would be a truly worthwhile speed since Mach 6.0 is nearly one-fourth of orbital velocity. Also, flight at approximately 100,000 feet altitude and Mach 6.0 is equivalent to a sizable fraction of propellant that would be required to launch a rocket-only system in the same conditions. In typical chemical rockets for example, as much as sixty percent of the total energy is consumed passing through the atmosphere (although chemical rockets are accelerated to velocity vectors nearly vertical at 100,000 feet).

There are additional advantages that yield increased incentive to develop this all-nuclear combination. By reversing the takeoff sequence of transitions from turbojet to ramjet and then to rocket flight, atmospheric reentry is no longer an extremely difficult problem. The procedure for reentry and landing would include: First, a rocket retrothrust from reactor-heated hydrogen and with a nose-aft flight attitude to descend from a parking orbit and to enter the atmosphere at reduced velocities. Second, a single end-over maneuver for nose-forward flight orientation and an opening of ramjet inlets to yield nuclear-powered ramjet flight. Finally, a transition at a lower altitude and flight speed to nuclear-powered turbojet flight, and a controlled landing at any desired location on the earth. No other space propulsion system proposed to date offers the versatility of 1) reentry without excessive aerodynamic heating, and 2) controlled atmospheric flight thereafter with a virtually unlimited range.—END

Thomas Szekely is an advanced design engineer at General Electric's Aircraft Nuclear Propulsion Department. A graduate of Stevens Institute and Oak Ridge School of Reactor Technology, he has worked in the nuclear field for several years.

BUMPER 8, JULY 24, 1950

ATLAS "LONGFELLOW," 1960

FROM THE EXPERIMENTAL BUMPER IN 1950 TO THE ATLAS IN 1960 . . .

CAPE CANAVERAL'S FIRST 10

Just ten years ago, the first experimental missile was fired from Cape Canaveral. Here, General Electric reports on this key U.S. missile and space research center's first ten years of progress.

A few men, a quickly constructed wooden "command post" and the firing of a hybrid Army Wac Corporal/V-2 missile called BUMPER 8 . . . this was the beginning ten years ago of what today is the largest missile test center in the world: Cape Canaveral.

AS BUMPER 8, developed under General Electric systems management, climbed away from the then Long Range Proving Ground Division, the only horizon-breaking landmark was a lighthouse tower near a cluster of homes. Today, this scene has been dramatically changed with miles of hard top roads leading to hundreds of launch sites, test centers, hangars, fuel supply areas and block houses.

Behind this changed scene lies a record of more than 800 successful launchings that have been conducted by the three U.S. military services and other government agencies working with Air Force Missile Test Center personnel who maintain and operate "the Cape," or Station One of the Atlantic Missile Range and the islands "downrange."

AMERICA IS ACHIEVING IMPORTANT MILITARY AND SCIENTIFIC PROGRESS FROM CAPE CANAVERAL MILESTONES LIKE THESE . . .

FIRST CAPE LAUNCH

Wac Corporal/V-2 missile called BUMPER 8 was fired by handful of Army and G.E. personnel on July 24, 1950. It provided vital data as basis for early missile progress.

X-17 THREE STAGE MISSILE

First fired in July, 1956, Air Force X-17 re-entry test vehicle was designed to achieve high re-entry velocity and yielded important information relative to ballistic flight problems.

EXPLORER I SATELLITE

This nation's first satellite was launched on January 31, 1958 from the Cape and is still in orbit. Army Jupiter-C booster placed this historic satellite into orbit around the earth.

YEARS OF MISSILE AND SPACE PROGRESS

These launchings have paid immeasurable dividends. In the area of U.S. missile progress, Cape Canaveral test launchings have led to the present operational status of Thor, Atlas, Jupiter, Snark and Matador, and are now speeding the development of Polaris and Titan.

In the area of space technology, missile test flights from the Cape have proved the reliability of U.S. ICBM re-entry vehicles and the accuracy of U.S. ICBM radio command guidance, provided information on the belt of radiation around the Earth and other valuable data about space environment and flight that will serve scientists in their efforts to conquer space.

In satellite progress, the successful launchings of Pioneer, Explorer, Transit, Tiros and other satellites from the Cape have paved the way for a whole new generation of orbiting bodies that will aid in communications, navigation, weather forecasting and in the protection of the Free World.

This progress has truly been the result of team effort. The military services and government space agencies together with companies like General Electric . . . a member of the Cape team since its Bumper 8 missile beginning . . . have made vitally important contributions. General Electric, its Defense Electronics Division and the Defense Systems, Heavy Military Electronics, Light Military Electronics, Missile and Space Vehicle, and Ordnance Departments that are a part of this Division are proud to be members of this team and contributors to this progress.

A unique 15 x 19-inch four color illustration, suitable for framing, of the historic first missile launching from Cape Canaveral is available upon request from General Electric Company, Section 160-88, Schenectady, N. Y.

DEFENSE ELECTRONICS DIVISION

GENERAL ELECTRIC

FIRST PAYLOAD RECOVERY

First payload, a re-entry vehicle data capsule, to be recovered from space was launched by USAF Thor missile in 1958. G.E. built both re-entry vehicle and capsule.

FIRST ABLATION ICBM CONE

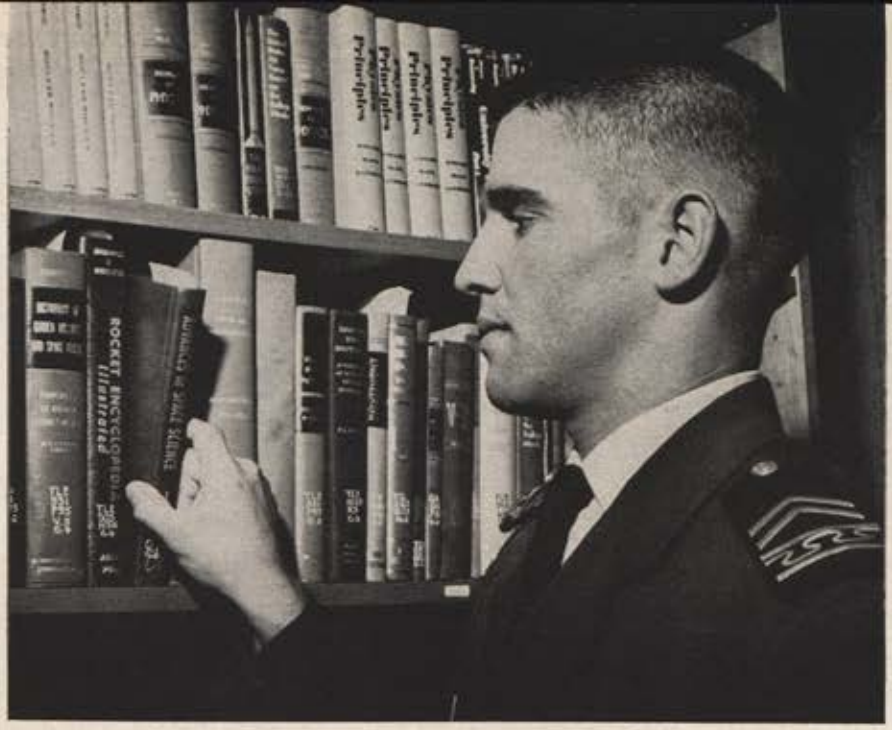
First ablation re-entry vehicle to fly full ICBM range was developed by G.E. and launched on July 9, 1958 . . . proved feasibility of ablation for ICBM re-entry.

FIRST POLARIS SHIP LAUNCH

First Polaris shipboard launch was made from Navy's USS Observation Island on August 27, 1959. G.E. is producing Polaris fire control and inertial guidance systems.

LONGEST MISSILE FLIGHT

USAF Atlas with G.E. radio command guidance and re-entry vehicle launched this May flew more than 9000 miles . . . longest Free World missile flight recorded to date.



Texts for tomorrow. Air Force Academy Cadet Michael P. Blaisdell scans an astronautical bookshelf of technical tomes dealing with missiles and space.

Astronautics is more than a word to the Air Force Academy. With an eye to the space missions ahead, Cadets are getting broad academic training in the multidisciplines of the new technology . . .

Schooling for Spaceflight

COL. RICHARD C. GIBSON, USAF

IN HELPING to transform astronautics from a dictionary definition to a living science, the members of the Department of Astronautics, newest department at the US Air Force Academy, have painstakingly sorted fact from fiction, written their own textbook, and established an entirely new course curriculum.

To the instructors of astronautics, the responsibility of creating a practical course of instruction has been no small task. Where does fantasy end and reality begin? The conquest of space is no longer fantasy. In a dizzying succession of events, the public has witnessed the evolution of successful intercontinental ballistic missiles, satellites, and space probes. Certainly, the advent of manned spaceflight is close at hand.

Although the dawn of the space age came on October 4, 1957, with the launching of the first Russian Sputnik, the Department of Astronautics at the Air Force Academy traces its existence back to a much earlier stimulus. In 1953 a thermonuclear breakthrough signaled the accelerated development of the long-range ballistic missile, an effort which soon became the nation's number-one priority job. From this development came the clear realization that tomorrow's Air Force officer must have an understanding of this revolutionary military technology. And, with the more recent space achievements has come the additional demand for education in rocketry, celestial mechanics, and interplanetary navigation.

Understanding astronautical affairs requires

New missions for the Agena

The Lockheed-built Agena satellite—used by the U.S. Air Force in its Discoverer, Midas, and Samos programs—has been chosen for another major program. The National Aeronautics and Space Administration plans to use a larger, more powerful version, the Agena B. NASA will use both Atlas and Thor boosters to launch it. Atop the Atlas, the versatile Agena B will vary from a 5000-pound earth satellite to an 800-pound space vehicle. Atop the Thor, it will be used for a new series of 1500-pound meteorological satellites. Lockheed is prime contractor and system manager for the Agena and Agena B.

LOCKHEED MISSILES & SPACE DIVISION
SUNNYVALE, CALIFORNIA

Agena is America's largest satellite, weighs 1700 pounds on orbit. Agena B is larger, has doubled fuel capacity.

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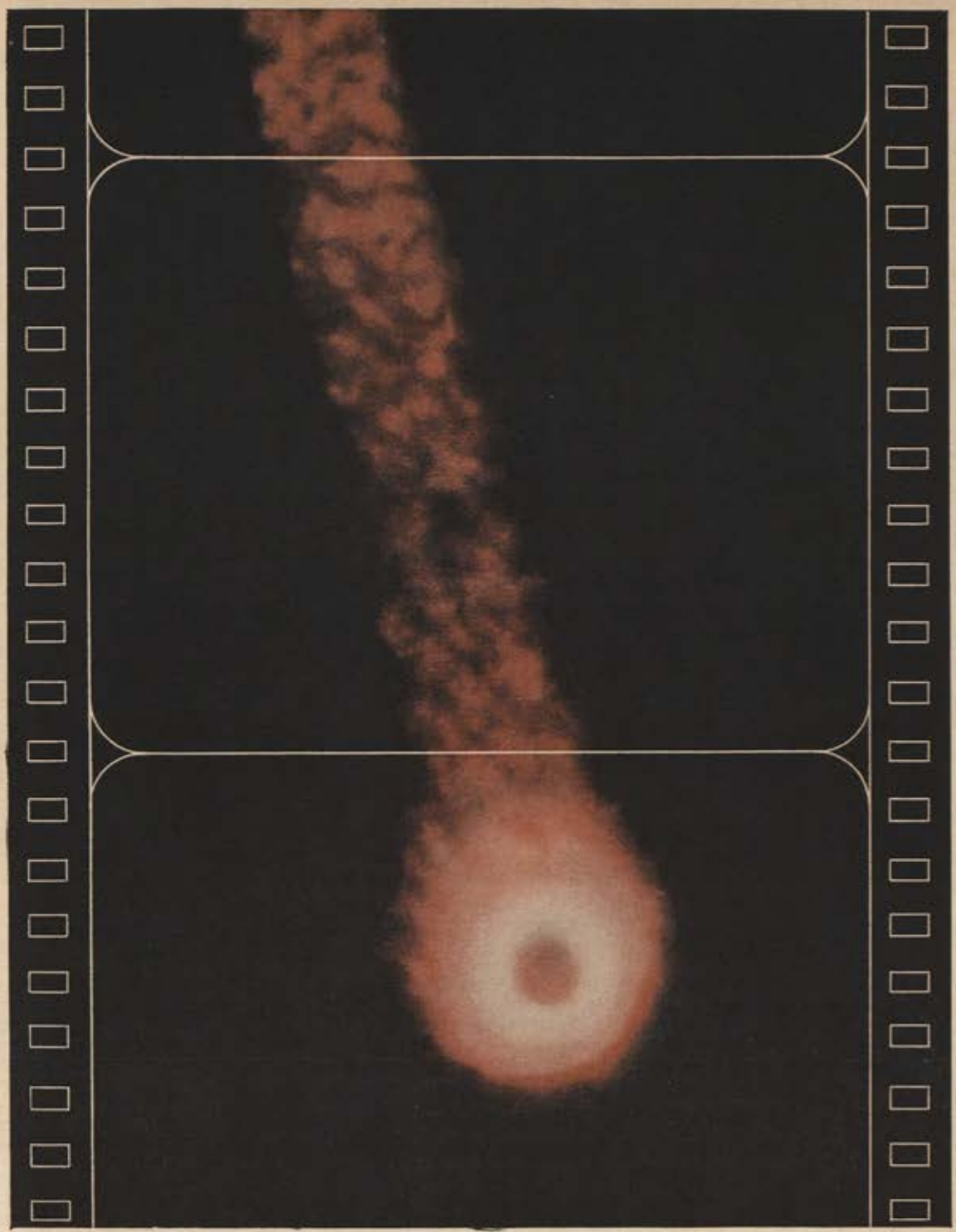


Re-entry portrait at 12,000 MPH. Critical performance data of re-entry vehicles at temperatures exceeding 12,000 degrees are obtained by a re-entry monitoring team from the Avco-Everett Research Laboratory. Portraits under these difficult conditions are obtained regularly as part of a general research program to study re-entry phenomena and related problems. Airborne equipment is used to acquire radiation data, trajectory information, and photographic documentation.

Avco

AVCO CORPORATION, 750 THIRD AVENUE, NEW YORK 17, NEW YORK

Following, from the Academy catalog, are the three current astronautical science courses. As the curriculum is expanded, an "enrichment" course, covering other aspects, is expected to be added.

Astronautics 411-412. Elements of Astronautics
The physics of ballistic missiles, satellites, and space vehicles. Includes studies of trajectories (powered, free flight, and reentry); propulsion principles; weapon systems design study and survey of related areas such as guidance, control, test techniques, new propulsion systems.
5 credit hours (2½ each term)

Astronautics 421. Inertial Measuring Instruments and Feedback Control Systems
Basic techniques of feedback control, using Laplace transforms, demonstrated by the analysis of mechanical, electrical, hydraulic, pneumatic, and thermal control systems. Determination of systems stability and time response to step, ramp, and impulse forcing functions, substantiated by analog computer exercises. Gyroscopic and accelerometer theory leading up to instrumented inertial and "Schuler tuned" stable platforms, supplemented by simple gyro and accelerometer experiments.
2½ credit hours

Astronautics 422. Ballistic and Space Vehicle Guidance
Philosophy of inertial guidance systems for ballistic and space vehicles proceeding from ballistic free-flight reference trajectories through determination of guidance constants, generation of steering signals, inertial measurements, gravity compensation, and composite inertial guidance systems. Comparison of inertial to radio inertial (command) guidance systems. Interplanetary guidance schemes including methods of instrumenting for mid-course and terminal space guidance.
2½ credit hours

mainly an adjustment of one's point of view. Natural laws apply both in space and on earth, even if the effects are sometimes different.

The astronautics faculty counts among its ten members three Ph.D.s, six rated pilots, one Rhodes Scholar, and years of experience in research, development, and combat.

While the serious student of astronautics always keeps in mind the socio-humanity aspects of this new technology, we believe that *only* a knowledge of the technical disciplines related to astronautics will give an insight into the application and limitations of space weapons. For this reason, the basic academy course in astronautics has as its objectives: 1) to develop an understanding of the fundamental physics of astronautics, and 2) to develop an appreciation of the engineering and military compromises which must be made in the creation of a new space weapon system.

This twofold objective is met by building the course upon the fundamental physics developed principally by Newton and Clausius. Newton established the science of celestial mechanics upon which the study of trajectories in space is based. Clausius stands out as the principal founder of the science of thermodynamics, the study of energy in transition. Upon the latter is built the study of rocket-engine design and the analysis of reentry heating. Thus, the astronautics course has its roots in man's earliest understanding of theoretical physics.

The technical disciplines in astronautics cover five general fields: mechanics of orbits and trajectories, propulsion, structures, guidance, and vehicle design.

Astronautics is bound to be one of the most important influences of all time. Substantial questions of law, both international and local, have been raised by the advent of the new technology. The "man on the street" has not yet fully realized that astronautics is inherently a high-cost activity which will affect government expenditures and therefore personal income. But substantial economic benefits may result. Astronautics is creating an entirely new industry which may some day exceed our largest present-day industries. The scientific applications of astronautics are almost without number and will add substantially to the well being of humanity.

That the inspirational objectives of space conquest can in fact be boiled down to specific educational objectives has been proven in the two years of teaching senior students at the Air Force Academy.

Air Force leadership, realizing the increasing military importance of space technology, has recently recommended an increase in emphasis on astronautics at the Academy. As a consequence it is anticipated that an additional four-credit-hour course in this subject will be added to the present six credit hours now required for all senior Cadets. This additional time will permit a more thorough treatment of ballistic missiles and space guidance—a course which is now offered as an elective to Cadets with exceptional aptitude in the applied science subjects. Thus, all Cadets graduating from the Academy will receive ten credit hours in astronautics, which will measurably increase their understanding of the technical problems involved in conquering our newest frontier.

Hopefully, among these future Air Force leaders will be men of vision, equipped by education to seek out better ways of doing the Air Force job, men who will diligently strive to keep the Air Force efforts in defense attuned to this nation's needs.—END

Colonel Gibson, head of the Air Force Academy's Department of Astronautics, holds a doctorate from Massachusetts Institute of Technology. His previous assignment was as Director, Experimental Vehicles and Instrumentation Division, Hq. ARDC.

Speaking of SPACE

WILLIAM LEAVITT
Associate Editor

Midas-Samos: Free-World 'Musts'

"Two groups of acts should be differentiated from the standpoint of world relations and international law: acts in the cosmos that are acts of war and those that are not acts of war but serve in international relations as expressions of mistrust, ill-will, and similar cold-war consequences.

"Clearly one cannot lump together the destruction of another country's Sputniks by means of antimissile missiles with the presence of photo and TV equipment in a satellite, even if employed for reconnaissance."

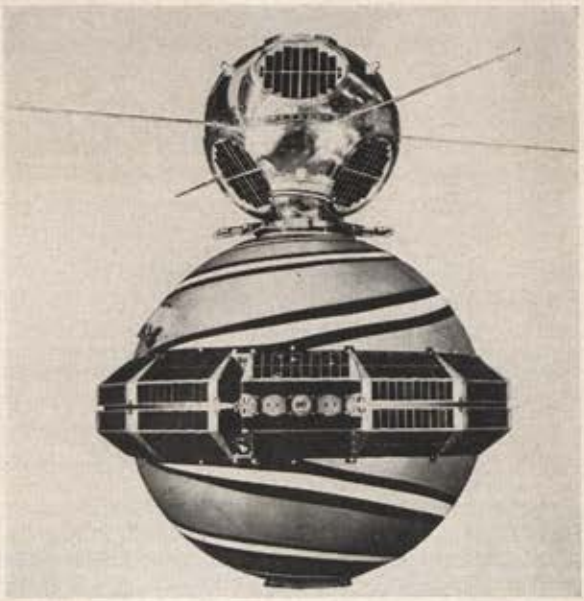
So wrote Korovin, a leading Soviet legal scholar, in January 1959, in an article entitled "International Status of Cosmic Space," published in the Soviet journal, *International Affairs*.

Korovin's view, which sounds almost Western in its objectivity, seems curiously soft in these post-U-2 and -RB-47 days. It is in sharp contrast to the current quasi-official Communist line on early-warning and reconnaissance satellites, as expressed in the following more recent outburst, broadcast in early July by Radio Moscow to Western Europe, a quote from the magazine *Soviet Fleet:*

"The hands of US brass hats are again itching to resume spy flights over the USSR. The Pentagon is racking its brains trying to discover a way of doing so with impunity. US brass hats believe the best means is an artificial spy satellite, work on which is now being intensified in the United States. . . ."

This new, hard line has begun to appear repeatedly in Soviet publications. It raises serious questions for American planners of the Midas early-warning and Samos reconnaissance satellite systems that many observers have suggested could establish a practicable world system of controlled peace, as this magazine has called it. The hard line is, of course, also a strong indication of the great annoyance with which the Soviets regard the possibility of American 'scopes in the sky monitoring their missile and space activities.

Because of the usual lag of politics behind technology, a dubious luxury that we can less and less afford, decisions that ought to have been made months ago relative to the Midas and Samos systems may be delayed in the midst of election excitement, and because of the budget-minded quietude of an Administration whose days are numbered. It would be more than a good idea for both contenders for the Presidency to be briefed technically on the significance of Midas-Samos. And it would be valuable, too, if the Administra-



June saw American astronautical "first"—the "piggy-back" ride of one scientific satellite atop another into orbit. Naval Research Laboratory's solar radiation satellite, top of photo, was separated in space from Navy's Transit II-A navigational satellite, is traveling in its own path as an independent experiment. Launch was by USAF Ballistic Missile Division, using Thor-Able-Star.

tion provided both candidates with full information on whatever decisions *have* been made thus far on surveillance-from-space programs.

The question of early-warning and reconnaissance satellites is inordinately complicated, from all three basic points of view—political, legal, and technical.

Politically, "eyes" in the sky are potentially explosive, and it may be that on political grounds the programs will literally never get off the ground. The fiasco of the U-2 has given the Russians incalculable propaganda ammunition. They can and are scaring the world into believing that the US—which in utter reality is the sole bar to their planned communization of the globe—has through aerial reconnaissance been risking world peace. This Russian campaign, which, as cited above, is now being extended to include surveillance from space, is having its effect in the United States. Many sincere and thoughtful observers, clinging to the idea that good will alone can be a weapon at the bargaining table, attacked the U-2 program on grounds of what they called American bad faith. They can be counted on to oppose spatial extension of American early-warning and reconnaissance programs.

This group, for the most part out of government, is unknowingly allied to a totally different segment of people in the Administration. These planners could delay both the Midas and Samos programs, on the grounds that the systems must be totally proved out technically before planning can be speeded for concurrent programs of training operational crews and building requisite ground-support equipment.

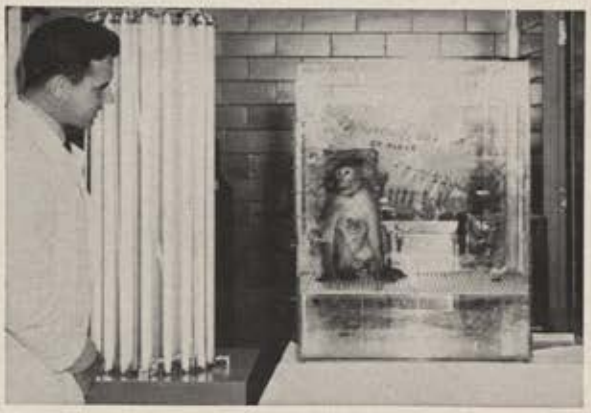
The views of the hesitant—for *political* reasons —and the hesitant—for *technological* reasons—could merge into a new and unfortunate attitude further paralyzing our national will to resist Soviet blackmail. Such a state of mind could tragically eliminate astronautics' potential for free-world security. Our defense plans would then be decided on the basis of a strange mixture of fear of Russian bluster compounded with vain hopes for totally riskless spending.

The legal questions involved in the Midas and Samos systems are complicated, and there are no flat answers. How high does national sovereignty extend? Can the Russians legally complain against surveillance from space?

Law is pragmatic. Although we think of the open seas as free to all, there was a time when powerful nations attempted to claim vast stretches of the ocean. Only when it became patently impossible to control the seas totally did the principle of freedom of the high seas become internationally accepted. And even today, different nations have different attitudes on territorial waters.

The launch of Sputniks and US scientific satellites without complaint by any nation against violation of its airspace is being held up by many experts as established precedent for freedom of space and as an argument that the Russians cannot object to space vehicles crossing their territory. The Russians, of course, can be expected to shout: "Yes, but those were peaceful scientific vehicles . . . a 'spy' satellite is an entirely different, and aggressive, matter." They are talking that way already.

On the free-world side, there is increasing effort, meanwhile, among specialists in air and space law, to encourage international agreement to establishment of the so-called von Kármán line, some fifty-three miles up, the point at which aerodynamic support of vehicles ends, as the limit of national sovereignty. Indeed twenty-eight papers (significantly, none from the Russians, but a few from the Red satellite countries), on space law are expected to be presented at the full day's session on space law scheduled for this month's Stockholm meeting of the International Astronautical Federation. Several Western papers will probably call for agreements to limit sovereignty to the aerodynamically navigable atmosphere.



USAF space ecologist Capt. Jack Bates prepares experiments at the Aerospace Medical Center, Brooks AFB, Tex., in which primates will breathe algae-supplied oxygen pumped into sealed cage. Project may lead to spacecrew life support system.

The interest in legalizing the fifty-three-mile limit is strong among most American students of space law, and there is no doubt that such an agreement, could add to international harmony. But prospects for agreement are most unlikely for

Fifth-graders take a trip to Mars and Venus as they watch International Business Machine Corporation's new astronautical exhibit at IBM Space Computing Center, Washington, D. C.

the simple reason that neither the Soviet nor the US wants to bind itself to a legal principle which might restrict either in the use of space for national security purposes. The only policy of the State Department so far has been "wait and see," and it is probably a wise policy even if it appears to drift. The official Soviet attitude, aside from the growing hard line on surveillance vehicles, has been to link demands for "peaceful use of space" with impossible political conditions, such as the closing of US overseas bases. Their real course is probably uncharted and could depend heavily on how we presented Midas and Samos to the world.

It is fair to ask whether in the absence of upper sovereignty agreement a US space surveillance vehicle might be destroyed by Soviet countermeasures. And if so, would such a Soviet act be an act of war? The trouble with asking the questions is that they remain academic so long as the Midas and Samos programs themselves retain what may be only a paper priority.

The paper priority status of the two programs has been suggested by one significant report in recent weeks, that future test shots for Midas are going to be carefully designed not to pass over Soviet territory. The latter report suggests a possible timidity on the part of Defense Department planners as a result of U-2. But then again, it might be nothing more than a policy of avoiding Soviet territory until the *real* Midas system comes into operation. The trouble is we don't know.

Until proved otherwise the Midas and Samos idea seems to be the most dramatic extension of US deterrent power in an increasingly shaky world situation. Aerial reconnaissance, whatever its earlier successes, is obsolete after the U-2, not only because of the Russians but also because of the understandable fears of allies living under the Soviet gun.

But surveillance from space is reconnaissance in a new dimension. It can be honestly justified on an international level as a truly necessary procedure of using space as a platform from which the entire world could be protected against the surprise attack that is a universal fear. Already such legislators as Senator Henry Jackson (D-Wash.) have called for a US offering of Midas and Samos capability to the United Nations. This is by no means visionary. It could dramatize to the world —including even the Soviet satellite countries— the fact, which somehow seems to have been lost sight of, that the *Soviet Union* is the negative quality in the world today. And if the United Nations did agree to an internationally operated surveillance system, it would be a reckless Soviet delegate indeed who bared the "peace-loving" Soviet Union's intent to destroy such a system. Using the UN as a forum, we could alarm the world to the great danger of surprise attack. A strong presentation of this theme could be a dramatic and effective act by President Eisenhower in his closing days of office.

The third aspect mentioned above, the technical, is really the least significant. Experts have assured us of the workability of surveillance satellites. Even if the experts turned out to be wrong, an intensive program could cost us only money, which is something we still can afford. Time we cannot.

Space Capsules

The question of whether conventional boilers and heat-exchange devices would work in low-

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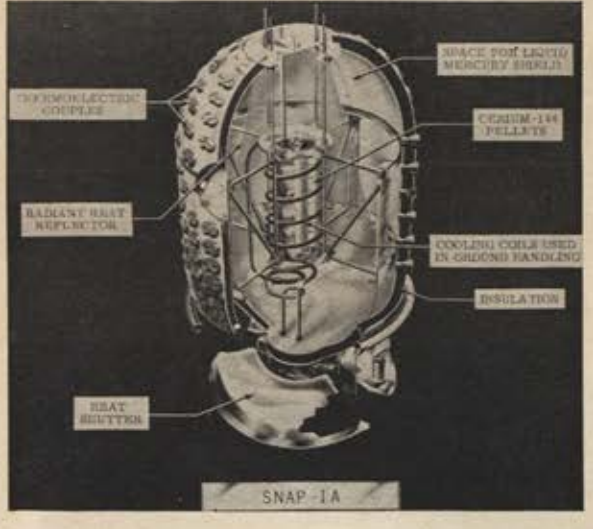
gravity conditions is being explored by RCA Astro-Electronics Products Division's CLIVE M. USISKIN. Experiments indicate, according to a film report to the AMERICAN ASTRONAUTICAL SOCIETY, that the boiling process *can* operate so long as there is even the small amount of "artificial gravity" producible by slow rotation of a space station. Usiskin says that only in the total absence of gravitational force does the boiling process become inoperable. . . . DR. MARGARET MEAD, who last month on these pages ("The Newest Battle of the Sexes") pointed up the need for maximum use of qualified women in science, should be heartened by the feature in the July issue of *Vogue* entitled "They're Important in Space." It's a photo-story of eleven women, all playing vital roles in astronautics, doing jobs ranging from analyzing missile trajectories at Cape Canaveral to planning spacemen's diets at the Air Force's Wright Air Development Division at Wright-Patterson AFB, Ohio.

DONALD N. MICHAEL's article, "Sputniks and Public Opinion," is quoted in the newly released staff study of the HOUSE COMMITTEE ON SCIENCE AND ASTRONAUTICS entitled "The Practical Values of Space Exploration." Written in lay language, the report is a highly readable booklet covering subjects ranging from astronautics as a substitute for war to spaceborne weather control systems.



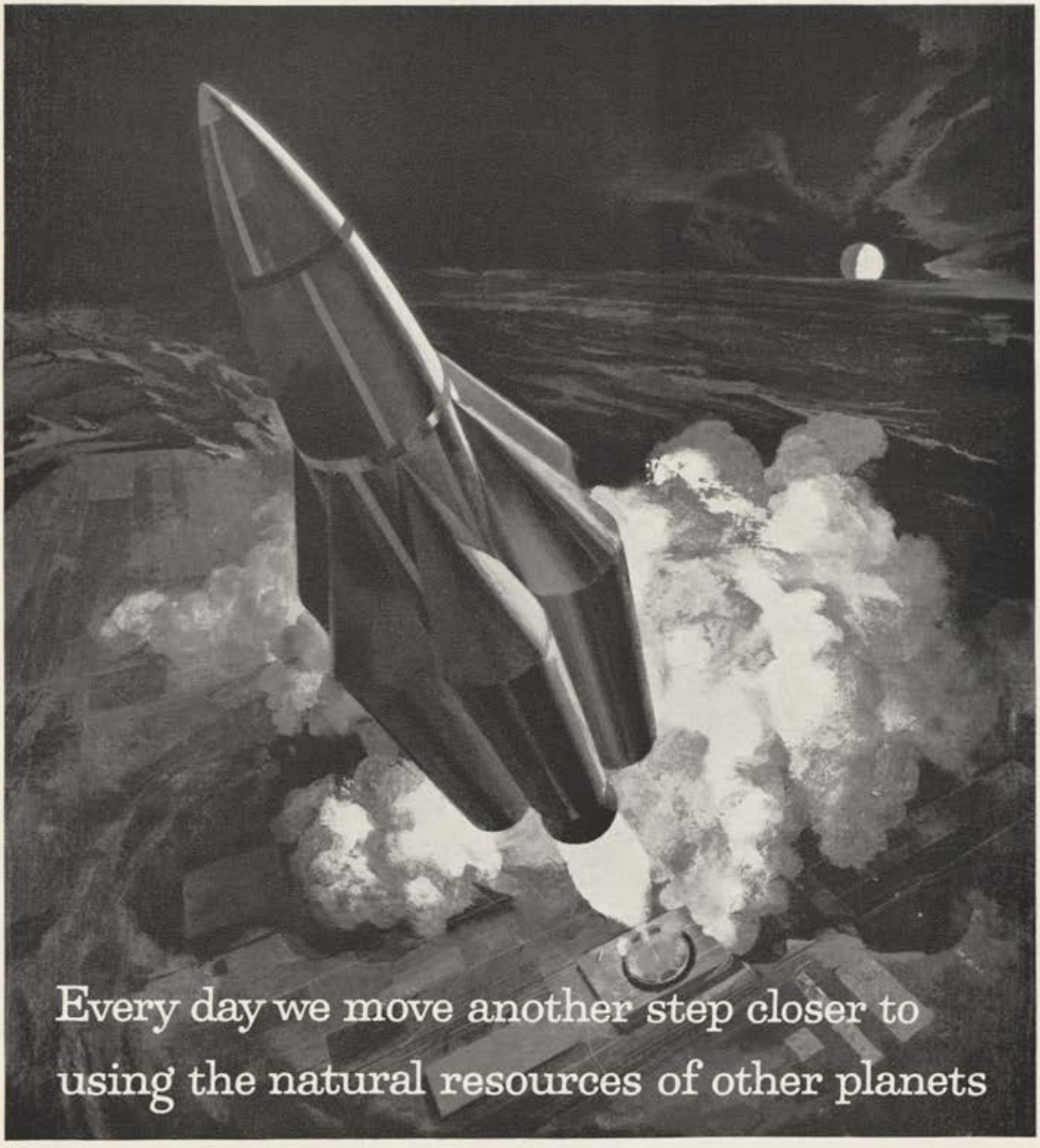
Martin Company is testing SNAP-1A, proposed compact, lightweight generator to convert heat from nuclear reactor byproducts directly to power satellite systems for periods of at least a year. Device weighs 175 pounds, is thirty-four inches long.

Write to the Government Printing Office, Washington, D. C. for information on purchase. . . . July 1 saw the operational death of TIROS I, the US weather satellite launched on April 1. In its three-month life, Tiros transmitted 22,952 picture frames from its orbital altitude averaging some 450 miles. An inoperative relay in Tiros' wide-angle camera system made it impossible to turn the camera off—draining the batteries, damaging the entire satellite system, and ending its life—according to the NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. NASA says Tiros II will be launched later this year.

Also out of business, but still circling the sun, is PIONEER V, which stopped transmitting after reaching a distance of some 22,000,000 miles from earth. In transmitting its 138.9 hours of data, Pioneer established, at least tentatively that: 1) transit of solar particles between the sun and the earth occurs millions of miles from earth; 2) sudden drops in cosmic-ray intensity do not appear to depend on the earth's magnetic system as previously believed; 3) the earth's magnetic field extends at least 64,000 miles from the earth; 4) there may be a measurable interplanetary magnetic field; 5) there seems to be a large ring current circulating around the earth at from some 30,000 to 60,000 miles; and 6) intensity of the outer Van Allen radiation belt does not seem to be produced by injection of electrons from the sun.

"To Solar System and Rest Rooms" is the message of an electric sign in New York's HAYDEN PLANETARIUM, according to a correspondent quoted in the popular "Trade Winds" column in the *Saturday Review*. . . . Air Research and Development Command is studying the feasibility of using balloons to decelerate and control buffeting and tumbling of reentry vehicles. The spherical coated balloon, developed by GOODYEAR AIRCRAFT CORPORATION, will be inflated at high altitude until it reaches a flow region suitable for maximum drag. When the reentry vehicle, a modified Cree missile, is slowed a parachute will be ejected at lower altitude to complete recovery. Firings to 150,000 and 200,000 feet are planned this summer to test the "Ballute" system.

BELL TELEPHONE SYSTEM has outlined to the Federal Communications Commission a plan for a network of fifty satellites in polar orbits to provide worldwide telephone and television communications. Estimated cost: $170 million.—END



Development of nuclear power, utilized in space ships like this Douglas concept, will speed the day when man will travel in outer space and use its resources.

Air Force space studies aimed at cracking military problems also reveal potential civilian benefits

Progress in space research is so rapid that consideration must now be given to projects you'd have scoffed at a few years ago. For instance, development of a nuclear rocket could drop payload costs so low that it would be economically worthwhile to import rare materials from other planets.

Projects such as this are the daily fare of engineers at Douglas. Right now they are studying the many problems related to interplanetary exploration: Can humans survive? What about temperature, gravity, water, food . . . and fuel for the return trip?

Douglas has been finding answers to such problems since 1941. These answers are seen in action every time a Douglas-built Thor boosts another payload into space.

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A few days after the Summit Conference fell apart, US and Canadian defense forces were called to "cocked-pistol" readiness in a now-annual exercise—Desk Top—to test NORAD's operational reflexes. This was June 8, 1960 . . .

AIR FORCE
AUGUST 1960

The Day NORAD Went to War!

Ed Mack Miller

Gen. Laurence S. Kuter (standing, center), Commander in Chief, North American Air Defense Command, shows apparent deep concern during a defense inspection trip to McGuire AFB, N. J. On General Kuter's left is Maj. Gen. Sam W. Agee, Commander of the 26th NORAD Region, Hancock Field, Syracuse, N. Y., while in the foreground is Brig. Gen. Gilbert L. Pritchard, who is Commander of the New York NORAD Sector, McGuire AFB. Standing behind the radar console is Lt. Col. Norman W. Campion, Commander of the 539th Fighter-Interceptor Squadron, which is based at McGuire AFB.

THIS is General Laurence Kuter. . . . The North American Air Defense Command has been ordered to a condition of air defense emergency. . . . High-speed tracks approaching the United States . . . have been positively identified as hostile aircraft. . . ."

With these words NORAD went to simulated war shortly after midnight on June 8.

A fortnight earlier the Summit Conference aborted in Paris. The cold war took on new dimensions. Defense Secretary Gates and Soviet Premier Khrushchev placed this development in grim perspective.

Khrushchev, speaking in Paris and elsewhere, rattled his rockets once again, warned the world of Soviet prowess, threatened to launch attacks on US allies that allowed reconnaissance planes to take off from their territory to overfly Russia. From the French capital, Secretary Gates reacted to stepped-up world tension by placing US forces on alert around the globe as a "precautionary measure."

Here at home, the chain of events that began with the U-2 incident on May 1 had culminated in intensi-

(Continued on following page)

fied demands for an increase in US military strength. The first week in June saw the Senate debating additions to the Administration defense budget; it voted them by midmonth.

This, then, was the supercharged atmosphere in which General Kuter, NORAD's Commander in Chief, broadcast his midnight message over radio circuits covering millions of miles. From New Mexico to Newfoundland to the Arctic, and at bases overseas, thousands of officers and men manning warning and communication facilities, ships, and planes responded. The 1960 edition of Exercise Desk Top was under way.

At ten minutes after midnight, both SAC and NORAD went to cocked-pistol readiness. Seventeen minutes later, NORAD moved to the next phases of Defense Readiness Conditions (DEFCONS) "Big Noise" and "Lemon Juice." CONELRAD (Control of Electronic Radiations) and "SCATER" (Security Control of Air Traffic and Electromagnetic Radiations) plans were implemented.

Almost simultaneously, the Office of Civil Defense and Mobilization implemented its "Checker Board" alert. At 0040, SAC theoretically launched a counterattack against the attackers.

While the "Big Noise," "Apple Jack," and "Delta" phases of alert upgrading were flashing to Stateside,

WASH., SHREVEPORT, LA., AND CHEYENNE, WYO., ARE UNABLE TO BE REACHED BY TELEPHONE OR TELEGRAPH. . . . THROUGH SUCH MILITARY COMMUNICATIONS AS MAY EXIST . . . PASS THE FOLLOWING: THE PRESIDENT OF THE UNITED STATES AND THE PRIME MINISTER OF CANADA BELIEVE A STATE OF WAR TO EXIST. A NUMBER OF GREAT AND DESTRUCTIVE EXPLOSIONS, INDICATING AN INTERCONTINENTAL BALLISTIC MISSILE ATTACK, HAVE OCCURED OVER A WIDE AREA IN BOTH COUNTRIES. THE BATTLE FOR NORTH AMERICA HAS BEGUN. . . ."

Throughout the long night of Exercise Desk Top III, officers and men along the edges of the free world were involved in this simulation of all-out war. USAF, Army, Navy, and Royal Canadian Air Force personnel figured in the actions and decisions, all the way from the far reaches of our early-warning radar lines down through the numerous manual radar and SAGE (Semi-Automatic Ground Environment) sites.

One object of the exercise was to test the reactions and capabilities of personnel up and down the line—at Colorado Springs, at region, division, and sector

Alert crews race to man their Convair F-102 Delta Daggers to investigate unknown aircraft. Fortunately, it turned out to be a friendly plane. Day-to-day training exercises like Desk Top III keep command personnel on their toes.

headquarters, at DEW Line stations in the Arctic, at aircraft control and warning squadron radar sites, at the Army's region and direction center locations, in all barrier and off-shore airborne early-warning aircraft of the Air Force and Navy, aboard Navy picket ships and antisubmarine warfare shore stations, and at USAF's isolated Texas towers. Around the world, at some 700 installations and facilities, air defense personnel played out their roles in this rehearsal of a drama that we hope never will be enacted.

Atlantic, Pacific, and European Commanders, NORAD headquarters was implementing "MINICOM" (reduction and control of teletype and telephone traffic).

The tension at NORAD headquarters in Colorado Springs rose to a high level. It did not take too much imagination to suppose in the heat of events that this could be the real thing. One exercise message, for instance, read:

"MSG FROM ALTERNATE WHITE HOUSE VIA JCS TO CINC, NORAD: INITIAL ATTACK REPORTS INDICATE METROPOLITAN AREAS OF ROME, N. Y., SAULT STE. MARIE, MICH., LINCOLN, NEB., SPOKANE,

The simulated attack consisted not only of ICBMs but also of 698 enemy manned bombers showing up suddenly on radar scopes across the more than ten and one-half million miles of NORAD's "lifewatch." On thousands of radarscopes, a great global air battle took place.

The incoming enemy missiles and planes actually

appeared on scopes as if they were real targets. Technicians plotted locations, speed, and altitude of the blips, and relayed the information to the "big board" at NORAD headquarters. Jet fighter aircraft were theoretically scrambled by weapons directors located at the many aircraft control and warning squadrons.

During the entire exercise, in reality, no aircraft left the ground, either to defend North America or play-act as the attackers. The exercise was "packaged." Film from the package was fed into scopes around the world.

The presence of enemy aircraft in the exercise was in line with General Kuter's conviction that if the Reds strike in the next decade, it will be with everything they have available. At present, their strength includes about 1,200 nuclear bombers in addition to a growing missile supply.

During this decade, says General Kuter, we face both a manned bomber and an intercontinental ballistic missile threat.

Packaged air raids as seen in this exercise are the product of years of work by the scientists of Systems Development Corporation of Santa Monica, Calif., a nonprofit organization that is an offshoot of the RAND Corporation. It did the early exploratory work in devising a technique for translating movements of imaginary aircraft into realistic blips on radarscopes.

Since 1954, when the System Training Program (STP) was first installed at the 26th Air Division, the program has spread to all manual air divisions in the US Air Defense Command, to all sectors of the Royal Canadian Air Defense Command, and to all operational sectors in the SAGE system. Teams of training specialists are maintained by the manual and SAGE branches at each division headquarters, SAGE direction center, and region headquarters.

The packaged air raid even includes such sophisticated adjuncts as radar countermeasures and battle-damage simulation. The package consists of films, punch cards, magnetic tapes, maps, scripts, and lists. The data contained in the package is used by Air Force personnel to create synthetic air defense situations and to observe and record the system performance during a training mission.

A substantial amount of data that must be stored on the STP materials in order to simulate realistically the complex air defense environment requires the use of high-speed computing and tabulating equipment. At manual direction centers, simulated radar returns are put into the radar sets from a special target generator, controlled by film which contains the radar target data and another film, which contains the electronic jamming data for that direction center.

The training is so specific that the computation model takes into account characteristics of each radar station, such as beam shape, antenna tilt, and local screening angles. The radar target films include geographic path points, aircraft types, speeds, altitudes, and various other factors important to the problem. In SAGE system training program exercises, simulated radar data are put into the SAGE computer from magnetic tape rather than from film.

The simulated training program is large and expensive. For Desk Top III, the exercise materials included a monumental arsenal of make-believe scripts,

Warning outposts tied to NORAD communications network ring the free world. DEW Line radar stations, one of which is shown above, protect against attack over the top of the world. Station took part in Desk Top III.

machine calculations, more than 35,000 feet of film to run through radarscopes, nearly 100,000 feet of recording tape to present individual coordinated attack situations over the vast area, and more than a half million square feet of machine-produced maps showing battle developments during the time schedule of the exercise.

The cost of the film used is approximately $1,000 for every AC&W squadron involved. This is not cheap. This figure, however, is about one one-hundredth of what it would cost for fuel and aircraft wear and tear if the alert were done as a "real thing"—as it has been up until the last several years.

A great advantage of the package is that it can be used over and over again. It can be cranked into ADC's works on short notice.

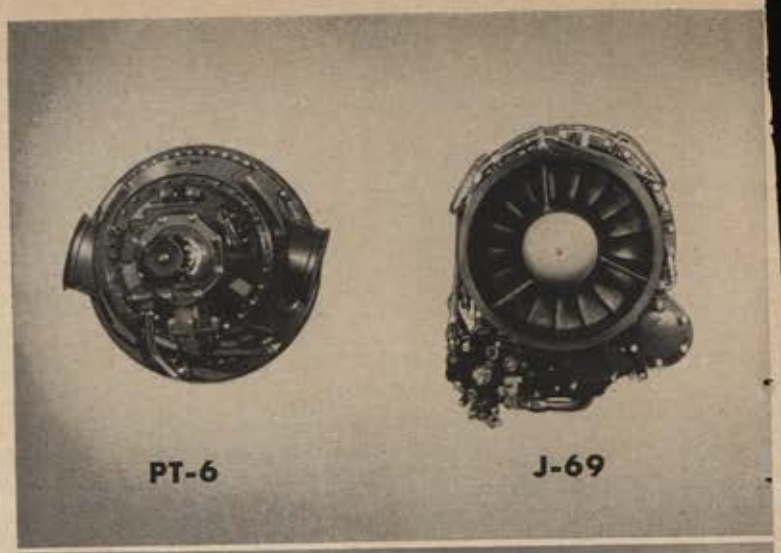
Exercises like Desk Top III are a big part of today's NORAD picture. If we are attacked by modern weapons, only a superbly efficient air defense network will enable us to survive. Training, alongside continuing defense weapon development, is the key.

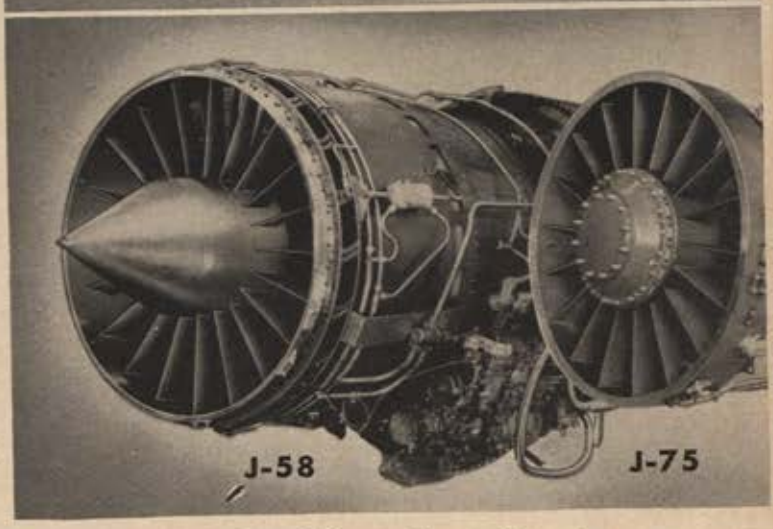
That was why NORAD went to war in June.—END

The author, Ed Mack Miller, is a veteran contributor to AIR FORCE *and other magazines. An instructor pilot for United Air Lines, he is a veteran both in the cockpit and at the typewriter. A Denverite, he is former president of the state's Authors' League.*

Controls for the "hot ones"

- for over 23,000 aircraft gas turbines
- for a liquid hydrogen rocket engine
- for the B-70's air-induction system
- for the power forms of tomorrow



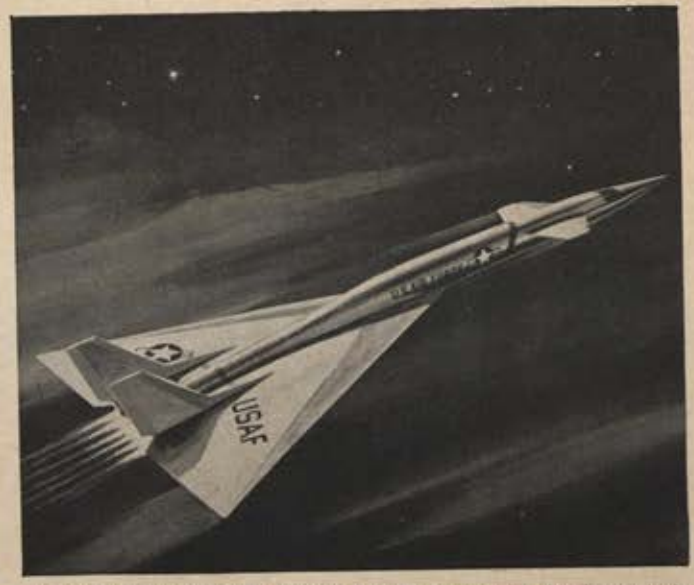


Hamilton Standard has supplied fuel and engine controls for over 23,000 aircraft gas turbines—powering 17 types of the nation's leading military and commercial aircraft.

Today, its experience is being applied to a new generation of "HOT ONES" . . . controls for an advanced liquid hydrogen rocket engine . . . a unique air-induction system for the USAF B-70 . . . hot gas servos and other hydraulic, pneumatic and mechanical devices for missiles and space vehicles. And for the power forms of tomorrow, Hamilton Standard research is furnishing new ideas for control of ion engines, fuel cells, ramjets and industrial gas turbines.

Hamilton Standard has the ability to solve your control problems—from concept to completion. Your inquiry is invited.

ROCKET ENGINE CONTROLS. Hamilton Standard has developed thrust modulation controls and fuel-oxidizer shut-off valves for an advanced liquid hydrogen engine. This work has provided important breakthroughs in low-temperature sealing problems and system reliability.



B-70'S AIR-INDUCTION CONTROL SYSTEM, now under development at Hamilton Standard, involves some of the most advanced control problems ever encountered. It is designed to provide the most efficient air-flow into the plane's engines over an unusual range of operating conditions.

SMALL GAS TURBINES

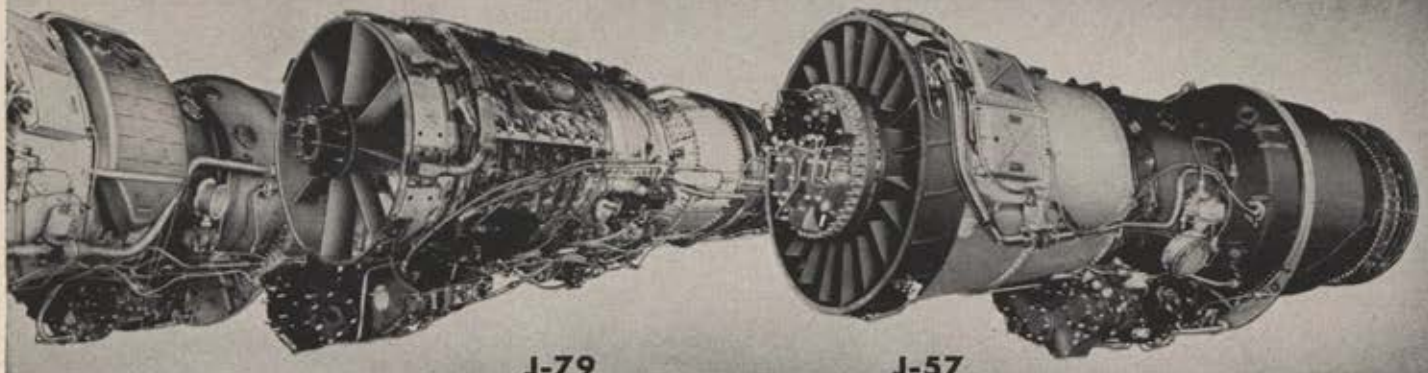
T-58

T-55

T-64

J-60

LARGE JETS



J-79

J-57

HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

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SOME OF THE MANY FIELDS OF GROWTH AT HAMILTON STANDARD

ENVIRONMENTAL CONDITIONING SYSTEMS for space vehicles and such advanced aircraft as the B-58, 880, B-70 are important aspects of Hamilton Standard diversification.

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If war does come, and modern weapons do strike our homeland, will your community be prepared to survive? Up-to-date civil defense measures can provide you with an affirmative answer to this question. In the following article, a local civil defense official describes . . .

'HOW WE PREPARE for the

Frank Ward
CIVIL DEFENSE COORDINATOR FOR BATTLE CREEK

I HAVE been Civil Defense Coordinator for the city of Battle Creek, Mich., for the past two and a half years. I believe my experiences in this regard, and observations thereon, may be of some general use to others faced with problems in an area of growing importance to national survival.

First, may I note that civil defense work is a natural for the ex-military man. I have found that an Air Force background, which provided a knowledge of the supply and delivery means of modern weapons, was a definite advantage in planning for the receipt of same—which is civil defense.

Civil defense has come a long way since World War II days. The popular picture of a volunteer in each household or each block, equipped with a tin hat, arm band, and bucket of sand is long out of date. Civil defense concepts today are far more inclusive. They provide for people and agencies with public responsibilities to continue to discharge these responsibilities, even as they attempt to relieve disaster situations with the help of specially trained personnel and groups.

Our predisaster planning and operations are predicated on two major disaster categories, natural disaster and man-made disaster. In Battle Creek and much of the United States, we are not blessed with hurricanes, earthquakes, tidal waves, or a big pile of rocks that is likely to throw smoldering boulders and hot ashes on us. Our potential natural disasters boil down to tornadoes or heavy snowstorms. Man-made disasters for which we plan and prepare include major industrial explosions, train and plane wrecks, catastrophic fires, and the like—in addition, of course, to World War III.

The civil defense concept of normal government continuing to operate in an emergency must apply not only to the city government of Battle Creek but also at the county, state, and national levels. (Parenthetically, Battle Creek is also OCDM headquarters for the nation, although my immediate concern is the local scene.) The city of Battle Creek three years ago, by ordinance under the state statutes, established the positions of Civil Defense Director and Civil Defense Coordinator as full-time positions in the city administration. The elected mayor of the city is the Director of Civil Defense. He has the full responsibility and the authority as the legal head of government.

The Civil Defense Coordinator has no authority over any department. He has no office staff working directly for him. But he does have the responsibility for coordinating all forms of major disaster planning within and between city departments. This extends to public services provided by private means: utilities, hospitals, some industrial activities.

His goal, in planning with these groups, is twofold. He is interested, first, in survival for as many of his fellow citizens as possible. Second, he is concerned with the post-disaster period of recovery and restoration.

The Civil Defense Coordinator's program in Battle Creek has been primarily aimed at establishing a warning system and selling the concept of individual family home shelters.

Our warning program is in essentially two categories—a telephone calling network and an air-raid-warning siren network. The telephone network incorporates two existing networks, one established by the Chamber of Commerce as a tornado-warning network in industry, the second established by the Retail Merchants Association in conjunction with the Police Department to alert all stores to the presence of bad check passers.

Superimposed on these existing telephone networks and stemming from a state and national warning telephone and radio chain, we have a network that involves city departments. Each department is responsible for one area of the network, which at present consists of approximately 280 telephone points.

We tell our people that when the warning sirens go, "turn on your radios and find out what's going on." Actually, there are two official, nationally recognized siren signals.

The alert signal is a steady blast of three to five minutes. It means the nation is at war and attack is possible. This is to be used only in the event the United States becomes engaged in hostilities.

The second signal, the take-cover signal, is a wailing tone of the sirens for three minutes. It means that danger is imminent. This would be used in the event a tornado was headed directly for the city. It would also be used to warn of imminent direct attack, the arrival of radioactive fallout, detection of bacteriological and chemical attack, or the imminent presence of destructive weapons. Basically, it means to the people in Battle Creek, "take your portable radio with you to the shelter and then turn the radio on and find out why you are there."

Shelters for our population, civilian as well as military, can mean the difference between the survival and extinction of our United States. Many studies have been conducted in this regard. One conservative finding was that without shelter twenty-five percent of the nation would die from radioactive fallout,

whereas with shelter only three percent would die. Figures as high as ninety percent losses without shelter as opposed to twenty percent losses with shelter have been quoted. In any event, it is certainly obvious that radioactive fallout shelters must become a part of our lives. They must be looked upon as features of our civilization, ranking with inspection of milk and foods, public maintenance of reservoirs, and so on.

The need to sell a concept of home family shelters presents a fascinating challenge. We have succeeded to an extent in Battle Creek.

By talking to groups of from three to 300 at a time, we have persuaded an estimated 1,500 to 1,600 families to prepare shelters. These protect occupants with a minimum of eight inches of solid concrete or twelve inches of dirt. Our folks also keep on hand in the shelters at least two weeks' supply of food. This last, of course, is quite ambiguous. It can run all the way from fourteen cans of beans to a quite elaborate stock of food costing as much as $200 to $300 for a family of four to six. We point out that a good stock of food is better than money in the bank; you can eat it.

Simple plans for family shelters have been made available. We are fortunate in our locality in that digging a shelter in a backyard is relatively easy. The ground is sandy. Our underground water level is usually far enough down to present no problem.

One young mother and her three small youngsters dug one four feet deep, fifteen feet across, and about twenty-five feet long. Then she called me asking how to proceed. Her husband was indifferent to the project. But, determined to have a safe shelter for her family, she went on and has now finished the task with a minimum of outside assistance.

I have visited between 200 and 300 home shelters in the Battle Creek area to assist with construction, engineering, design, or supply problems. I have talked to hundreds of other persons who have told me of their shelters.

I have made two attempts to make house-to-house surveys to determine the existence of shelters. But I have learned that the existence of a shelter is a very personal thing. People whose shelters I visited one week will deny to me the next week that they have a shelter. This is not too hard for me to understand because, when I built my house in 1951, neither the architect, the builder, nor my wife knew that the basement area of my house was designed as a shelter.

I walked through the streets of Hiroshima in the latter part of 1945. I was impressed. In fact, I was scared. My own shelter, and my initial interest in civil defense, grew from that experience. But, at the time I built the shelter, I didn't want to advertise even to my wife that I was thinking in these terms. This sort of attitude is not uncommon even today. I know one pair of next-door neighbors whose families are very close and who have been talking generally to each other about shelters. But neither one knows the other has a shelter. Even the kids haven't squealed. I have been in both these shelters.

Actually, however, shelters in our community are becoming more than something to think about, talk about, or feel shy about. More and more families are building them. Our campaign began snowballing somewhere along the line. Advertising and speeches helped get things started. Now we have reached a point where people tell me their shelter was built not because of something they heard or that they read in the newspaper, but because friends or relatives have built shelters. This is a kind of nuclear-age "keeping up with the Joneses."

In addition to the prime emphasis of a warning system and a shelter program, there are many other areas that must be covered to prepare a community for survival. An over-all plan is essential. This is difficult. My experience has been that the plan is never quite complete. It is a big job. The over-all National Plan will probably wind up with about forty annexes, most of them covering separate areas of disaster survival. A community plan, such as ours, should naturally be considerably smaller, but it is still a full-scale undertaking and an essential one.

We base our planning primarily on the hazards of radioactive fallout. Battle Creek is geographically situated so that we estimate we would have an hour and a half warning before the arrival of fallout. In this period, if it fell during a working day, eighty percent of the population would be able to reach home. The instructions under these conditions are for all nonessential personnel to go home.

Emergency workers such as police, firemen, plant-protection personnel, and industrial and utility emergency crews, probably including those who are off duty at the time, would report to assigned stations according to specific prior instructions. Radio stations would be broadcasting instructions to people in their vehicles and at home and in shelters.

In all, I believe that we in Battle Creek have taken a few good steps up the rational road to survival. I am sure that some communities have done a better job in preparing for the worst. I am also certain that a vast number of individuals and communities have done little or nothing to meet their life-or-death survival requirements. I hope that this brief discussion of our Battle Creek program may prove helpful to this latter group in particular.—End

WORST IN BATTLE CREEK'

When he is not involved in civil defense activities in Battle Creek, Mr. Ward is a sales consultant. A Charter and Life Member of AFA, he has served AFA in many ways—as Commander of the Michigan Wing, Regional Vice President, and as a National Director. He has two children.

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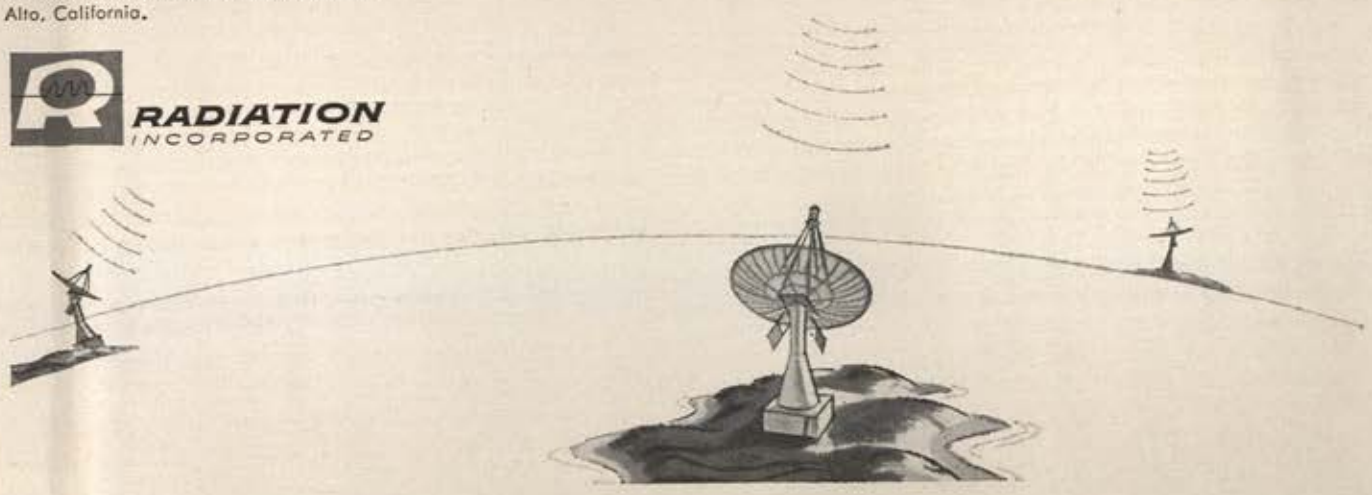


the Ready Room

RESERVE AND AIR GUARD NEWS

Congress Approves ROPA Amendments

ROPA amendments approved by Congress shortly before its adjournment early in July included virtually all points **recommended by the Air Force Association.**

The **new legislation** authorizes unit vacancy promotions to **major and lieutenant colonel,** eliminates the "pusher" clause, and invokes the **mandatory retirement** of officers upon reaching **twenty-eight or thirty years** of commissioned service. It also adopts recommendations of the **Hall Board** on reserve forces general officer promotions *(see June '60 "Ready Room").*

All these measures had been recommended by AFA in a statement before the **Senate Armed Services Committee** by **Brig. Gen. Don Strait,** representing AFA President **Howard T. Markey.**

The Congress failed to enact a proposed amendment to retain officers **promoted to the grade of captain**—or certain classes of officers promoted to major—when no vacancies exist in that grade within their units. However, the Senate committee noted that the intent of that amendment is presently being accomplished through **administrative means.**

Most important amendment for the reserve forces is undoubtedly that which authorizes **immediate promotions** to major and lieutenant colonel to fill unit vacancies. Minimum time in grade for promotion to major or lieutenant colonel is four years.

Operation in the Sandhills

More than **30,000 air reserve forces personnel** go into action this month when **Operation Bright Star/Pine Cone III** unfolds in the North Carolina sandhills.

According to the scenario, a small friendly nation, "Platka," is invaded by a **belligerent neighbor,** "North Vada." Platka, unable to fight off the aggressor, calls on the US for military help under terms of its **mutual assistance pact.**

But active US air units are needed to defend against possible outbreaks in other parts of the world and cannot be spared to go to Platka's aid. So the President calls on the **air reserve forces** to move into the combat zone to **gain air superiority** and **drop troops and equipment** into Platka.

Fourteen Air Force Reserve troop carrier wings, under operational command of **Brig. Gen. Rollin B. Moore, Jr.,** will deploy some 500 troop carrier aircraft into ten bases in North and South Carolina, Kentucky, and Georgia.

On or about August 20, the entire airlift force will airdrop **8,000 paratroopers and 1,250 tons of cargo,** and make assault landings with **2,400 paratroopers and 1,550 tons of cargo.** Army troops employed in the exercise will be the **101st Airborne Division** from Fort Campbell, Ky.

Before and during the D-day airborne assault, the Air Guard tactical air force, commanded by **Brig. Gen. Don Strait,** will sweep the skies and hit aggressor air bases and troop concentrations to provide all possible support for the airlift operation.

General Strait's force will include seventy-five F-84Fs from his own **108th Tactical Fighter Wing,** based at Richmond, Va., McGuire AFB, N. J., and Atlantic City, N. J., and sixteen F-100s from **TAC's 354th Tactical Fighter Wing** at Myrtle Beach AFB, S. C. His reconnaissance will be provided by eighteen RF-84Fs of Alabama's **160th Tactical Reconnaissance Squadron,** operating from Seymour-Johnson AFB, N. C.

The Air Guard's **251st Communications Group** will set up and operate a field communications system, and the Guard's **157th Tactical Control Group** will provide a tactical air control system throughout the exercise area. Supporting these groups as necessary will be **TAC's 507th Communications and Control Group** at Shaw AFB, S. C.

Two Air Guard **SA-16 squadrons** will be used in the exercise to work with Army special forces on espionage, sabotage, and guerrilla activity.

1960 Ricks Trophy Event

Pilots from twelve Air Guard tactical fighter squadrons will compete in the **1960 Ricks Trophy** event September 20 and 21, signaling the opening of **AFA's National Convention** in San Francisco.

They will fly **Republic F-84F Thunderjets.** As in recent past years, the event tests each pilot's combat proficiency rather than speed.

The flying phase of the competition will cover only about 400 miles from **George AFB, Calif., to San Francisco.** It will be preceded by a **weapons meet** at George AFB when pilots will demonstrate their proficiency in **conventional and simulated nuclear weapons delivery.**

The winner will be determined on the **combined results** of the weapons meet, the dive-bomb run, and elapsed time between George AFB and San Francisco.

Participants will represent the 110th Tactical Fighter Squadron, **St. Louis, Mo.;** 112th, **Toledo, Ohio;** 113th, **Terre Haute, Ind.;** 119th, **Atlantic City, N. J.;** 141st, **McGuire AFB, N. J.;** 149th, **Richmond, Va.;** 162d, **Springfield, Ohio;** 163d, **Ft. Wayne, Ind.;** 164th, **Mansfield, Ohio;** 166th, **Columbus, Ohio;** 169th, **Peoria, Ill.;** and 170th, **Springfield, Ill.**

In addition to the Ricks Trophy which goes to the winner, **AFA will award plaques** to pilots who place second, third, and fourth. All twelve pilots, and their crew chiefs, will be **guests of AFA** during the Convention.

The Ricks Trophy is named for the late **Maj. Gen. Earl T. Ricks,** who was chief of the National Guard Bureau's Air Force Division when he died in 1954. Present holder of the Trophy is **Capt. Donald K. Reid,** 171st Tactical Reconnaissance Squadron, Detroit, Mich., who won last year's event, an RF-84F elapsed-time photo mission between Memphis, Tenn., and Miami, Fla.

Reserve Region Commanders Named

Commanders of the **six new Air Force Reserve regions,** set up under the current reserve reorganization, have been named by **Lt. Gen. William E. Hall,** CONAC Commander. Five region headquarters were **activated on July 1.**

Three of the regions are headed by commanders of the former CONAC numbered Air Forces which are replaced by the six regions. The three new regions are commanded by colonels. This is the lineup:

- First AFR region: **Mitchel AFB, N. Y.**—Col. Charles W. Bicking.
- Second: **Andrews AFB, Md.**—Col. Howard F. Bronson, Jr.

(Continued on following page)

- Third: **Warner-Robins AFB, Ga.**—Maj. Gen. Chester E. McCarty.
- Fourth: (to be activated in the **San Antonio, Tex.,** area)—Col. John S. Chennault.
- Fifth: **Selfridge AFB, Mich.**—Maj. Gen. Harold R. Maddux.
- Sixth: **Hamilton AFB, Calif.**—Maj. Gen. Sory Smith.

New Members to Policy Group

New membership of the Air Reserve Forces Policy Committee was announced in mid-July by the Secretary of the Air Force. Three new members were appointed to both the Air Force Reserve and Air National Guard panels. The USAF membership showed an **almost complete turnover** from last year's group.

William P. Wright, Jr., new Deputy for Reserve and AFROTC Affairs in the Office of the Secretary of the Air Force. He is a colonel in the Reserve.

Maj. Gen. Clarence A. Shoop, Chief of Staff of the California ANG, remained chairman of the over-all committee as well as the Air Guard panel.

Other Air Guard holdovers were **Brig. Gens. Frank Bailey** of Arkansas, and **George R. Doster, Jr.,** of Alabama. New members were **Brig. Gens. Joe Foss** of South Dakota, **John M. Campbell** of Nebraska and **Collins H. Ferris** of Wisconsin.

Newly designated Air Guard alternates were **Brig. Gens. Charles H. DuBois** of Missouri and **Frank W. Berlin** of Iowa.

The Air Force Reserve panel came under a new chairman, **Brig. Gen. Frank T. McCoy** of Tennessee. Holdovers included **Brig. Gen. Ramsay D. Potts, Jr.,** of Washington, D. C., and **Cols. Asa W. Candler** of Georgia and **Edward J. Haseltine** of New Hampshire. Joining General McCoy on the panel for the first time were Cols. **Joseph W. Barron** of Washington, D. C., and **Charles E. Heidingsfelder** of Texas.

New alternates on the AFR panel were **Brig. Gen. Roy Sessums** of Louisiana and **Col. James H. McPartland** of Michigan.

Among USAF members the only holdover was **Maj. Gen. Elvin S. Ligon,** Director of Personnel Planning. Joining him on the committee were **Maj. Gen. John K. Hester,** Deputy Director of Operations; **Albert P. Clark,** Director of Military Personnel; **James V. Edmundson,** Director of Personnel Procurement and Training; **Prescott M. Spicer,** Director of Programs; and **Thomas J. Gent,** Director of Manpower and Organization.

Meanwhile, a proposal has been made to Hq. USAF that the regional policy committees formerly at numbered Air Force level be reconstituted under the **major USAF gaining commands** of the new reserve organization—CONAC, TAC, ADC, and MATS.

High-Level Appointee

William P. Wright, Jr., of Scarsdale, N. Y., has been appointed Deputy for Reserve and AFROTC Affairs to **Lewis S. Thompson,** Special Assistant to the Secretary of the Air Force for Manpower, Personnel, and Reserve Forces. He succeeds **Ben Fridge,** of San Jose, Calif., who resigned to enter private business in the Washington, D. C., area.

Wright, an Air Force Reserve colonel, has been a vice president of the J. Walter Thompson Advertising Agency in New York. He has been a member of the Air Reserve Forces Policy Committee and also served on the 1959 *ad hoc* committee on a separate Air Force Reserve budget. A 1933 Princeton University graduate, where he earned an ROTC commission, Wright served in Europe during World War II.

Pioneering in Texas

A new plan which could outmode the traditional fifteen-day **summer field training period,** at least for certain types of units, is being tested during fiscal year 1961 by the **Texas Air National Guard.**

Instead of having all its 2,500 men in training at one time, the Texas Air Guard will call up its members individually for from **one to fifteen days** throughout the year.

Texas operates the **136th Air Defense Wing,** with interceptor units at Dallas, San Antonio, and Houston. Since its air defense mission continues throughout the year, the Wing came up with this plan which **provides training—and needed manpower**—throughout the year instead of concentrating it in one two-week period.

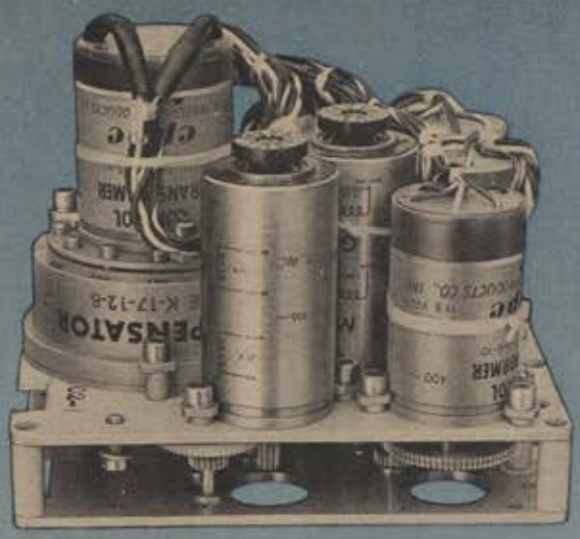
The plan was approved by the National Guard Bureau, the Air Defense Command, and the Assistant Chief of Staff for Reserve Forces. It allows a commander to program **all his manpower resources**—air technicians, unit drill periods, additional flying training periods, and field training tours—to provide a level flow of manpower support throughout the year.

Among the advantages cited for the plan were the following:

- It gives the commander **more men each day** to help meet his operational commitments to ADC.
- It provides for **more effective training** because air technicians are able to devote more time to supervising on-the-job training of individual drill-status Guardsmen.
- It enables the individual Guardsman to schedule his field training at a time **most convenient to himself** and his civilian employer. It is also possible for him to perform his field training in one fifteen-day period or to break it up into several sessions totaling fifteen days.

Credit for originating the plan goes to **Maj. Robert H. Taylor,** Commander of the 147th Interceptor Group at Houston, and **Capt. Jim Rose,** wing administrative assistant (and Commander of AFA's Dallas Squadron). Details were worked out under direction of **Maj. Gen. Harry Crutcher, Jr.,** Chief of Staff for Texas ANG.

Col. Fred Hook, Chief of Air Operations and Training Division in the Bureau, foresees the possibility that if the plan works out as expected in Texas it might be extended not only to **other Air Guard defense wings** but also to other units with **year-round operational missions,** such as the Guard's new long-range air transport wings.—END



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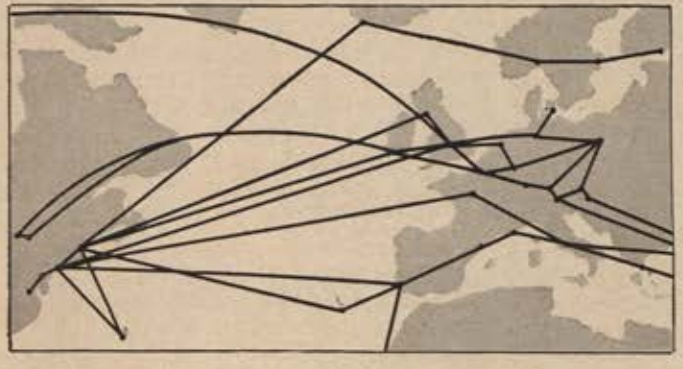

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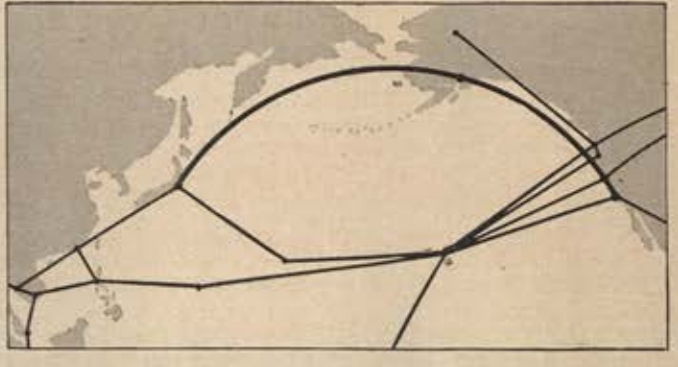

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AFA NEWS

SQUADRON OF THE MONTH

Olmsted, Pa., Squadron Cited for

effectively demonstrating, through its educational programs, that AFA units can make a tangible contribution to aerospace education at the state and local levels.

Julian B. Rosenthal, one of the thirteen founders of the Air Force Association and **current Chairman of the Board,** was principal speaker at the **twelfth annual Convention of the Pennsylvania Wing,** held May 21 in Lewistown.

Wing Commander C. C. "Cap" Carn was in charge of the program. The Convention Committee consisted of members of the host **Mifflin County Squadron** under the direction of **Squadron Commander Charles W. Wallace.**

Feature event of the program was the awards banquet held at Lewistown's Green Gables Hotel. Top awards went to **David J. Kelly,** feature writer for the Pittsburgh *Press,* for outstanding public service; to **John B. Hughes,** public affairs director for Station WTAE-TV, for coverage of USAF affairs; and to **William J. Duerr,** former USAF sergeant, for public relations efforts while serving with the USAF Recruiting Service. **Carl J. Long** of Pittsburgh, former Wing Commander, and last year's "Man of the Year," made the presentations.

Styron Reichenbach, former Mifflin County Squadron Commander, served as toastmaster for the dinner. National Chaplain **Rev. William Laird** delivered the invocation. Laird is also Wing Chaplain.

Steve Yednock, Harrisburg, was elected Wing Commander to succeed outgoing Commander Carn. Steve was chairman of the recently completed aerospace education program in his home town, as reported in this column last month.

Key participants in the Aerospace Education Symposium sponsored May 25 in Harrisburg, Pa., by AFA's Olmsted Squadron. Standing: Col. Carlo Tosti, a Special Assistant to the Commander, ARDC; Col. Thomas Gurnett, Olmsted AFB Commander; Jack Gross, Association National Treasurer; Dr. R. N. Ford of the Millersville State College, Pa.; Maj. Arthur Murray, USAF. Seated: Steve Yednock, General Chairman of the program and new state Wing Commander; Dr. Mervin Strickler, FAA Chief of Aviation Education; Dr. Charles Boehm, Supt. of Instruction, Commonwealth of Pa.; and Dr. Donald F. Kline, Research Director of F. E. Compton Co. and member of Association's Aerospace Education Council.

The **thirteenth annual Michigan Wing Convention** was held in Detroit on June 25. The program, under **Wing Commander Jerome Green,** took place in Detroit's Veterans Memorial Center.

Winner of the **Michigan Wing Airability Award** for outstanding contributions to aviation in the state was **Lt. Col. Marjorie O. Hunt,** USAF. Colonel Hunt, now stationed at Mitchel AFB, N. Y., was one of the organizers of the **Mt. Clemens Squadron.** Currently Chief of Administrative Services, CONAC, she is not only the first woman ever to win the award but is also the first active-duty recipient.

Paul Bagwell, candidate for governor of Michigan, delivered the principal address at the awards dinner. A team of four officers from NORAD also presented a panel discussion on the **air defense of the continent.**

Robert G. Saltsman of Birmingham, Mich., was elected at the convention

(Continued on page 108)

Julian B. Rosenthal, AFA Board Chairman, Dave Kelly of Pittsburgh *Press,* John Hughes, WTAE-TV manager, and Carl Long of Pittsburgh AFA admire public service awards that Wing presented to Kelly, Hughes at the Wing Convention.

Omaha Squadron and Nebraska Wing check for $1,000 goes to University of Nebraska Professor Dr. Frank E. Sorenson, Chairman of Association's Aerospace Education Council, for teacher education program. Shown here are Gene Sample, Wing's Treasurer, National Director Arthur Storz, from Omaha, Dr. Sorenson, and John Markel of Omaha Squadron.

What's up...and where?

Philco airborne radar for ALRI extends the vision of SAGE

ALRI, the Airborne Long Range Input system of the U. S. Air Force, is the seaward extension of SAGE, the vast electronic network that warns of aircraft approaching the North American continent. Philco will develop, produce and modify the airborne height-finding radar as an ALRI team member under the system manager, Burroughs Corporation. Philco was selected for this vital work because of its long and extensive experience in the development and production of military airborne radar and its major contributions to radar technology. Here is further evidence of Philco's leadership in advanced electronics . . . for reconnaissance, communications, weapon systems, space exploration and data processing.

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Shown at a meeting at the Pacific Club, Honolulu, of the Oahu Squadron are Roy Leffingwell, Regional V-P; Gus Duda, Organization Director, visiting from Washington; Bill Crittenden, Squadron Commander; and Maj. Gen. Chester W. Cecil, Deputy Chief of Staff, Pacific Air Forces, who was guest speaker for the program, which took place on June 5.

AFA, other service organization guests look on as Navy attack plane comes in for landing aboard carrier *Independence* during June briefing arranged by Navy and the Navy League.

to **succeed Green as Wing Commander.** A former Squadron Commander, he served as program chairman of the convention.

The **Arnold Division of AFA,** composed of now-commissioned former members of the **AFROTC's Arnold Air Society,** has gone over the top in its membership drive. **John D. Johnston,** Division President, has proudly announced that the **goal of 150 has been exceeded,** and along the way a full squadron has been set up in **Albuquerque.**

Johnston also advised that Division members at **Kirtland AFB, N. M.,** have organized an aerospace educational program, with personnel from the base holding **class every Saturday morning** for children of base and for AFA personnel. The Division also offers its members **free insurance policies** and is building a **scholarship fund** for members. We're very proud of this enthusiastic new group.

The AFA Board's long-awaited **aircraft carrier trip,** arranged and sponsored by the **Navy League of the United States,** took place June 14 to 16. Several Wing Commanders and national committee members took part with the Board.

Present with this AFA contingent as guests on the carrier *Independence* were Board members of the **Association of the US Army** and a host group from the Navy League. The AFA group was led by President Markey.

CONTINUED

At Minnesota Wing Education Symposium in May are Gen. E. W. Rawlings, USAF (Ret.), Regional V-P; Brig. Gen. R. W. McDermott, Dean of the Faculty at the Air Force Academy; Dr. Stanley Wenberg, University of Minnesota Vice President; Dr. Paul Cherington, Harvard Professor of Business Administration.

The visitors witnessed **carrier flight operations, took escorted tours of the ship,** and received **Navy briefings** on carrier aviation.

An extra added attraction was provided by aviatrix **Jacqueline Cochran.** She flew aboard in a jet, first woman passenger ever to land on a carrier.

The three-day carrier trip, designed to provide **increased understanding of naval operations,** was the second half of an "exchange" agreement between AFA and the Navy League. USAF and AFA were hosts to the League Board at **SAC Headquarters, Offutt AFB, Neb.,** some months ago.

President Markey has announced appointments of officials for the **San Francisco Convention.**

Joseph L. Hodges, South Boston, Va., Regional Vice President for the Central East Region, will serve as

(Continued on page 111)

KOLLMORGEN STARFINDER

Polaris missile submarines use the Kollmorgen-designed and built Type 11 periscope—the world's largest—for pinpoint fixes by celestial navigation. Reference stars are programmed into the sub's stabilization computer in advance as celestial navigation coordinates. The Type 11 periscope then trains on a reference star, with adjustment by the operator as necessary, and feeds an error signal back through to the ship's inertial navigation system, which is automatically corrected. The precise position data necessary for optimum execution of the submarine's mission is thus assured.

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Resumes invited from qualified optical engineers.

T/Sgt. Bill Wallrich of USAF's Chicago Office of Information was the recipient of Illinois Wing annual award for outstanding public relations accomplishment. Presentation is made by George A. Anderl, who chaired Wing's annual Convention on May 7 at the Conrad Hilton Hotel in the Windy City. Also shown is Nadine Wolf, who was official Wing hostess.

Chairman of the Business Sessions, the same post he held with distinction at Miami Beach last year.

William J. Farmer, former Commander of the Utah Wing, will again serve as **Parliamentarian. Julian Rosenthal** will be in the Chair during the annual **election of officers.**

All three business sessions will take place in the **St. Francis Hotel** in San Francisco. The first is scheduled for Thursday afternoon, **September 22,** the second and third the following day. More complete details on the Convention will be distributed to all Wings and Squadrons shortly.

CROSS COUNTRY . . . Members of the **Chennault Squadron, Berkley, Mich.,** took part in a parade commemorating **Memorial Day.** The Squadron displayed a mockup of a missile. Quite a few other units took part in Memorial Day celebrations, among them the **Mifflin County, Pa., Squadron** of Lewistown, Pa., home of the very first AFA Memorial Day program. . . . An old friend, **Lt. Col. J. B. Booth,** USAF, asks us to pass along the word that the fifteenth annual reunion of former personnel of the **45th Air Depot Group** is scheduled for August 12 and 13, in Springfield, Ohio. Colonel Booth can be reached for details at Adv. Log. Course, Box 5066, Wright-Patterson AFB, Ohio.

Four members of the **Norman Lyle Squadron, Mich.,** recently headed a group of civic leaders on a four-day trip to the USAF Academy. They returned from Colorado Springs so full of enthusiasm that they immediately announced a city-wide drive for funds to be donated to the Academy stadium campaign. . . . Here's a novel arrangement. The 1961 **convention of the California Wing** will be held in conjunction with members of the **Nevada and Arizona Squadrons,** and will take place at the Stardust Hotel in **Las Vegas.** Guess the AFAers in California just want to get a preview of the 1962 National Convention site.

Speaking of Nevada, the seventh anniversary of the **Thunderbirds,** the official USAF demonstration team, was marked at **Nellis AFB near Las Vegas** June 25 and 26, and AFA's **Barney Rawlings,** of that city, served as PIO for the celebration.

—Gus Duda

airman's bookshelf

Exploring Today's Frontiers

***Man High*, by Lt. Col. David G. Simons (MC), USAF, with Don A. Schanche (Doubleday, 1960, $4.50)**

Reviewed by Maj. W. T. Coleman, Jr., USAF

This book, appropriately titled *Man High*, is written by an Air Force flight surgeon, Lt. Col. David G. Simons, the test subject of Project Man High II. It will give readers an intimate, exciting view of the highly significant Air Force Man High project, a program that took a giant step toward getting man into space.

Man High is the personal account of Colonel Simons' famous balloon trip to 102,000 feet inside a hermetically sealed life-support capsule. It took place in 1957. The book was written with the able assistance of *Life* staff editor Don Schanche.

Also presented are interesting views of other aerospace pioneers including Brig. Gen. Don Flickinger, Chief of Bio-Astronautics, Air Research and Development Command; Col. John P. Stapp of rocket-sled test fame and head of ARDC's Aeromedical Laboratory; Capt. Joe Kittinger, Man High I test subject and the man who recently jumped out of a balloon at a height of over 76,000 feet; and Lt. Clifton McClure, test subject of the dogged-for-luck Man High III flight.

Colonel Simons' book is magnificently done. In a very real way, the reader relives the author's history-making experiences. You share his mixed emotions as he rises to 102,000 feet: a feeling of claustrophobia within a restrictive gondola, rapture at attaining extreme height, the stress of isolation, other psycho-physiological reactions that beset man as he ventures far from his natural environment.

Colonel Simons remained at a height of almost twenty miles for several hours. At this level, he was above ninety-nine percent of the earth's atmosphere. There was no haze to make the distant stars twinkle, nothing to dim the sun in its piercing white light. A thin wall of aluminum stood between him and the strange void at the edge of space.

The author of this book is one of the many dedicated military and civilian scientists who have done so much in so short a time to carry us across the space frontier.

It has been easy in these days of glamorous and sophisticated machines to overlook man—the planner, designer, builder, manager of these fantastic pieces of hardware. *Man High* goes a long way toward reemphasizing the importance of people, a lot of people, in this dawning space age. This volume, in effect, provides stirring testimony of man's current efforts to unlock the secrets of the universe.

Man High is written in a style to match its substance. It is compelling; the kind of book you "can't put down."

In short, here is one of the best books I have read in a long while.

About the reviewer: *Major Coleman, a wartime combat fighter pilot, was information officer of Man High III. He is currently ISO, Plans and Projects, Hq. ARDC.*

When Flight Was Young

Biographies of two famous air pioneers lead the list of new aviation books.

The first, *Saint-Exupéry*, by Marcel Migeo (McGraw-Hill, $5.95), studies the French flyer-writer from boyhood through an adventurous career that ended in his untimely death in a P-38 during World War II. It is by far the most comprehensive and detailed of the many biographies written about this famous early aviator.

Author Migeo, a personal friend through the years of Antoine de Saint-Exupéry, is objective. He evaluates the flyer's major and minor books (among them *Wind, Sand and Stars; The Little Prince; Night Flight; Wisdom of the Sands*) in relation to the man himself and his times. Migeo dispels Saint-Exupéry legends that have been grown. He describes Saint-Exupéry as selfish but heroic, unhappy, sensitive, often distraught, and "long removed from the world of mankind" by writers and admirers.

On July 31, 1944, Saint-Exupéry disappeared on an unarmed P-38 air reconnaissance mission near Borgo, Italy. Migeo offers evidence that he was shot down by the Luftwaffe. He reconstructs the flight with the assistance of a former Luftwaffe officer, Hermann Korth, who was stationed in that area at the time.

An American air heroine of the twenties and thirties is the subject of an intriguing biography, *Daughter of the Sky: The Story of Amelia Earhart*, by an Air Force Academy English instructor, Capt. Paul L. Briand, Jr. (Duell, Sloan & Pearce, $3.95).

Author Briand writes little about Miss Earhart's early life. He concentrates on her flying activities and historic "firsts" which lead up to her mysterious disappearance in June 1937 while on a round-the-world attempt. He writes with a pleasant combination of scholarship and readability.

These traits are particularly evident in his reconstruction of Miss Earhart's last globe-girdling venture on which she vanished over the Pacific. The writer presents a plausible case for the theory that Amelia Earhart and her navigator, Fred Noonan, got lost, missed their Howland Island destination, landed at the Japanese island of Saipan where they were imprisoned and subsequently put to death. Josephine Blanco Akiyama, a Japanese on Saipan at the time, testifies in the book that she witnessed their capture.

Romance of the Sky

The romance of the sky and the challenge of flight are reflected in a variety of works for the private flyer and passenger.

Let's Go Flying, by Martin Caidin (Dutton, $3.95), is an amateur pilot's account of his step-by-step experiences in learning to fly and securing his private license. It is filled with advice and tips for those who would follow.

Your Pilot's License, by Clay Johnson and Joe Christy (Crown Publishers, $3.95), answers in narrative and illustration the questions most frequently asked by student pilots. Johnson, flying service operator and instructor, covers topics from aircraft construction to FAA tests. *Learning to Fly*, by John T. Holland (Rinehart, $5), is a basic primer on flight training.

Frank K. Smith's *Flights of Fancy* (Random House, $3.95) successfully documents a private pilot's "see America" air adventures in a low-wing Piper Comanche on week-end and vacation flights with his family. It is a sequel to his *Week-end Pilot*, which recounted the joys and woes of learning to fly.

In *The World Aloft* (Houghton Mifflin, $3.75), former Air Force navigator Guy Murchie (author of the

(Continued on page 114)

THE LOCKHEED T-40 JETSTAR FLIES AS FAST AND AS RELIABLY AS THE BIG JETLINERS —DOUBLES AS A TRANSPORT/TRAINER

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As a transport, the Lockheed T-40 JetStar is jet-fast, comfortable, reliable. It has intercontinental capabilities, yet can land at smaller airports. Because its operational environment is compatible with combat-type jet aircraft, the JetStar is also suited to many training and utility missions. The JetStar is powered by four Pratt & Whitney Aircraft J-60 (JT12) engines. Each weighs only 436 pounds but develops 3,000 pounds thrust, one of the most efficient powerplants ever developed. Its simple, rugged design means high operational reliability and easy maintenance. Furthermore, the J-60 is backed by Pratt & Whitney Aircraft world-wide service.

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1954 Book-of-the-Month Club selection, *Song of the Sky*) discusses the physics and nature of the world of the air including the science of meteorology, navigation, and the aerodynamics of flight as related to a variety of situations confronting the pilot.

A bird's-eye view of natural and man-made Old World landmarks of historic, cultural, and engineering significance is presented in *Europe from the Air*, edited by Emil Egli and Hans Richard Muller, translated from the German by E. Osers (Wilfred Funk, $15).

Aerospace Progress

With minimum resources available, USAF has pushed ahead in the effort to produce a nuclear-powered aircraft.

Last winter, a special report on the Air Force's nuclear-powered aircraft program was written for the *Air University Quarterly Review*. Published at that time in a special issue of that journal, it now appears in commercial book form, *Nuclear Flight: The United States Air Force Programs for Atomic Jets, Missiles, and Rockets*, edited by Lt. Col. Kenneth F. Gantz, USAF (Duell, Sloan & Pearce, $4). Twenty-four experts in the field, headed by USAF Chief of Staff Gen. Thomas D. White, make a twenty-three-chapter progress report.

Last fall, USAF sponsored the Second International Symposium on the Physics and Medicine of the Atmosphere and Space, a three-day gathering of top aerospace experts from throughout the free world. Major papers delivered at this gathering are now combined into a distinguished volume, *Physics and Medicine of the Atmosphere and Space*, edited by Maj. Gen. Otis O. Benson, Jr., USAF, Commander of the USAF Aerospace Medical Center, Brooks AFB, Tex., and Dr. Hubertus Strughold, Professor of Space Medicine, at the School of Aviation Medicine, Brooks AFB (John Wiley, $12.50).

Rockets of the Air Force, by Erik Bergaust (G. P. Putnam's, $2.50), is the third in a service trilogy presenting an up-to-date survey of missiles and rockets now used by or under development in the USAF. This narrative-picture-caption treatment is foreworded by Brig. Gen. Homer A. Boushey, USAF, then Director of Advanced Technology, Hq. USAF, now Commander, AEDC, Tullahoma, Tenn.

The Exploration of the Solar System, by a nineteen-year-old English boy, Felix Godwin (Plenum Press, $6.50), has won high praise from the scientific community. It deals with interplanetary travel, space stations, planet colonizations, and detailed plans on costs, personnel, food and air requirements for space travel, and the science behind all this.

Astronomy simplified for the space age is the theme of Alan E. Nourse's *Nine Planets* (Harper, $5.95). Each of the planets is explored in detail.

Aircraft New and Old

Aviation buffs, air historians, and model builders will delight at a new British Harborough publication, *Fighter Aircraft of the 1914-1918 War*, edited by E. F. Cheesman (Harleyford, Letchworth, Herts, England, $8.50, with American distribution). This is illustrated, exhaustive, and topflight historically and technically.

The dramatic story of the dirigible *Italia*, its flight to the North Pole, its crash in the Arctic on May 25, 1928, and the survival and rescue of its crew, is related in *Ghost Ship of the Pole*, by Wilbur Cross (William Sloane Associates, $5).

Fourth in a series "famous airplanes of history," is David C. Cooke's *Racing Planes That Made History* (G. P. Putnam's, $2.50). Forty-one air racers are featured in text and photo.

English writer John W. R. Taylor has compiled an excellent new desk reference, *Warplanes of the World* (Ian Allan, Hampton Court, Surrey, England, 10 shillings 6 pence), which features 238 planes in use throughout the world today.

In *Russian Aircraft*, (Ian Allan, London, England, 2 shillings 6 pence), Mr. Taylor presents a complete photo-narrative and statistical guide to Soviet military and civilian aircraft of all types.

Technical Aerospace

The Exploration of Space, edited by Robert Jastrow (Macmillan, $5.50). Symposium proceedings dealing with research, problems, and recent developments in space science by prominent experts in various areas.

Handbook of Geophysics, by Geophysics Research Directorate, USAF (Macmillan, $15). Comprehensive presentation of geophysical data, including flight and rocket explorations, Arctic expeditions, solar observations, balloon flights, and meteorological observations. Reprint of an official ARDC manual.

The Space Encyclopedia, by Sir Harold Spencer Jones and others (E. P.

(Continued on page 117)

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As the first step, we invite you to accept *free* any one of the books listed on this page . . . and to choose another book as your first selection in the AeroSpace Book Club. These and all AeroSpace Book Club selections are handsome volumes that lend prestige to your bookshelves . . . make valuable additions to your collection. Each book is carefully selected by a committee of experts on aerospace power.

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You can build a better aerospace library . . . keep up to date in the fast-moving aerospace field . . . help your career . . . obtain fine, timely volumes not available in the average local retail bookstore . . . and save money at the same time by filling in and mailing the coupon below.

1. MAN HIGH

By Lt. Col. David G. Simons, USAF

The true story of the first man to reach 102,000 feet in a record-breaking balloon flight . . . to feel the cold . . . the loneliness of the threshold of outer space where the blue of the skies gives way to blackness even during daylight hours . . . where the stars are so close, free from atmospheric interference, that you can almost reach out and touch them . . . and yet so far that the mind cannot grasp the distances. Colonel Simons' story will be part of the first chapter of the history of space exploration when that history is written. This is the summer selection of the AeroSpace Book Club. Bookstore price $4.50.

2. BAA BAA BLACK SHEEP

By "Pappy" Boyington

Told in his own earthy prose, the true story of a hard-drinking, hell-for-leather flyer who moved from the Flying Tigers to take a group of "misfits" and build them into one of the great flying units of World War II . . . who shot down 26 Japanese planes to win the Congressional Medal of Honor. Winds up with the interesting theory, "Show me a hero and I'll show you a bum. . . ." Bookstore price $4.50.

3. ATLAS *The Story of a Missile*

By John L. Chapman

This last selection of the AeroSpace Book Club is the full story of America's first intercontinental ballistic missile, from its beginnings to the 16,000-mile-an-hour, 6,300-mile-long leap from Cape Canaveral . . . the story of the missile selected to put the first Astronaut into orbit in Project Mercury. An inside account capturing the full excitement of the birth of the missile-space age. Must reading for all professional USAF and aerospace industry personnel.

4. STRATEGY IN THE MISSILE AGE

By Bernard Brodie

Here is a balanced, objective analysis of the fundamental military problems presented by modern warfare . . . a book to stimulate thought, conversation, and action. No one who is concerned with airpower and its place in military strategy in the years ahead can afford to miss this important new book. Bookstore price $6.50.

5. SOVIET STRATEGY IN THE NUCLEAR AGE

By Raymond L. Garthoff

The inside story of Soviet military planning—missiles and rockets, strategic and tactical air forces, air defense, atomic warfare, thermonuclear warfare, limited and local skirmishes, the Soviet Navy, etc. Much hitherto secret information . . . gathered and presented by one of the world's top experts in Soviet affairs. Bookstore price $4.50.

6. THE GREAT DECISION

By Michael Amrine

Here is the secret history of the atomic bomb laid bare. Who was for its use, who against. Have you wondered how the crews were picked? Trained? How much did they know about the history-making load in the bomb bay? What was it like over Hiroshima? Nagasaki? This fascinating account moves from the rare atmosphere of the summit down to the boys who softened the defense, flew decoy missions, and finally delivered the atomic egg. It names places and people. Bookstore price $3.95.

7. A HISTORY OF THE UNITED STATES AIR FORCE

Alfred Goldberg, Editor

In this big, beautifully illustrated volume, you will review fifty eventful years of military aviation—the men and planes, the wartime exploits and peacetime missions. Highlights are the Billy Mitchell trial and American airpower during World War II. A great, exciting story . . . an invaluable reference book. Bookstore price $6.75.

9. MITCHELL: Pioneer of Airpower

by Isaac Don Levine
A classic collectors item..$6

10. Montgomery's Memoirs

A great book by a great soldier..$6

11. Man in Space

About the USAF program . . . foreword by General White..$4

12. Space Weapons

Articles by Generals White, Doolittle, Dr. Strughold. Includes astronautics glossary, bibliography..$5

8. THE IMPACT OF AIR POWER

Edited by Dr. Eugene M. Emme

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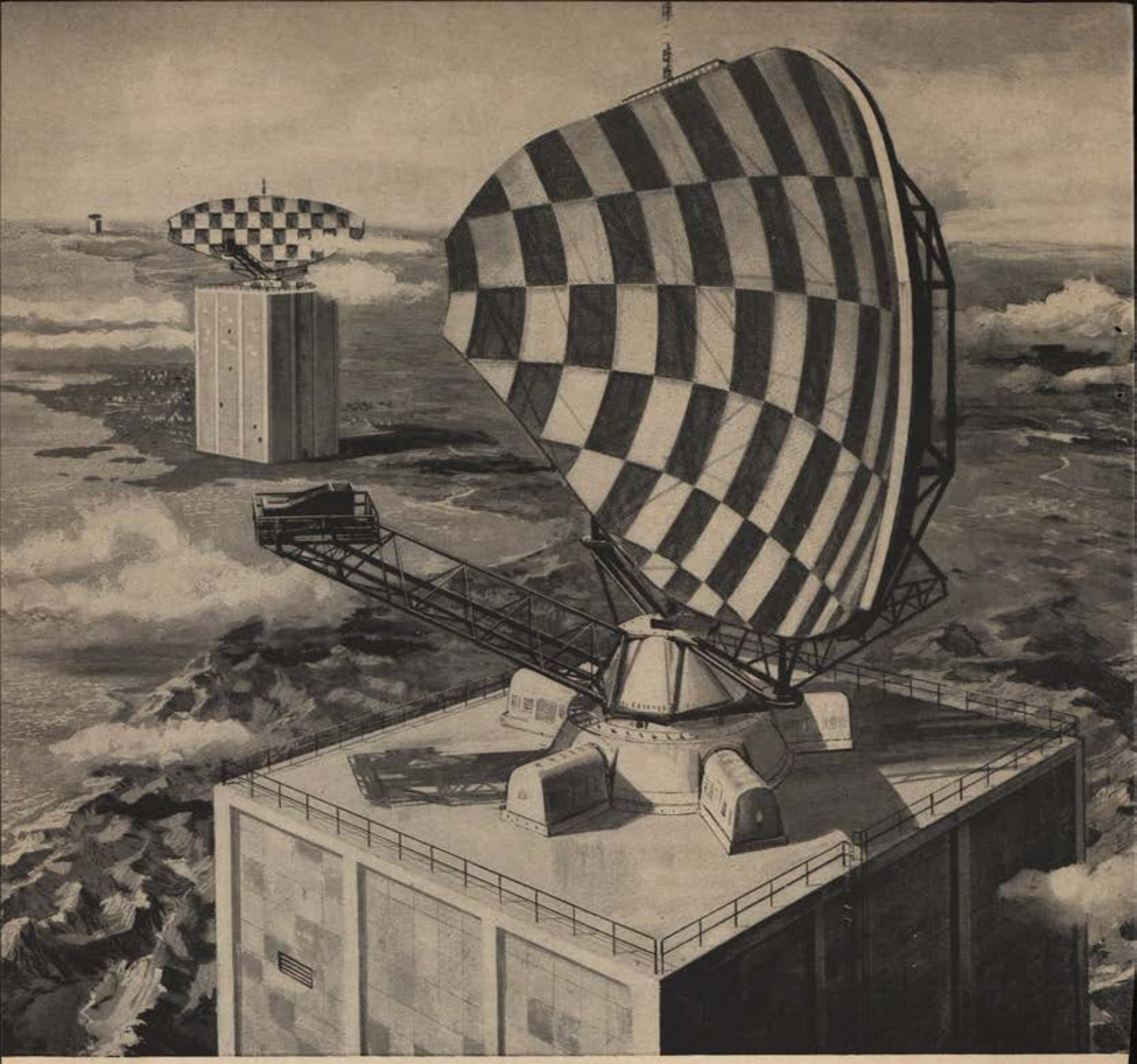

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SPERRY

Dutton, $6.95). Newly revised and updated edition.

Aerospace Dictionary, by Frank Gaynor (Philosophical Library, $6).

Fundamentals of Stress Analysis, by Albert Deyarmond and Albert Arslan (Aero Publishers, $5.75). New second edition.

World Aviation Directory (American Aviation Publications, $10). Fall-winter 1959-60 edition of this standard aviation reference with missile and space industry added.

What Makes Ivan Tick?

One result of the cold war has been a quantum-jump increase in our knowledge and information about the Soviet Union. Each month, volumes appear examining political, social, economic, military, cultural, industrial, scientific, and historical facets of the Soviet regime. New Soviet-subject books include:

The Secrets of Soviet Science, translated from the French by Alan Neame (New York International Public Service, $5).

Atomic Energy in the Soviet Union, by Arnold Kramish (Stanford Univ. Press, $4.50)—The history, present state, and future of nuclear research and development in the USSR.

USSR Information: The Great Soviet Encyclopedia, translated from Russian by J. T. McDermott (Pergamon, $30)—An official Russian reference containing statistics, biographies, and vital facts of the Soviet Union and its republics.

The Communist Party of the Soviet Union, by Leonard Shapiro (Random House, $7.50)—A definitive history.

The Communist Persuasion: A Personal Experience of Brainwashing, by Eleutherus Winance (Kennedy, $3.95)—A Benedictine monk who lived under the Red Chinese regime describes methods used by them to impose their ideology on the country and to transform its customs and institutions.

Stalin and the Soviet Communist Party: A Study in the Technology of Power, by Abdurakhman Avtorkhanov (Praeger, $6)—Describes the formation of the Communist Party and its history through Stalin to his successors. The author maintains that Stalin played a more important role than either Lenin or Trotsky in making Russia and her Communist Party what they are today.

The Communist Challenge to American Business, by Clarence B. Randall (Little, Brown, $3.50)—A warning to American businessmen to examine traditional thinking on problems of world industry, development, and trade, and to meet the Communist challenge with new imagination and greater energy in the arena of world business.

A Calendar of Soviet Treaties, 1917-1957, by Robert M. Slusser and Jan F. Triska (Stanford Univ. Press, $15)—A guide and reference to the more than 2,000 international agreements made by Soviet Russia. Identifies treaties, lists them chronologically, and carries brief summary of status of each, entry into force, duration, extension, and modification.

—Maj. James F. Sunderman, USAF

Smithsonian Institution

In life and in death, John Bevins Moisant achieved historic aviation firsts half a century ago. An extraordinary adventurer and man of many talents, he was successively a farmer, a revolutionary, a banker, a mechanic, a designer. But, most of all, he was . . .

KING OF THE AVIATORS

Jerry Hopkins

Moisant, "King of the Aviators," shown here in a rare old 1910 photo with his cat "Miss Paris." The animal accompanied the young flyer across the English Channel. Moisant's mechanic also was a passenger on the Channel flight.

Underwood & Underwood

FIFTY years ago last month, an American aviator named John Bevins Moisant presented himself in Paris and requested permission to compete in the Circuit de l'Est, a major air show being held there.

"How long have you been flying?" an official asked.

Smiling, Moisant replied that he had been up only twice. The application was denied.

Then came the day of the show. A large crowd arrived early and waited impatiently through what seemed an interminable period of preparation and engine-warming.

Suddenly, a shout rose.

Just as the contestants were climbing into their kitelike flying machines, a small Bleriot monoplane appeared above the Parisian rooftops. Closer and closer it came, then eased down to a graceful landing at the center of the field. Out stepped Moisant.

The young American beamed and clasped his hands above his head. Then a passenger emerged from the craft. The crowd let out a tremendous roar. In that era, the carrying of aerial passengers was most unusual. His third time in the air, Moisant had become the first aviator to fly a passenger over a city. He had, in fact, staged a characteristic entrance into the field of aviation—with daring and bold imagination.

Here was a man of many parts—a twentieth-century renaissance character. He was a designer and mechanic as well as a brash pilot. Before coming to Paris, he had spent months in Cannes developing his own steel and aluminum monoplane. When he was finished, he had what amounted to a racing plane—a rather advanced model in view of the fact that he was yet to take his first flight. That came next.

"When I left the ground, my machine shot upward so fast I lost control," Moisant recalled of that initial experience. "So I just cut off the motor and let her drop. I figured it was better to fall ninety feet than 300 or 400 feet."

He also decided at that point to learn how to fly a slower airplane before again trying his metal racer.

Shortly after stunning Parisians at the Circuit de l'Est, Moisant again flew over the French capital in his Bleriot. This time he took flyer Roland Garros along. This was the second time a pilot had flown a passenger over a city.

Next, Moisant became the first man to fly from Paris to London by compass. His seventh time in the air, he made this historic flight guided by a glycerine-floated compass he had borrowed. The instrument was balanced on Moisant's knee during the 200-mile trip. His mechanic accompanied him on the flight. It was the first crossing of the channel with a passenger.

Moisant was born to French-Canadian parents in Kankakee, Ill., in 1873. At nineteen, he left home for California, where he and his three brothers purchased a farm. Then they drifted to Latin America, acquiring a sugar plantation near San Salvador. While there, he designed a cheap irrigation system that enabled him and his brothers to prosper and expand their holding to several thousand acres.

Then, in 1907, government troops swooped into the plantation ranch house and confiscated seventeen rifles. Two of his brothers were thrown into jail on charges of inciting revolution. Moisant escaped, however, and appealed to the US State Department. Dissatisfied with the answers from Washington, he concluded that as long as he had the name, he might as well play the game. He joined the rebels.

In his first action, he led 100 of the Nicaraguan army and 200 Indian natives in an amphibious attack on a government strong point. Following debarkation from a gunboat, Moisant and his force, in five minutes of battle, captured a well fortified garrison, took the commander prisoner, and recruited 100 more rebels from the government troops.

Moisant then went up to San Francisco, possibly to seek funds, friends, or firearms. Whatever the outcome of this venture, we next find him in the banking business in Guatemala, once more in partnership with his brothers; the two who had been jailed were now out.

Meanwhile, Moisant remained in contact with revolutionary friends in Nicaragua. In 1910, he went to France on their behalf to look into the possibility of buying airplanes for use in another revolt. Latin American political affairs seemed forgotten, however, when he arrived in Cannes and began experimenting with his own plane. Next stop, as we have seen, was Paris.

After his startling flying successes in Paris, Moisant returned to the United States. An aviation competition was scheduled that fall at Belmont Park race track on Long Island. On the first day of competition, October 29, 1910, Moisant crashed. Helped from his damaged plane, he shook off the dust and said, "Hurt? No, not at all. Nothing ever happens to anybody flying."

The next day, Belmont scheduled the "Most Colossal Race of the Decade." An industrialist-millionaire had put up $10,000 for the flyer who clocked the best time in a thirty-six-mile round trip between the field and the Statue of Liberty out in New York Bay.

First, there were to be several warmup flights. Moisant was one of the first in the air, piloting his hastily repaired Bleriot. He crashed again. Miraculously, again he was unhurt. But it appeared, with his craft once more smashed up, he would miss the Statue of Liberty race.

Moisant tried desperately to find another machine. He went from plane to plane on the field, trying to find one available for his immediate use.

The race started. Claude Grahame-White of Britain and Count Jacques deLesseps of France soared into the air. The Englishman took the lead. Moisant was still on the ground. Then, in a Perils of Pauline turn of events, Moisant found a plane, jumped aboard, and took off after them.

He knew he couldn't overtake the Briton and Frenchman in a straight race. So he tried to outwit them. As the others headed south to follow the Long Island shoreline, Moisant selected a different route. He flew west over Brooklyn, then over the East River and the Battery at the southernmost tip of Manhattan Island. He rounded the statue, turned, and headed for home—then got momentarily lost. He had confused elevated subway tracks for the Long Island Railroad. Now he found the Long Island Railroad and followed its tracks back to Belmont Park.

The race judges calculated elapsed time. As Moisant thawed from the cold, the announcement came that

(Continued on following page)

Night scene of the administration and terminal building at Moisant International Airport at New Orleans, La., which was dedicated in November 1959.

he had beaten the Englishman by a mere forty-three seconds, covering the thirty-six miles in thirty-four minutes, 38.4 seconds. He also had set a new straightaway airspeed record, the last three and a half miles at 104.2 miles an hour.

Shortly afterward, Moisant left New York and started a cross-country tour. In December he was in Memphis, Tenn., setting a 2.4-second record for turning a full circle in the air. He turned so sharply his wings pointed almost vertically. René Simon, a Frenchman whose aerial antics had earned him the sobriquet "the fool flyer," ran into a hangar, refusing to watch.

On December 8, Moisant, by then himself dubbed "King of the Aviators," challenged the United States Navy to a duel. After flying directly over the US gunboat *Aphitrite*, anchored on the Mississippi River, he openly declared:

"As I swung over the warship, I could look down on her decks very distinctly. How easy it would have been to have dropped a detonating explosive on that big expanse. I have often said that a passenger-carrying, bomb-dropping aeroplane would put a warship out of commission ten minutes after sighting it. From my own observations, I am perfectly willing to take my chances any day if they'll take theirs—that is, they can shoot at me all they want to if they'll let me retaliate and drop a bomb on them."

The Navy declined the offer.

Soon after that, Moisant was on his way to New Orleans for an international competition with aviators from the US, France, Switzerland, and Ireland. The day before the show was to begin, a California group offered Moisant $100,000 to stage a rival flying show in San Francisco. New Orleans was offering only $10,000, but Moisant kept his word. He flew to Louisiana—and the end of his spectacular career.

On December 24, Moisant took off from New Orleans' City Park race track. He headed over the city, circling the business district four times. On the streets below, throngs of Christmas shoppers looked up and saw him. When Moisant returned to the field, with just three pints of gas left in the tank, his forty-six-minute flight was hailed as the longest sustained flight over a major city. Also, it was his fourteenth cross-city flight, a greater number than had been flown by any other two aviators of the era combined.

The next five days Moisant raced his plane against small automobiles, performed a daring glide from 9,000 feet, braved a sixty-mile-an-hour gale, and tuned his fifty-horsepower engine for a contest with a 150-horsepower Fiat racing car. On December 30, he lost a five-mile race with the high-powered Fiat by a hair. Then he took time out for an interview with a local newspaper reporter.

"Don't you worry about getting killed when you try those crazy stunts?" he was asked.

"I do not expect to die in an airplane," Moisant was quoted in reply.

On December 31, Moisant and four other pilots competed for the $4,000 Michelin Prize, to be awarded to the pilot who stayed in the air longest. The world's record was seven hours, forty-five minutes. Moisant figured he could stay aloft for eight hours.

Moisant passed up the red-painted monoplane he had designed in Cannes and had his mechanics roll out the Bleriot he had crashed twice in New York. The craft had been completely reworked and was in top flying condition. An extra thirty-five-gallon gas tank had been installed under the frame.

Moisant took off in midmorning. Waving to the spectators who lined the City Park field, he headed for another field just outside New Orleans on a practice hop.

He circled the practice field three times at a 200-foot altitude and prepared to land. But rough air at twenty-five feet caused the plane to dip sharply. It almost stood on its nose. Moisant was thrown from the cockpit. He landed in a clump of bushes, his back broken. Within minutes the man they called the "King of the Aviators" was dead.

Ironically, even in death Moisant set a mark in flying. *Scientific American* magazine reported that he was the first aviator to be thrown from his plane in such a fatal accident.

In New Orleans, where he died fifty years ago, Moisant has not been forgotten. In 1946, the city opened a new airport not far from the scene of Moisant's death. The field is called Moisant International Airport. Jimmy Doolittle was present for the dedication ceremonies. He unveiled a monument which reads:

"In commemoration of a pioneer in aviation, John Bevins Moisant, who lost his life in an airplane accident near this site December 31, 1910. He was the first pilot to carry a passenger across the English Channel, inventor of the early all-metal airplane, a man of lovable character whose tragic death was a great loss to aviation."—END

The author, Jerry Hopkins, is a staff reporter for the New Orleans Times-Picayune. *A journalism graduate of Washington and Lee University and Columbia University, he has also worked on newspapers in Virginia, North Carolina, and New York, covering "everything from politics to the DAR." Mr. Hopkins, twenty-four, is an Army Reserve second lieutenant.*

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$15,000	$15,750	$16,500	$17,250	$18,000	$18,750
$20,000	$21,000	$22,000	$23,000	$24,000	$25,000
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8-60

If you want protection for family members, write the necessary information on an additional sheet, and mail with this application.

Application must be accompanied by check or money order. Send remittance to: TRAVEL INSURANCE, Air Force Association, 308 Mills Building, Washington 6, D. C.

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Recent USAF film releases of special interest to readers of AIR FORCE

These and other selected USAF films are available for loan from the Air Force Film Library Center, 8900 S. Broadway, St. Louis 25, Mo., and USAF film libraries elsewhere. Requests, welcome from both military and civilian groups, should contain Air Force serial numbers and correct titles to avoid delay in processing. Because of heavy demands for certain films, particularly those on missiles and space, the Film Library Center recommends that requests indicate both alternate films as well as showing dates.

SFP 633—Target Within Range—The Key Role of the USAF Navigator. The vital and diversified mission of USAF navigators around the clock, around the world, day in and day out.

SFP 1005—Operation Worldwide—Author-newsman Bob Considine narrates the MATS story—Berlin and Korean Airlifts, rushing of troops to trouble spots of the world during emergencies, day-to-day readiness.

SFP 552—Aerial Firepower—A modern firepower demonstration at Eglin AFB, Fla., USAF's largest base. Modern aircraft delivering rockets, missiles, napalm.

TF 1-5079b — Radar Refraction and Weather — The Radar Coverage Problem — Geometry of refraction, application of optics, loss of coverage due to radar ducts and holes, other problems.

TF 1-5079c—Radar Refraction and Weather; the Radar Weather Problem—How weather information is used at three different levels of the operational Air Force.

TF 1-5079d—Radar Refraction and Weather; Airborne Early Warning and Control—Explains weather conditions that affect the aircraft radar units during flight, the importance of radar in the detection of hostile aircraft.—END

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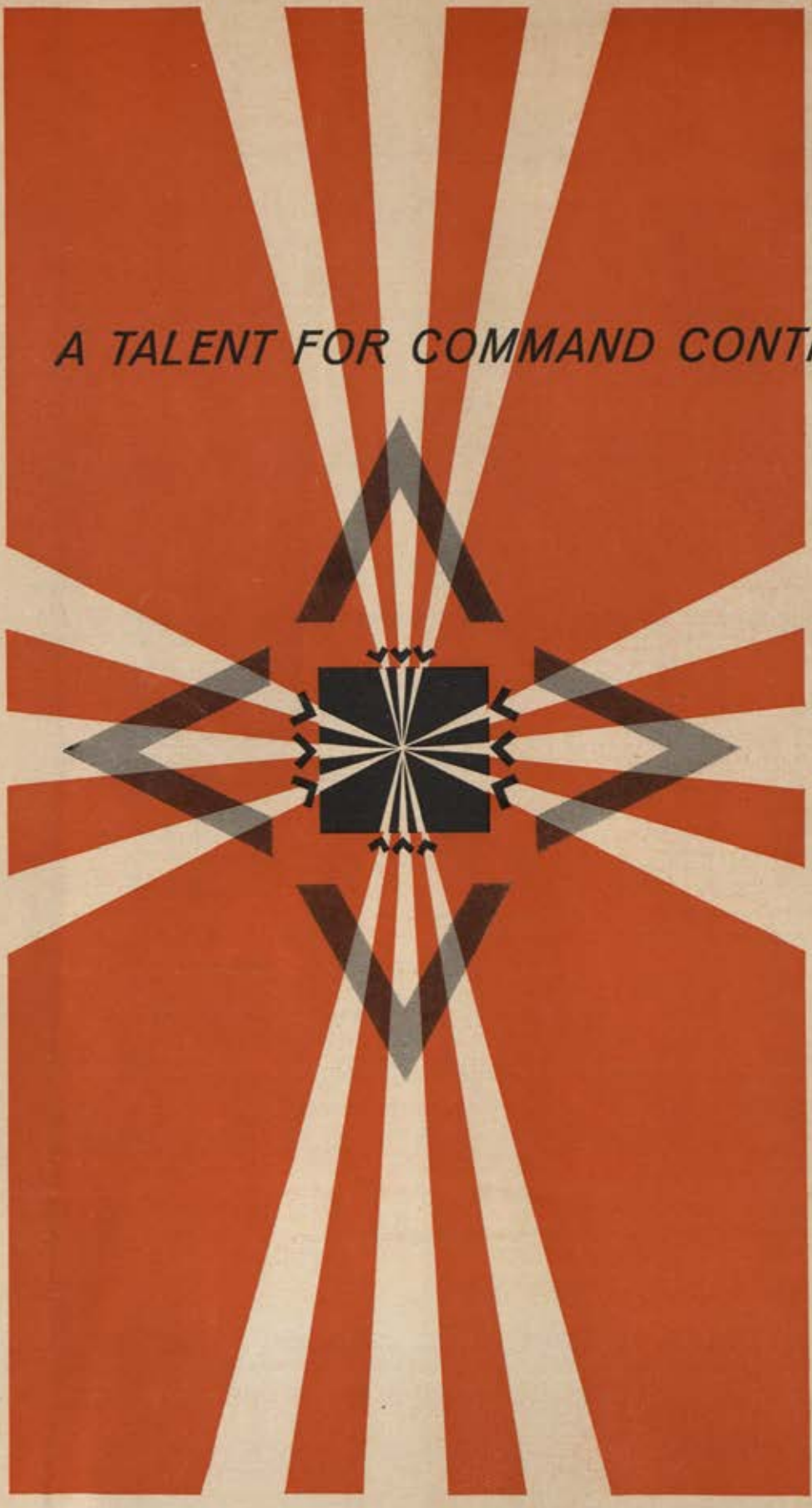

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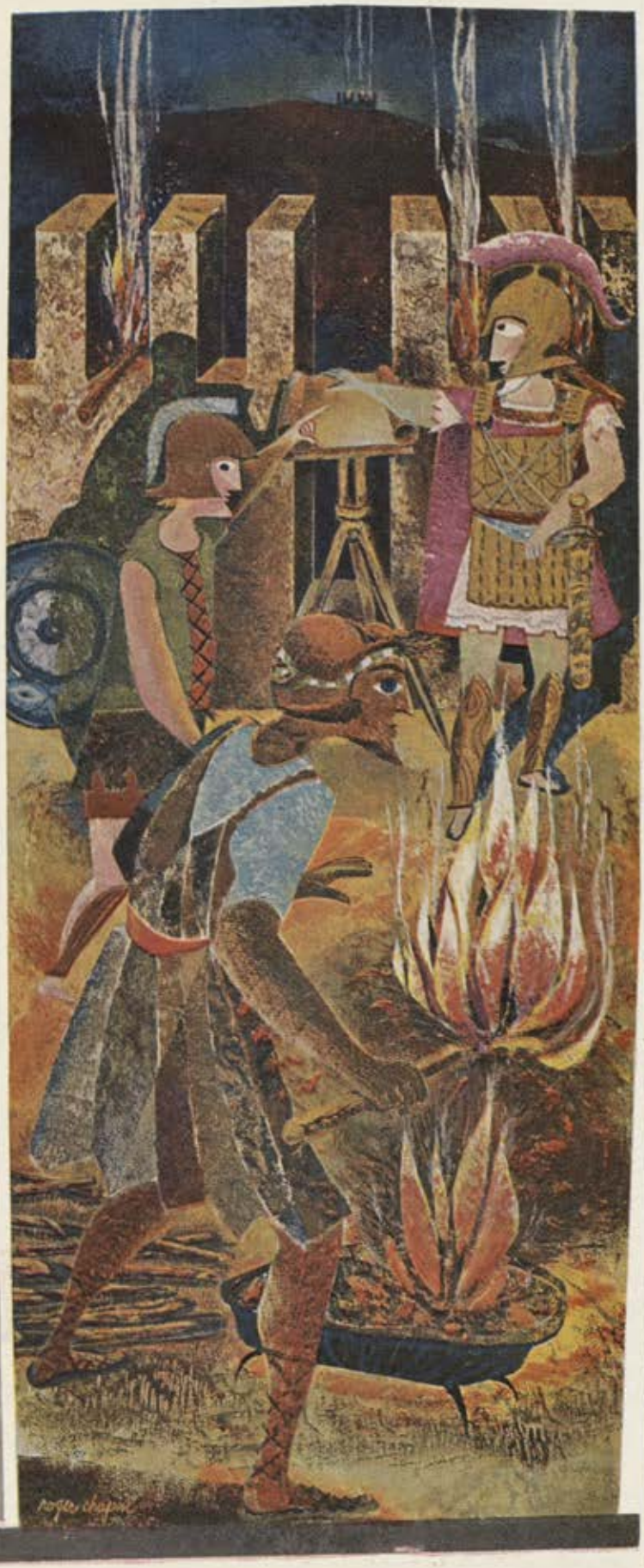

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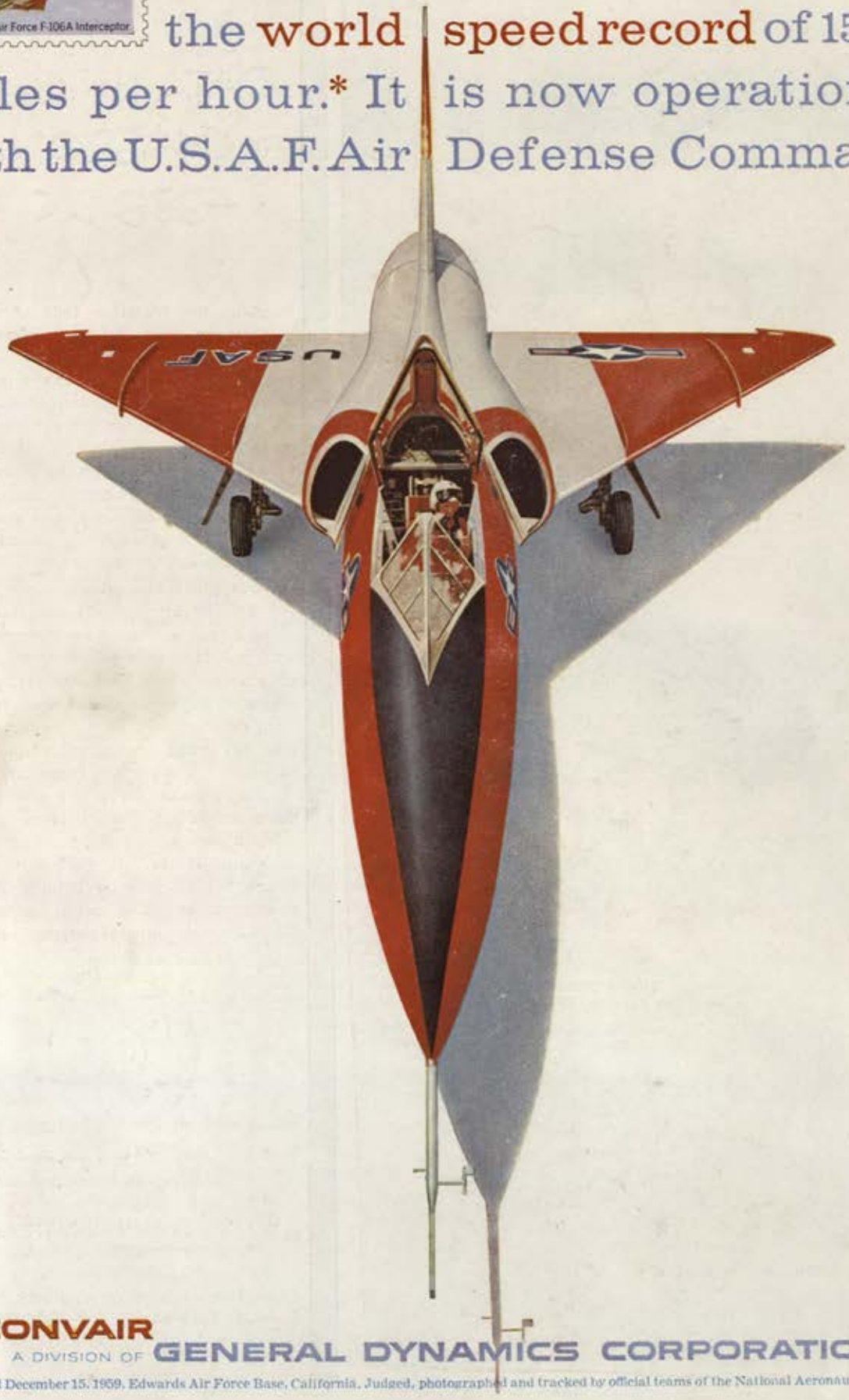

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