JULY 1959 / 50c

AIR FORCE

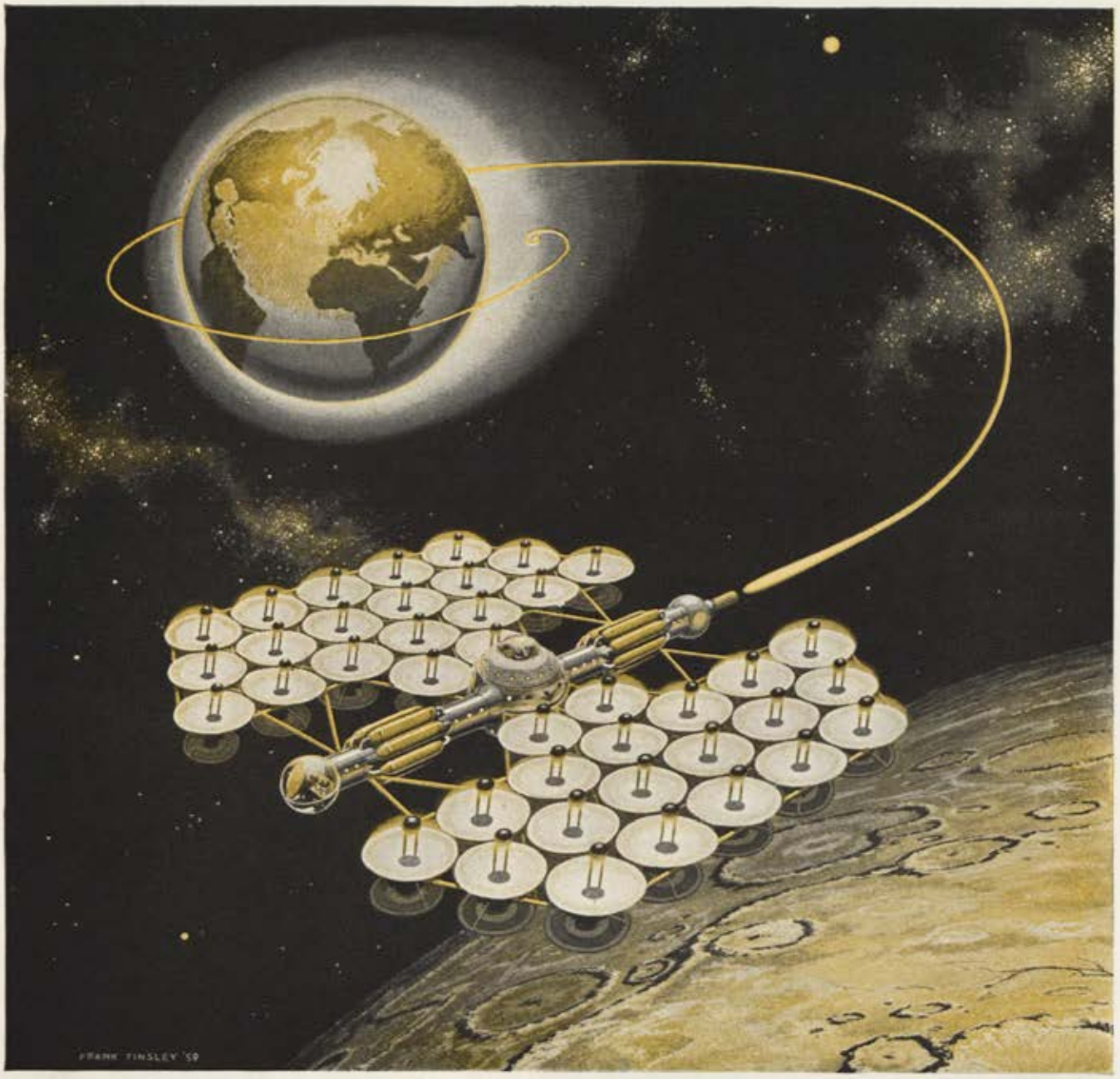
and SPACE DIGEST

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

First Aeroplane in Military Service

THE WRIGHT BROTHERS' 1909 AEROPLANE AT FORT MYER, VIRGINIA

1909 — Fiftieth Anniversary — 1959



STEPS IN THE RACE TO OUTER SPACE

Cosmic Butterfly

Spreading its wings to absorb the eternal flow of solar energy is the Cosmic Butterfly, a space vehicle of a type first conceived by Dr. Ernst Stuhlinger of Redstone Arsenal.

Each of the fifty-foot parabolic mirrors in the wings concentrates the Sun's rays on a boiler at its focal point. Steam is developed, which drives a 200-kw turbo-generator in the base. Cooled by frigid outer space in heat diffusers, the steam reverts to water and is pumped back to the boiler to be used over and over again.

The current thus generated drives the main propulsion unit, an ion rocket in which powerful electric fields accelerate charged particles, shooting them from the rear of the rocket exactly as the electron gun in your TV set bombards the screen. Sunlight, then, is the power source, whereas cesium is the propellant.

While the recoil thrust is relatively small, the weightless vehicle is operating in a vacuum and the push is enough to enable the Butterfly to reach interplanetary speeds. Unlike conventional rockets, the Butterfly is under power the entire trip. Half way to its destination it turns around, and the ion thrust is used to slow the craft down to arrival speeds.

Since its thrust is entirely inadequate to cope with the gravity of major planets, the Cosmic Butterfly never lands. It is assembled in space and shuttles between artificial satellites.

The Cosmic Butterfly could carry ten passengers and 50 tons of cargo from an Earth satellite to a comparable one orbiting around Mars in about one year of continuous travel.

Inertial navigation systems will play an increasing role in the exploration of outer space. ***ARMA***, now providing such systems for the Air Force ATLAS ICBM, will be in the vanguard of the race to outer space. ***ARMA*** . . . Garden City, N. Y. A Division of American Bosch Arma Corp.

AMERICAN BOSCH ARMA CORPORATION

WASP

THESE MEN DO ALMOST NOTHING BUT THINK

Unique new group helps Westinghouse anticipate and plan for future military needs

It's harder than ever to stay out front in defense.

Weapons systems are now fantastically complex. New innovations—like thermoelectricity and molecular electronics—threaten to make key subsystems obsolete overnight. New developments may suddenly reduce the tactical usefulness of a U. S. weapons system.

Westinghouse, like many other firms, has been concerned about how to meet this problem—and how to organize its many R&D and manufacturing operations to more effectively support America's increasingly complex defense needs. It seemed that the organization which had worked fine in the past simply wasn't adequate for anticipated future demands.

So things were completely reorganized in February, 1958. A new Defense Products Group was established, centralizing control of all defense-oriented activities within the company.

But a most interesting—and promising—part of this new organization, the new Westinghouse Advanced Systems Planning Group (now commonly called WASP), wasn't announced publicly until August.

This was a significant development. Since technology is moving faster than ever before, there's a real need to effectively anticipate what will be needed in 5 or 10 years. If this can be done, longer-lived defense systems can be developed more quickly and substantial sums can be saved. WASP should be able to provide the advance thinking needed by Westinghouse to meet this need.

Staffed with hand-picked engineers and scientists—specialists in electronics, outer space, atomic power, ASW, operations research, etc.—and headed by Allan Chilton (top center photo above), WASP operates on a unique charter: to concern itself primarily with

CONTINUED

MATCHING NAVAL REQUIREMENTS with Westinghouse capabilities, Leonard Dow, a professional career specialist in naval strategy, tactics, and weapons systems, is associating advanced technology to future naval systems.

"The idea is sound, but how can we keep it from burning up? Present insulations won't work. How about ablative heat sinks? No—they won't work either in this case."

complete advanced weapons systems, to deal with the "whole" instead of "parts".

This is not just a "blue-sky thinking" assignment. Westinghouse believes future defense needs will be so complex that only a full-time team of specialists—like WASP—will be capable of the kind of conceptual planning and guidance needed.

There's another reason why defense planners will be interested in WASP. This new group gives them a single point of contact within one of America's largest and most versatile industrial firms to which they can take immediate and long-range defense problems. No longer will it be necessary for someone

"... son, it circles the earth at 18,000 miles an hour." Space consultant, K. Satyendra, a Ph.D. from India, keeps WASP and other company scientists abreast of space needs. He is an authority in mission, trajectory, and communication concepts.

TOP ENGINEER AT WASP, Rein Kroon joined Westinghouse in 1931. Among other accomplishments, he headed the engineering group responsible for the design of the first American turbojet engine for aircraft.

"What's the best way to destroy an enemy reconnaissance satellite? Attack it from earth? Or from another satellite? How would we go about either method?"

to try to guess which Westinghouse division is best equipped to tackle a given job.

This is a bigger advantage than might be apparent. A newly-published capabilities chart*, for example, lists 29 different Westinghouse facilities and, for each, indicates specific study, design, or manufacturing capabilities in 33 different areas (infra-red, rocket powerplants, torpedoes, missile base equipment, etc.). This same chart lists 16 Westinghouse facilities which can handle system analysis and 7 capable of complete system management.

**Available to qualified individuals and firms upon request.*

"Could we deflect enemy ICBM's by sending them false signals at the time of launching? If so, could this be done from distant transmitters? Could this be done automatically from remote un-manned stations?"

MAN ON THE MOVE, Bill Robinson has his sights on tomorrow's systems and provides guidance for WASP in planning for future Department of Defense needs.

Westinghouse

DEFENSE PRODUCTS

1000 CONNECTICUT AVE., NW, WASHINGTON 6, D.C.

YOU CAN BE SURE... IF IT'S Westinghouse

...NEWS IS HAPPENING AT NORTHROP

Now being produced and delivered to the U.S. Army Signal Corps, the Radioplane SD-1 gives greater battlefield surveillance flexibility to combat units than ever before. (This photo of terrain was actually taken from an SD-1 at 1,000 feet.)

RADIOPLANE PRODUCES FIRST COMBAT-READY SURVEILLANCE DRONE

Meeting tough Army Signal Corps requirements and being produced in operational quantities, the SD-1 is proved and ready to fly unmanned photo reconnaissance missions for tactical troops.

Highly mobile, the camera-carrying SD-1 may be zero-length launched in rough terrain from a camouflaged position. It is flown by remote control over enemy installations on surveillance missions without risking a pilot's life or man-carrying aircraft. Within minutes after the SD-1 returns from its mission, photographs are delivered to the requesting unit.

Other specialized sensory equipment may be carried by the SD-1 depending on particular mission requirements.

This Army-Radioplane achievement exemplifies Radioplane teamwork with all of the U.S. Armed Forces. Radioplane provides a complete drone family spanning medium speeds through supersonic performances.

RADIOPLANE

Van Nuys, California, and El Paso, Texas
A Division of
NORTHROP CORPORATION

AIR FORCE

THE MAGAZINE OF AEROSPACE POWER

Volume 42, Number 7 • *July 1959*

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FEATURES

SPACE DIGEST
Starts on page 49

DEPARTMENTS

An Editorial

No Surprises in the Record

John F. Loosbrock, Editor

WE MUST confess that we were both pleased and disturbed by some of the press reactions to our editorial of last month—"Too Much Information . . . Not Enough Facts."

We were pleased when the Denver *Post* called it "the best suggestion we have read for solving the maddening problem of how to provide the nation with adequate defense in the face of interservice competition and conflicting military advice. . . ."

We were likewise pleased when the Milwaukee *Journal*, our own journalistic alma mater, devoted its lead editorial to a discussion of the points raised in AIR FORCE/SPACE DIGEST last month.

What disturbed us was the fact that these papers evidenced surprise that the official journal of the Air Force Association should take an editorial position that might be opposed to the parochial service interests of the Air Force.

The Denver *Post* saw the suggestion (to provide Congress with its own staff of independent experts) as coming "from an unexpected source . . . despite [the magazine's] customary alignment with the air service viewpoint."

The Milwaukee *Journal* said that "AIR FORCE Magazine normally looks with sympathy on expenditures for the military—especially those for the Air Force."

We can't let this go without a challenge and a bit of documentation.

From its inception, the Air Force Association has been wedded to the concept of a unified defense effort. It was a leader in the fight for the original National Defense Act of 1947, even though it stopped short of true unification. AFA and AIR FORCE Magazine have not wavered from this position over the years. A few quotes may serve to shake up the memory.

In July 1956 Gill Robb Wilson, then President of AFA, wrote an article in AIR FORCE Magazine, called "The Roles and Missions Muddle."

In this article Mr. Wilson said:

"Without an objective yardstick, each service builds toward what it thinks it needs. Unfortunately, the requirements for all three add up to much more than the nation is either willing or able to pay. So compromises and horse trades are made under budgetary ceilings that ensure, among other things, that we may well never have enough of anything.

"This, then, is the problem and the root of everything that smacks of interservice rivalry. It leaves one with the uneasy feeling that the services are building and buying for three separate war plans. It is a manifestation, on a grand scale, of what one expert called the 'commander's syndrome.' Every commander wants to control everything he thinks he needs to do the job. Lacking clear definition of responsibilities, the individual services can scarcely be blamed for following the same pattern."

Mr. Wilson then called for concrete action toward unification—specifically, a single promotion list and a single chief of staff, which, he said, "leads, of course, to what we know as a single service—true identification with military organizations based on missions rather than the color of the suit."

He further said: "We in the Air Force Association heartily applaud this approach even though many individuals in the Air Force may not agree with it. . . . We hope that all service groups will submerge partisan feelings and assist us in this effort. Specifically, we invite the Association of the United States Army and the Navy League to join arms with AFA in supporting the progressive development of a single military service."

This was in July 1956. The invitation met with no response. And only a few weeks later, in its official 1956 Statement of Policy, AFA laid it on the line once more:

"The three-service system can no longer be tolerated. The goal must be one program for utilizing national resources in the national defense. We must have one defense plan. . . . Each of us, civilian and military man alike, must place the realities of the national defense requirement above narrow service interest."

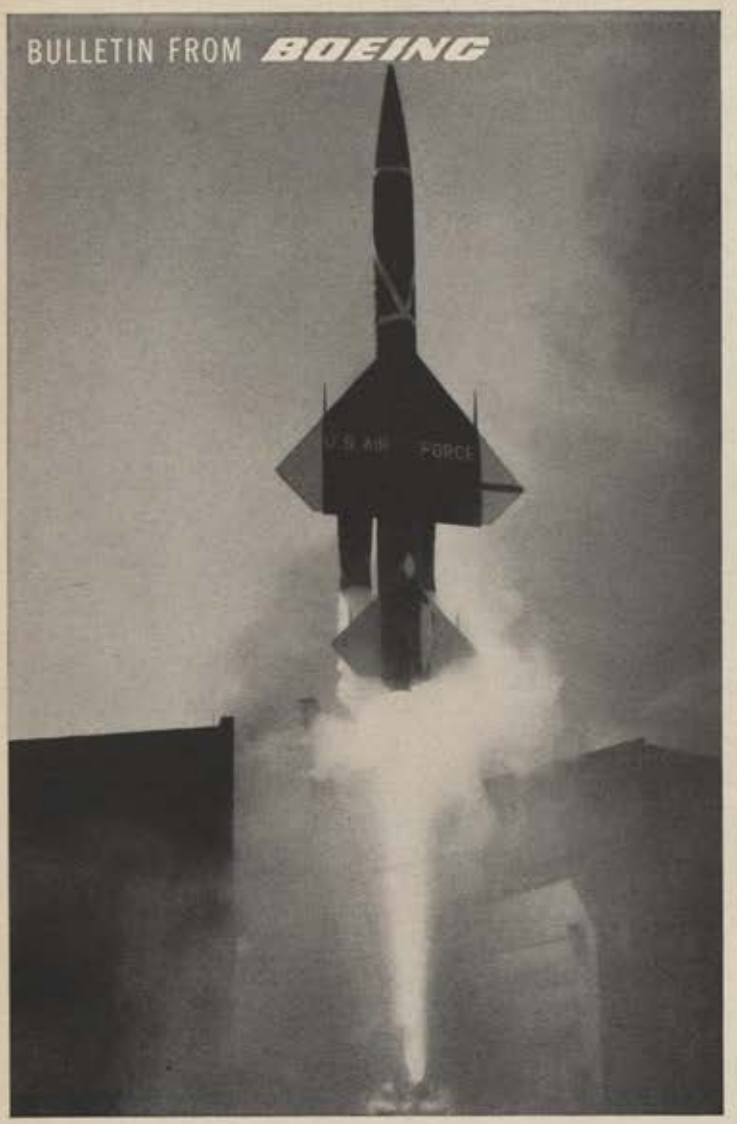
AFA also supported the President's reorganization plan of last year as a step in the right direction, but regretted, and this magazine still regrets, that the step was not longer and firmer.

A dozen years ago, when the first feeble efforts toward a unified defense organization were being made, an eminent military leader said:

"Such unity as we have achieved is too much form and too little substance. We have continued with a loose way of cooperating that wastes time, money, and talent with equal generosity. With three services, in place of the former two, still going their separate ways and with an over-all defense staff frequently unable to enforce corrective action, the end result has been not to remove duplication but to replace it with triplification.

"All this must be brought to as swift an end as possible. Neither our security nor our solvency can permit such a way of conducting the crucial business of national defense."

Since these words were spoken, the law has new and sharper teeth, even though the Administration has been curiously reluctant to use them. Perhaps "curiously" is not strong enough a word. For the man who pleaded so eloquently for an end to indecision and bickering currently is Commander in Chief of the Armed Forces of the United States.—END



SUPERSONIC DEFENDER. Boeing BOMARC, the Air Force's longest-range defense missile, can seek out and intercept single or multiple targets long before they reach U.S. borders. One base, armed with a squadron of BOMARCs ready for instant action, can provide interceptor cover over thousands of square miles. Bases are now nearing completion.

MAN IN SPACE. Space-age projects at Boeing include research to develop protective environments and efficient controls for crews of advanced aircraft and space vehicles. Boeing is also at work on orbital systems, a boost-glide vehicle, and Minuteman, a solid-propellant intercontinental ballistic missile under development.

MISSILE BOMBER. Boeing B-52G, now in operation with the Strategic Air Command, is world's longest-range jet, and U.S. Air Force's most versatile long-range weapon system. B-52G carries supersonic air-to-ground missiles for in-flight launching hundreds of miles from target areas, in addition to regular nuclear bomb load. B-52G can strike several targets thousands of miles apart on a single retaliatory defense mission.

BOEING

U.S. NAVY EXPLORES THE

GRUMMAN AIRCRAFT ENGINEERING

Its seas and oceans cover over 139 million square miles. That's more than double the surface of Mars, more than nine times the area of the Moon. No other planet within the vision of man is like it. The planet is Earth.

From its depths comes one of the free world's greatest menaces—the submarine armed with the frightful capacity to launch a missile against any city anywhere in the United States.

STRANGEST PLANET OF ALL

Any protection against this hidden danger? Most certainly! The U.S. Navy—and its long-range carrier-based aircraft. They patrol the high seas, probe their depths, screen their contents. They detect, identify and track. And, upon provocation, destroy. They help make our Navy our strongest defense against the threat of the submarine.

These anti-submarine warfare aircraft are operational with the Navy throughout the world. They are Grumman S2F Trackers.

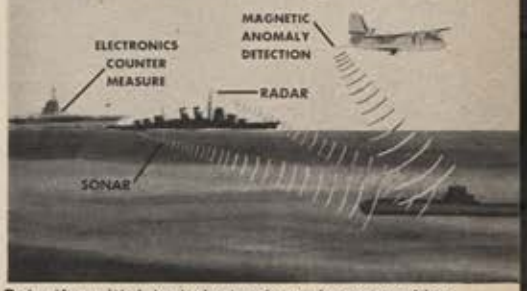
Grumman

CORPORATION **Bethpage • Long Island • New York**

MISSION...

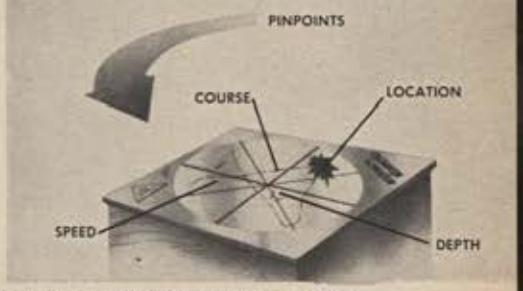
...to bring the most devastating and accurate armament to bear against the enemy.

DETECTION Of Target



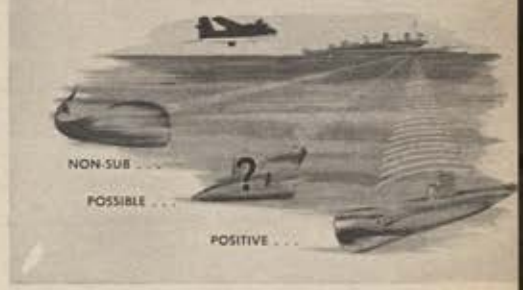
Detection with latest electronic equipment enables the ASW force to determine the enemy's presence.

LOCALIZATION Of Target



Localization starts immediately, plotting general location of enemy sub.

CLASSIFICATION Of Target



Classification utilizes sophisticated electronics equipment to determine exact nature of intruder.

DESTRUCTION Of Target

IS SELF-EXPLANATORY IN ITS . . . FINALITY

AIRCRAFT MODIFICATION

ALPHA MODIFICATION CENTER OFFERS COMPLETE SYSTEMS MANAGEMENT RESPONSIBILITY

One of the time-saving, packaged systems project services offered by Alpha Corporation is tip-to-tail modification of aircraft for both industry and government . . . in this country and abroad.

Whether you require the addition of simple or complex electronic equipment . . . or complete redesign and overhaul, including custom interior, Alpha Corporation Modification Center specialists will deliver a flight-tested, turnkey job to your specifications.

A notable example in the aircraft modification field is "Project Shirley" . . . a contract awarded Collins Radio Company by the United States Army Signal Corps. Starting with six surplus R4D aircraft (Navy versions of DC-3's) the airframes were reconstructed to meet exacting requirements imposed by the installation of extra complex electronic assemblies. Further, interiors were redesigned for extreme flexibility . . . including accommodation of seating or extensive airborne test equipment. These versatile "flying laboratories" exemplify the kind of complete, turnkey jobs Alpha handles at its Air Modification Center. Further, Alpha fabricates specialized equipment and installs it on client aircraft all over the free world.

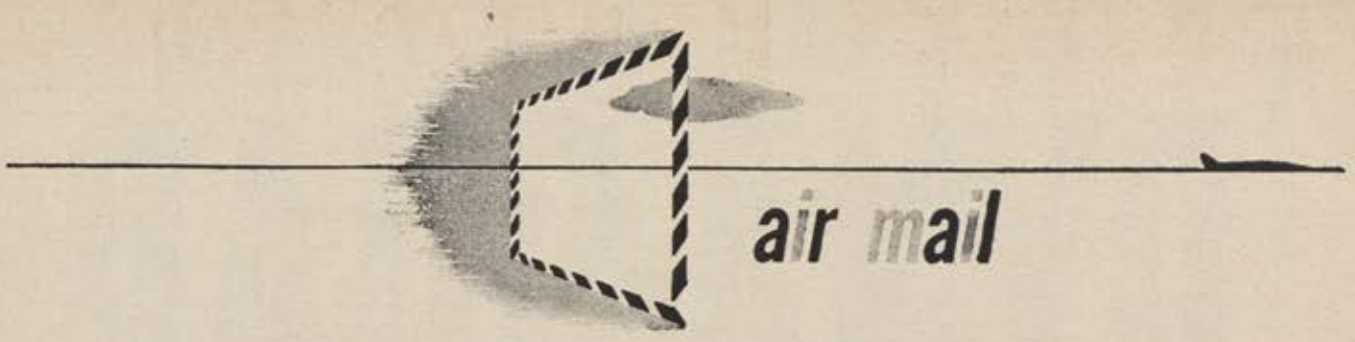
Alpha was formed to extend and broaden the types of systems management work done for years by Collins Radio Company. This includes design, engineering and installation of space age communication systems complete with related roads, buildings and towers. The best available equipment from industry is used. Alpha trains client personnel or furnishes skilled crews for finished projects where needed.

Alpha . . . with its highly specialized organization of designers, engineers, scientists and constructors . . . is the sound, dependable answer to the need for proven skill with complete systems management responsibility.

Alpha CORPORATION
A SUBSIDIARY OF COLLINS RADIO COMPANY

DESIGNERS, ENGINEERS, CONSTRUCTORS, WORLD-WIDE • RICHARDSON, TEXAS • TELEPHONE DALLAS ADams 5-2323 • CABLE ADDRESS: ALPHA DALLAS

Alpha capabilities include technical systems management in all fields, with special emphasis on: • Space vehicle tracking and communication • Test range instrumentation and communications • Voice, teletype and data transmission • Aircraft modification and overhaul • Integrated shipborne, airborne, and ground communications • High capability remote control and switching



More on AF Housing

Gentlemen: Having read your article on "Housing . . . One of USAF's Unsolved Problems" in the March 1959 issue, I just finished writing to Senator Mike Mansfield regarding the possibility of mobile homes being used to help solve the housing shortage at Air Force bases. I also sent him a copy of the article, which I feel was very well done, with the true facts used. I am a staff sergeant, USAF Reserve, on a ready status and have pulled my fifteen days' active duty at Malmstrom and Glasgow AF bases and have seen just what this housing shortage is like. I also talked with many active-duty personnel who were very unhappy with the whole housing program.

I would like very much to see one of your staff add an article on mobile homes and living in them.

I personally believe there is a great deal of money to be saved in the housing program by using mobile homes, plus helping morale among the active-duty personnel.

There are many Air Force personnel living in mobile homes. Maybe if some of them were contacted there could be some good articles and ideas gotten. Also I am sure many of the mobile home manufacturers would be willing to help.

Any help you can give on this matter will be very rewarding, I am sure.

Dale E. Crandall
Bozeman, Mont.

Gentlemen: Thanks much for trying to give us Air Force troops a break by publishing the article on "Housing . . . One of USAF's Unsolved Problems" [March '59 issue].

We just hope that someone with authority to do something about it reads your article.

Thanks again for myself, but most of all for my family.

A/1C Robert W. Wallis
Burlington, N. J.

Reprints No Longer Available

Gentlemen: Are there reprints available on Claude Witze's article on the sonic boom which appeared in your January issue? I can't say this is one of his better works, because all of them seem to be his best! I would very much appreciate it if we could have two copies of this fine summary of the situation.

In addition, could we request reprint permission from you for this item? I think many of our readers would be interested in the effect, both domestic and foreign, although we are of the opinion that the jet-caused sonic boom does not constitute an answer to the scores of mysterious "sky-quakes" heard all over the world in recent years.

As I have noted in previous correspondence, may I again heartily congratulate the entire staff for the continuing excellence of AIR FORCE and the constantly growing value, worth, prestige, and timely potency of SPACE DIGEST, which I still hope will be issued as a separate publication, available to the general public, shortly.

Lee R. Munsick, Editor
Fulcrum Productions
Morristown, N. J.

● *Sorry, but requests for reprints of Mr. Witze's article exhausted AFA's supply some time ago. As part of a concerted effort to educate the public on the sonic-boom problem, the Air Force itself, supported by aircraft manufacturers, distributed 100,000 copies. We understand that these, too, are no longer available. Reprint privileges are granted you, provided credit is given* AIR FORCE *Magazine and the author.*—THE EDITORS

The Deepfreeze

Gentlemen: For a number of years the airborne radio operators (AFSC 29352), many of whom performed the same type of duty in World War II and in Korea, have been frozen to a five-level Air Force Specialty Code.

The flight (mechanic) engineers and gunners were allowed to progress, but not so the airborne radio operators. This has brought about the situation which exists today—qualified men having as much as fourteen years in grade as staff sergeant.

Since the Air Force has started retraining its surplus NCOs, many airborne radio operators, who were surplus at first but who are not at the present time, applied for retraining, only to receive the reply that retraining is not allowed for airborne radio operators who are required on a unit manning document. A requirement does exist, but promotion, or even a chance for promotion, does not. It is no joking matter when a man on his first enlistment makes technical sergeant partly because he possesses a seven-level AFSC.

Can you give any information that will help clarify the reason for our being frozen and what is the possibility of airborne radio operators being allowed to progress to a seven level? If we could get a seven level we could at least sweat it out for a promotion. A little hope is better than none at all.

Staff Sergeant
Groveport, Ohio

● *Air Force policy allows up-grade training to the seven-skill level to meet current and projected requirements. In cases where a seven-skill level AFSC is listed as surplus in AFR 39-8, up-grade training is not authorized.*

AFR 39-8, dated January 1, 1959, does not list AFSC 29372 (Airborne Radio Operator Technician) as a surplus specialty, so up-grade training is authorized provided only that the airman is assigned to duty in an authorized seven-skill level position.

The limited number of authorized seven-level positions restrict up-grade training of many airmen, and therefore makes them ineligible for promotion. The Air Force is cognizant of the problem and is presently considering a recommendation that should resolve it to the benefit of the airmen as well as to the Air Force itself.—THE EDITORS

New AFROTC Reader

Gentlemen: I have been receiving AIR FORCE/SPACE DIGEST for about two months now, and enjoy reading it very much. I would appreciate it if in some future issue you would cover some nonflying specialties, such as intelligence in my case, since not all AFROTC cadets will be going into a flight category.

Henry W. Schroeder
Cincinnati, Ohio

DYNA-SOAR

Dyna-Soar (for dynamic soaring) is a joint project between the Air Force and the NASA, and is an attempt to solve the technical problems of manned flight in the sub-orbital regions. Advance knowledge on the project indicates how a boost-glide vehicle can operate from the outer fringes of the atmosphere where it can maneuver and be recovered undamaged. Studies show that by varying the original rocket boost, and thus the velocity, and with the control available to the pilot, the Dyna-Soar aircraft can circumnavigate the earth, followed by a normal and controlled landing. Boeing Airplane Company, one of the competing companies for the development contract for the complete boost-glide system, has delegated to RCA the responsibility for the development of important electronic components of Dyna-Soar.

RCA

Tmk(s) ®

RADIO CORPORATION of AMERICA

DEFENSE ELECTRONIC PRODUCTS

CAMDEN, N. J.

INDEX TO ADVERTISERS

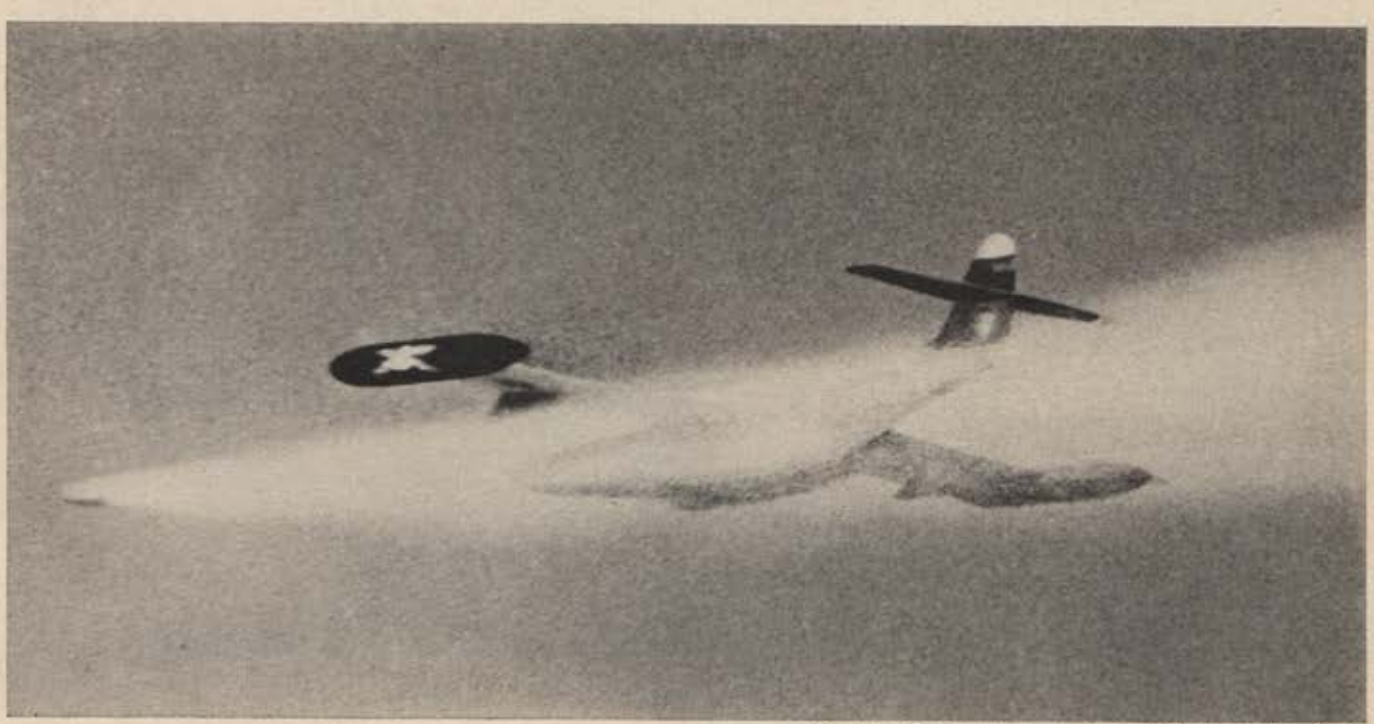
U. S. AIR FORCE AIR-TO-AIR MISSILE

The men:

. . . USAF ordnance technicians assigned to service the Douglas *Genie* air-to-air nuclear-armed missile. They have undergone extensive training in Air Force technical schools and from Douglas field service engineers to become proficient in both rocketry and nuclear ordnance.

The mission:

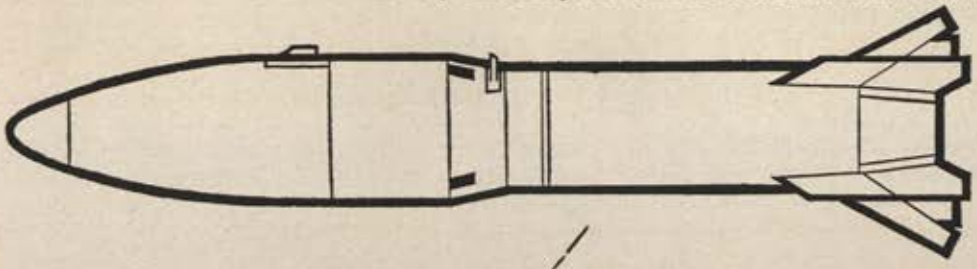
. . . high-level interception of enemy aircraft. Ideal interception would take place far from U.S. boundaries. The atomic warhead of the Douglas *Genie* was detonated under test conditions over friendly troops with no resultant danger.



Air Force interceptor fires a "live" *Genie* atomic missile

The missile:

. . . the Douglas-built *Genie*. This nuclear missile has actually been fired in flight. Retractable fins allow the missile to nest close to the plane's fuselage. Or it can be carried in the bomb bay. Interceptors can be armed with two *Genies*.



Depend on **DOUGLAS**

The Nation's Partner in Defense

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.

O. K. Antonov, one of Russia's top aircraft designers, has announced his latest: a glider with a butterfly tail.

• • •

The Russians have a four-letter word for it: *Blat*. This is the equivalent of "influence" in the West. *Blat* has come to light recently in connection with the selection of students for the higher and better institutions of learning—such as Moscow University. Influence is being used to get the sons and daughters of the wealthy bureaucracy that has grown up around the government in Russia special consideration in applying for admission to Russia's top university. There are far more students than facilities to accommodate them in the Soviet Union's universities —and so, for example, some seventy percent of those who apply to the Physics Department at Moscow University fail to gain admittance.

• • •

Battle order intelligence:

These are some of the generals and admirals of the armed forces of East Germany and their positions: Maj. Gen. Rudolf Bamler, Commanding General of Assault Guns and Techniques; Maj. Gen. Bernhard Bechler, Deputy Chief of Staff of the National Volksarmee; Maj. Gen. Paul Blechschmidt, Commanding General of the Cadet School at Naumburg/Saale; Maj. Gen. Helmut Borufka, Chief of the Training Department of the Defense Ministry; Gen. Rudolf Dolling, Deputy Minister of Defense; Lt. Gen. Heinrich Dollwetzel, Commanding General of the Infantry School at Plauen; Maj. Gen. Walter Freytag, Chief of the School for Regimental Commanding Officers at Dresden; Maj. Gen. Heinz Heitsch, Chief of Logistics; Lt. Gen. Heinz Hoffman, East German delegate to Warsaw Pact Hq.; Maj. Gen. Fritz Johne, Chief of Administration at Training Command Hq.; Maj. Gen. Heinz Kessler, Commanding General of the East German Air Force; Maj. Gen. Martin Lattmann, Commanding General of the Armored Vehicle School; Maj. Gen. Arno von Lenski, Chief of the Light Troops; Lt. Gen. Erich Mielke, Minister of State Security; Adm. Heinz Neukirchen, Chief of Staff, East German Navy; Lt. Gen. Vincent Mueller, Chief of Staff of the National Volksarmee; Maj. Gen. Hermann Rentsch, Chief of Military Area Command No. 5 (not further identified); Vice Adm. Waldemar Verner, Commanding Officer of the Navy; Maj. Gen. Heinz Zorn, Chief of Staff of the East German Air Force.

A former chief of the frontier police, Lt. Gen. Hermann Grathmann, is now East German Military Attaché in Moscow.

There are nearly fifty other generals and admirals in the East German armed forces.

• • •

The Russians are pushing computer production and say by 1965 they will be turning out computers at 450 percent of today's output. Computers, of course, are important components of ICBM guidance equipment that is located on the ground and involves radar tracking and radio command guidance. There is not much evidence that the Soviets have developed computers small enough to put inside an ICBM, although there is some evidence that there is one in Sputnik III. The Czechoslovakians have done the best job of anyone behind the Iron Curtain (insofar as is known) in producing small, miniaturized computers.

• • •

Electronics-laden Soviet submarines have made several sorties into the North Atlantic to check US radar and communications equipment and to take readings on precise positions of the US target cities.

• • •

IL-18 turboprop transports, similar to the Lockheed Electra, are now in regular service on USSR air routes, and one was used to carry Foreign Minister Gromyko to the Foreign Ministers' meeting in Geneva.

• • •

The Russians say that they now have a one-man helicopter. *Soviet Aviation*, which reports the new development, claims it has only a five-horsepower gas turbine engine using kerosene fuel. The whole gadget is strapped onto a soldier, who can use it to hop over obstacles as he sees fit. Total weight is said to be less than thirty pounds.

• • •

"Spring has brought a stir to the Arctic these days," says *Pravda* in reporting that the Russians have sent aerial expeditions to the Arctic to change the personnel on two drift stations on the ice, North Pole-6 station and North Pole-7 station. More than twenty-five automatic weather stations will be set up on the drifting ice this year.

• • •

One of Russia's long-range missile test ranges has its impact area in northeastern Siberia, east and north of Yakutsk. This has made Yakutsk an important transportation city for Russian engineers and military personnel, and as a result Aeroflot, the Russian airline, which first introduced regular service to Yakutsk about two years ago, now operates several flights per day to the city.

• • •

Each flying year that a pilot or stewardess puts in is counted as two calendar years in calculating pensions for them. Thus, the Aeroflot pilot who retires after "twenty-five years of service" may actually have only thirteen or fourteen years of real flying behind him. At age forty, an Aeroflot pilot can get a pension of 1,500 rubles per month, which isn't bad in Russia. It converts to about $150.

How's this for retirement benefits?

All employees of Aeroflot, the Russian airline, get length-of-service pay increases. These amount to a thirty percent raise after fifteen years in service.—END

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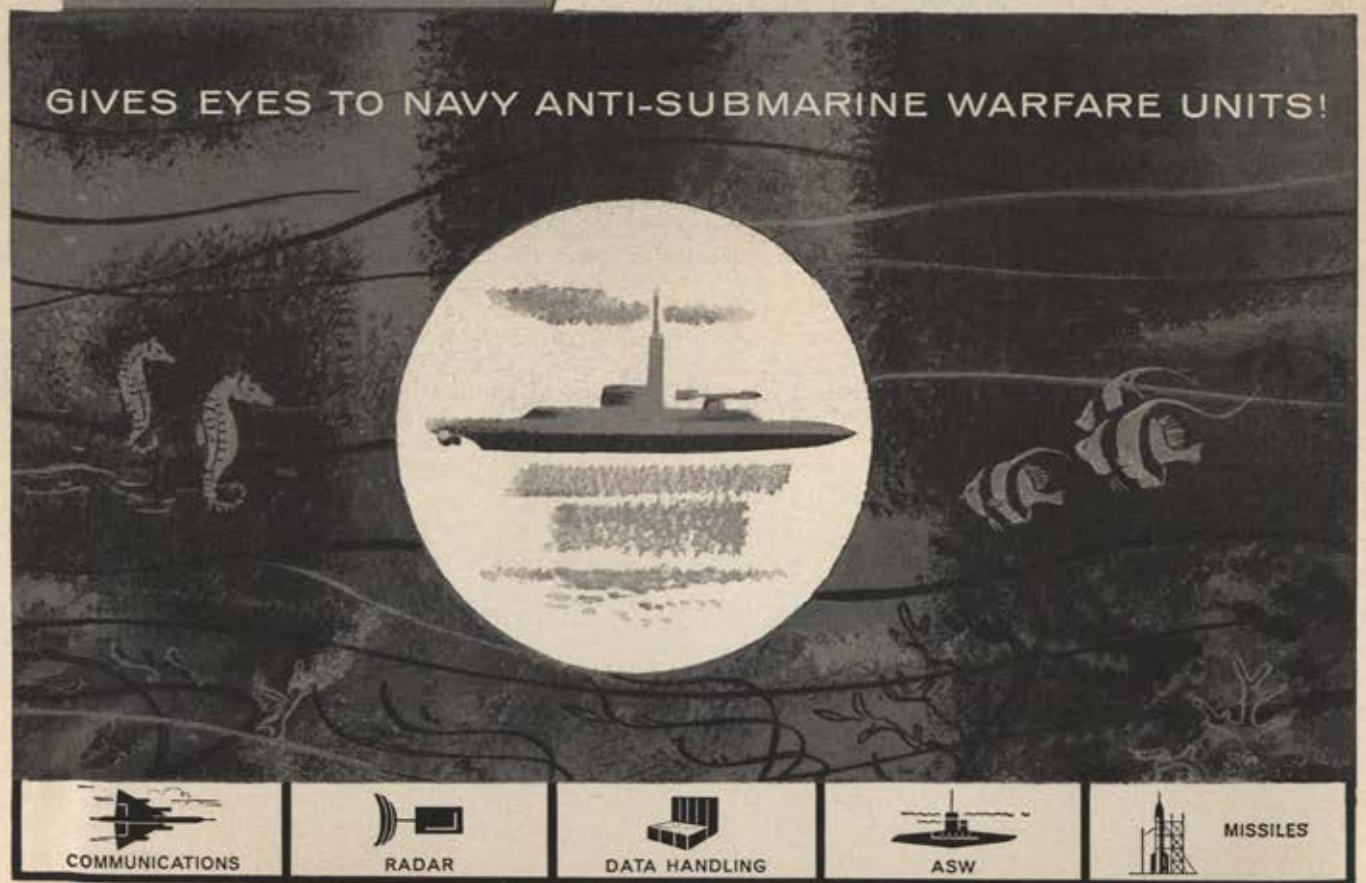

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AIRPOWER in the news

Claude Witze
SENIOR EDITOR

Now the Signal Corps

WASHINGTON, D.C.

Summer heat has arrived early in Washington this year, just in time to wilt the spirits of our annual spring visitors from the nation's high schools. The Weather Bureau has introduced a new yardstick called the Discomfort Index and, eager to show us what it means as quickly as possible, almost immediately pushed it up toward eighty, which is the point where cops no longer are good natured and congressmen become more unreasonable than ever.

The Pentagon, however, is air-conditioned. This being a fact that does not have to be reviewed by a committee you would expect the things that happen in this concrete cobweb to be more reasonable than those that happen out in the noonday sun. But they aren't. If you have any doubts, pay heed to this:

The US Army, with its Chief of Staff as spokesman, is urging the Joint Chiefs of Staff to recommend a single Global Strategic Communications System with the Army's Signal Corps as manager. The Army would need, of course, additional funds and personnel to do the job.

For the significance of this effort, which is almost sure to get serious consideration, we need look no further than a recent statement by Gen. Thomas S. Power, boss of the Strategic Air Command. Said he: "Without communications I can't command anything but my desk."

When you consider the fact that SAC, which means General Power, controls more than ninety percent of the total firepower which the free world can bring to bear against a common enemy, the Army effort before the Joint Chiefs assumes major importance.

The entire matter first was brought to public attention by the House Appropriations Committee a few weeks ago. In their report they noted that all three services are trying to increase speed and reliability of their global communications. One of these projects is a commercial contract placed by USAF, which anticipates a tremendous increase in the demand as steps are taken to meet the ballistic missile threat.

A Defense Department spokesman told the committee there is a plan to integrate the communications networks under operational control of the JCS. The committee said this is a fine idea and called for an aggressive pursuit of the idea.

Despite the heat, it is being pursued in a vigorous way by the Army. Within USAF, however, there persists strong doubt that the Signal Corps should be allowed to take over control of the communications channel that connects General Power's command post at Omaha with the cockpits of his bombers all over the world. The additional idea that the Army might win control of the lines connecting the SAGE system with the Bomarc missile and interceptor bases and that it could force USAF to share these lines with other branches of the armed forces clearly is not acceptable.

The objection has been made clearest by Gen. Curtis E. LeMay, Vice Chief of Staff:

"Communications are an integral part of the weapon systems which we develop and employ and an essential element in the proper functioning of the command structure that controls and launches these systems.

"The communications equipment which we develop must be tailored to meet the exact requirements of our specific tasks. Common items, those which satisfy some of the needs of all the services but do not meet the full requirements of any service, are not the answer.

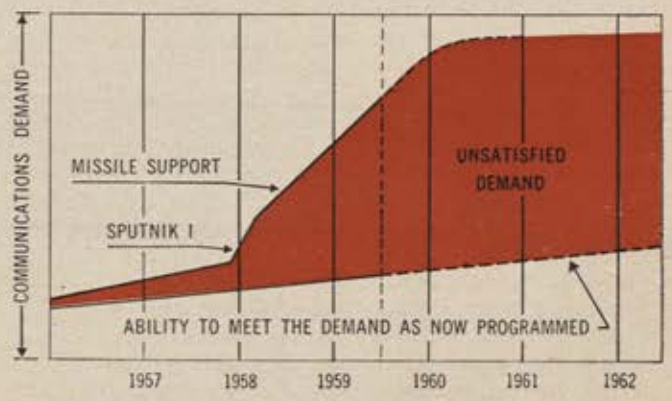
"Requirements for Air Force communications equipment must be met with no compromises."

If we look back to the source and the temper of the House Committee, it is clear that the impetus for a single manager for communications comes from the unholy terror of duplication. Duplication infers that wasteful and unnecessary circuitry is being planned and built. This is not true. Nor is it true that a forced merger of Army, Navy, and Air Force circuitry would reduce the total circuitry.

But more basic is General LeMay's stern point that communications today are part of each weapon system. The Signal Corps has long and good experience with the transmission of messages that direct cavalry and tanks and doughboys across the field of battle. But in aerial weapon systems the communication line is part of the system, and the Signal Corps cannot be given control of it any more than the quartermaster can put his hand on the throttle.

There are two other factors deserving mention. First is the matter of reliability, which must be built in the communications system just as it is in fire control, navigation, and other subsystems. Yet outside the Air Force a

(Continued on following page)



USAF communications complex, already fourteen times that of the Radio Corporation of America, is lagging far behind requirements dictated by new weapons. The aerospace era will demand faster communications between more widely dispersed points. USAF already is planning a decade ahead.

ninety-nine percent reliability circuit is considered almost perfect. Well, a circuit that is that good is not operating fifteen minutes in each day. And fifteen minutes is the exact amount of time we will have for warning from ICBM detection sites in Alaska and Greenland.

The final item is an invitation to look to the future. USAF is preparing for the aerospace age, and there is no doubt that its activity will spread into space within our lifetime. In an era of space weapons, communications control will assume even greater importance.

The 'Munitions Makers'

Representative F. Edward Hébert, a Democrat from Louisiana, a few days ago delivered himself of the opinion that you can't rely on the integrity of a defense contractor. He said this is proven by history.

It is interesting that this attitude came to light in Room 304 of the Old House Office Building while the newspapers still were headlining another remark, made a few days earlier at the White House. In that case, the President of the United States, a Republican, expressed concern over possible influence of contractors on the defense program. He said he didn't *think* he ever called them "munitions makers"—a term that could become a dirty word in the political squabble—but admitted that he *may* have called them by that name.

These events make it pretty clear that we are in danger of inaugurating an open season on contractors. From "munitions makers" it will be easy for some quasi-demagogue to slip to "merchants of death." From there the spirit of Gerald P. Nye is reached with no effort, and the entire defense program will be in peril. It is not necessary to document dead history again in these columns. The Nye investigation was held in the early thirties, and by the time of Pearl Harbor we still had not recovered from the aftermath.

There is a distinction between the two eras that must not be ignored. Up to the time of World War II there is no doubt the military budget was spent for beans, bullets, and boots. Military materiel had a narrow application and always was expendable. Defense spending today is in an area of technological marvels, of complex machines that call for a staggering amount of scientific, engineering, and managerial talent.

If there is any parallel between making gunpowder and making a modern weapon system, it is not evident to this desk. Mr. Hébert's committee spent a number of days this spring listening to an elaborate presentation on the weapon system concept. It was given by a number of America's leading aircraft manufacturers, and the text of their remarks makes a two-inch volume that is the best dissertation on the subject ever printed.

Yet Mr. Hébert said the other day that after hearing "a large segment of industry who *allegedly* are operating under the Weapons Management System of contracting . . . we are trying to find out actually what the system is, if it is a system. . . ." And so the seminar continued, with presentations by the Air Force. If the message has penetrated and the committee understands the weapon system concept, it is not evident to the hearing witnesses.

As a result of the White House remark the next major subject before the committee will be the employment of former general officers by defense contractors. Here again there is a danger that the changing character of the defense industry will be ignored. Why do contractors hire former generals? Because of what they know about modern weapon systems and their familiarity with the operational demands. You wouldn't know it from the *Congressional Record*, but this has been going on for a great many years.

If these men are shut off as a source of talent for defense industries, the national security effort will suffer. In the aerospace age there will be no abundance of talent any more than there has been in the era of Sputnik's predecessors.

How About a Little Salesmanship?

Belatedly, perhaps, the Military Air Transport Service is striking back. It is handing out some statistics about its operation that its critics prefer to ignore. At the same time it is quietly pursuing the concept that the Department of Defense can save money by using more airlift.

One of the baffling things about the MATS controversy in Washington is that the very people who should be helping to sell airlift are spending their energy to beat MATS over the head with a lead pipe. Like most major cities, this town has its share of commercial airline salesmen who know how to show a corporate traffic manager that he can save money by using air transportation. MATS is presenting the identical argument in the Pentagon, as we pointed out here last April, but the airline hymn of hate is not designed to promote the concept.

Some arithmetic from MATS headquarters shows that the commercial airlines have increased their share of MATS passenger-mile traffic by 3,916 percent since fiscal 1955. Passenger miles flown by MATS itself have gone down eight percent in the same period. Operating expenses of MATS aircraft have increased thirty-five percent, but the amount spent for commercial lift has increased 1,573 percent.

Lt. Gen. William H. Tunner, MATS boss, makes the point that if there has been a "persistent expansion" since 1955, it has been almost wholly in the commercial phase of the operation. Far from winning support for his idea that this should continue, he is being hindered.

The bitterness of the anti-MATS effort sometimes reaches astounding proportions, particularly in the public prints. One journal, which has likened MATS to an octopus, of all things, now has accused the service of trying in vain to play a dirty trick on the airlines by issuing off-standard specifications. MATS, it declared with a sneer that wrinkled the page, asked the commercial carriers for airplanes with seats that are fifteen inches wide. And, it added with a note of authority, the industry figure is fourteen and a half inches.

Well, anyone who has been in a modern airliner even without a tape measure knows the seats are of more generous proportions, as they must be to accommodate some of the pear-shaped passengers who get aboard. We asked the Air Transport Association for some figures on this and learned that the seats range from eighteen and a half inches on the Constellation to nearly twenty-five inches on the Stratocruiser. Most seats are nineteen, twenty, or twenty-one inches wide.

As for MATS, the current seat specification sets a minimum of sixteen and a half inches. MATS has proposed that this be enlarged to seventeen inches, and the idea is under study by the Defense Department and the industry. MATS *never* has suggested a fifteen-inch seat, and fourteen and a half inches is *not* the "industry figure."

This kind of misrepresentation must arise either from stupidity or malice, and it is up to the individual to pick his own motivation. It can't be the heat because it persists in winter as well as summer.—END

Anniversary Issue

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September AIR FORCE/SPACE DIGEST will present the most comprehensive editorial review of the United States Air Force available—its command, its weapons, its bases, and its programs—in the annual Air Force Almanac. Because of maximum reader interest, your advertising will be seen again and again by Air Force management men and their partners-in-industry who use this Anniversary issue as a year-round Air Force guide.

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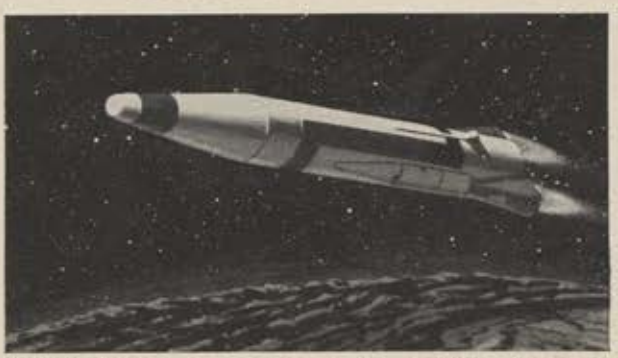
men in two of its most vital weapon systems—the B-70 bomber and the F-108 interceptor.

For though the Strategic Air Command will have squadrons of intercontinental missiles at its command, it will need the B-70 to balance its deterrent power. Aptly named the Valkyrie—for the maidens of Norse mythology who roamed the skies above the battle, deciding its outcome—the B-70 will skirt the edge of Space at 2,000 miles an hour. It will have the range to reach any target...can launch its missiles from afar at enemy ground defenses or the target itself.

And though the Air Defense Command will have a battery of deadly counter-missiles, it will need the 2,000-mph F-108 long-range interceptor. For the enemy must also rely on manned weapon systems for precision bombing. The F-108 Rapier can meet him a thousand miles from our borders...identify him...destroy him.

North American Aviation, Inc. is weapon system contractor for the B-70 Valkyrie and the F-108 Rapier. The best qualified companies in America, large and small, are subcontractors. Work on both these vital projects is already well underway.

AMERICA NEEDS BOTH FOR A BALANCED DEFENSE



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Aerospace Banquet Speaker
Friday night, September 4

GENERAL SAMUEL E. ANDERSON
Commander of AMC
Industry Briefing Speaker
Friday, September 4

LT. GEN. BERNARD A. SCHRIEVER
Commander of ARDC
Industry Briefing Speaker
Friday, September 4

LT. GEN. WILLIAM E. HALL
Commander of CONAC
Reserve Seminar Speaker
Thursday, September 3

MAJ. GEN. WINSTON P. WILSON
Chief, AF Division, NGB
Reserve Seminar Speaker
Thursday, September 3

The Program

WEDNESDAY—SEPTEMBER 2:
(For AFA Leaders only)

6:00 PM AFA Directors Meeting
8:00 PM AFA Leaders Meeting

• THURSDAY—SEPTEMBER 3:

9:00 AM Reserve Forces Seminar
12:00 N AFA Honors Luncheon
3:00 PM 1st AFA Business Session
7:00 PM Panorama Reception

• FRIDAY—SEPTEMBER 4:

9:00 AM 2d AFA Business Session
9:30 AM 1st Industry Briefing*
11:30 AM Industry Buffet Luncheon*
2:30 PM 2d Industry Briefing*
2:30 PM 3d AFA Business Session
7:30 PM Aerospace Banquet

• SATURDAY—SEPTEMBER 5:

9:00 AM Air Force Symposium
12:30 PM Awards Luncheon
7:00 PM Air Force Reunion

SUNDAY—SEPTEMBER 6:

1:00 PM Panorama Open

*Not included in registration fee—separate registration required. Note the two types of registration—TOTAL and BASIC. Basic is for persons who can attend for only one or two days.

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FLIGHT LINES

Northrop Corporation's twin-jet **N-156F, the Freedom Fighter,** was rolled out on May 30 before an audience that included representatives of more than forty free world countries. **Built specifically for free allied nations outside the US,** the N-156F was designed and developed in parallel with the **supersonic T-38 Talon,** and the fighter makes extensive use of the designs, parts, tools, and test experience used in the T-38 program.

Fred C. Kelly, friend and biographer of the **Wright brothers,** died in May in Kensington, Md., at the age of seventy-seven. Mr. Kelly, the first syndicated columnist, met Orville Wright in the 1930s, and was largely instrumental in bringing the **1903 Kitty Hawk plane** back from display in England. The Smithsonian Institution had considered **Professor Samuel Langley's** plane the first heavier-than-air plane to fly. Orville Wright refused to send his plane to the Smithsonian under those circumstances, and it was not until 1948, two months after Orville's death, that Mr. Kelly's efforts were rewarded, and the Kitty Hawk plane was installed in Washington's National Air Museum.

Capt. George A. Edwards, Jr., flying a McDonnell RF-101 Voodoo reconnaissance fighter, set a new world's speed record of 816.279 miles an hour on April 15. He flew over a 500-kilometer, closed-circuit course at altitudes from 40,000 to 48,000 feet terminating at Edwards AFB, Calif. Captain Edwards is assigned to the 432d Tactical Reconnaissance Wing, Shaw AFB, S. C.

Ryan's XQ-2C jet target drone set a new record by reaching a radar-measured **altitude of 59,000 feet,** making four simulated target runs during seventy-seven and a half minutes of remote-controlled flight above 50,000 feet. Total flight time was ninety-six and eight-tenths minutes. **Ryan and Lockheed Aircraft** are jointly modifying the **C-130 Hercules** to air launch and direct four of the one-ton drones.

STAFF CHANGES . . . Maj. Gen. James Ferguson has been reassigned from Director of Operational Requirements, DCS/O, Hq. USAF, Washington, D. C., to be Vice Cmdr., ARDC, Andrews AFB, Md.

Brig. Gen. Philip H. Greasley, who was Director of Planning in the Office of the Assistant Secretary of Defense, is now Chief of the USAF Group, Joint Military Mission for Aid to Turkey, APO 254, N. Y., replacing **Brig. Gen. John A. Hilger,** who was transferred to duty with the 1141st Special Activities Squadron, APO 230, SHAPE Allied AF, Northern Europe.

Brig. Gen. Frank E. Rouse, Hq. ADC, Ent AFB, Colorado Springs, Colo., has been reassigned from Assistant Deputy for Operations, ADC, to become Deputy for Materiel, ADC. The former ADC Deputy for Materiel, **Maj. Gen. T. Alan Bennett,** was assigned to DCS/M, Hq. USAF, Washington, D. C., as Director of Maintenance Engineering. . . . **Brig. Gen. Clarence T. Edwinson,** formerly Cmdr., 30th Air Division (Defense), ADC, Willow Run Air Force Station, Belleville, Mich., has been reassigned as Cmdr., Chicago Air Defense Sector, and Cmdr., North American Defense (Continental Air Defense), Chicago Air Defense Sector, ADC, Truax Field, Madison, Wis. . . . **Brig. Gen. William H. Wise** has been transferred from duty as Cmdr., 37th Air Division (Defense), and Cmdr., 37th North American Air Defense (Continental Air Defense) Division, ADC, Truax Field, Madison, Wis., to be Cmdr., 32d Air Division (SAGE), and Cmdr., 32d North American Air Defense (Continental Air Defense) Division, ADC, Dobbins AFB, Ga., replacing **Brig. Gen. Edward N. Backus,** who has been assigned to the Office of the Secretary of the Air Force, Hq. USAF, Washington, D. C., to be a member of the Secretary's Personnel Council.

Model B Boeing IM-99 Bomarc, pilotless long-range interceptor missile currently being added to American continental defense arsenal, has a solid-propellant boost rocket and improved ramjet engines. Six-ton slabs of concrete launch shelter can be opened in three seconds.

Maj. Gen. Morris R. Nelson, relieved from duty as Chief, USAF Section, Joint Brazil-US Military Commission, Brazil, Rio de Janeiro, Brazil, and Chief, Air Section MAAG, Brazil, was assigned to Hq. Command, USAF, Bolling AFB, Washington, D. C., as Assistant to the Cmdr.

Brig. Gen. Edward J. Hopkins, former Assistant Comptroller for Fiscal Operations, AF Comptroller, Hq. USAF, Washington, D. C., is the new Cmdr., Hq. Air Force Accounting and Finance Center, Denver, Colo.

Brig. Gen. James O. Guthrie, who was Cmdr., 39th Air

(Continued on following page)

Division, PACAF, has become Commandant, USAF Air-Ground School, TAC, Keesler AFB, Miss.

Brig. Gen. James McGehee, who was Cmdr., 4520th Combat Crew Training Wing (Tactical Fighter), is the new Cmdr., 2d Air Division, and Chief, US Military Training Mission, Saudi Arabia, with additional duty as DoD Representative, Saudi Arabia, for Technical Discussions. General McGehee replaces **Brig. Gen. Albert P. Clark,** who has moved to Hq. USAF, Washington, D. C., as Director of Military Personnel, DCS/P. . . . The former Director of Military Personnel, **Maj. Gen. Raymond J. Reeves,** is now Vice Cmdr., MATS, at Hq. MATS, Scott AFB, Ill., with additional duty as Chief of Staff, MATS. . . . **Maj. Gen. Alfred F. Kalberer,** who was 15th AF Deputy Cmdr., SAC, March AFB, Calif., is now Vice

General Earle E. Partridge, left, Commander of North American Air Defense Command since 1955, will retire at the end of this month, after forty-one years of military service. His successor, second left, will be General Laurence S. Kuter, Commander of Pacific Air Forces since 1955. Also retiring: Lt. Gen. Clarence S. Irvine, Deputy Chief of Staff for Materiel, who will become vice president of AVCO Corporation, and, right, Maj. Gen. Reuben C. Hood.

Cmdr., CONAC, Hq. CONAC, Mitchel AFB, N. Y. . . . General Kalberer's replacement at 15th AF is **Maj. Gen. Joseph J. Nazzaro,** who had been Director of Personnel Planning, DCS/P, Hq. USAF, Washington, D. C. . . . **Maj. Gen. Elvin S. Ligon,** who was Cmdr., 3500th USAF Recruiting Wing, ATC, Wright-Patterson AFB, Ohio, is the new Director of Personnel Planning. . . . **Brig. Gen. Henry G. Thorne,** transferred from duty as Cmdr., Iceland Defense Force, replaced General Ligon at ATC.

Maj. Gen. Kenneth B. Hobson, former Vice Cmdr., 5th AF, PACAF, is now Cmdr., Ogden AMA, AMC, Hill AFB, Utah. **Maj. Gen. Leland S. Stranathan,** who was Director of Development Planning, DCS/D, Hq. USAF, Washington, D. C., has been reassigned as Cmdr., Caribbean Air Command, APO 825, New Orleans, La. General Stranathan was replaced by the former Assistant Deputy Cmdr. for Weapon Systems at ARDC, **Maj. Gen. Victor R. Haugen.** . . . **Brig. Gen. Ivan W. McElroy** has been reassigned from Cmdr., 834th Air Division, TAC, to be Cmdr., 401st Tactical Fighter Wing, England AFB, La.

Maj. Gen. John M. Reynolds, former Cmdr., 93d Bomb Wing (Heavy), SAC, Castle AFB, Calif., is the new Cmdr., 3d Air Division, SAC, APO 334, San Francisco, Calif. . . . **Brig. Gen. Robert Miller,** relieved from duty as Cmdr., 12th Air Division, SAC, March AFB, Calif., replaced **Brig. Gen. Charles M. Eisenhart** as Cmdr., 14th Air Division, SAC, Beale AFB, Calif. General Eisenhart became Chief, Operations Plans Division, in the Directorate of Operations, SAC, Offutt AFB, Neb.

Maj. Gen. Richard M. Montgomery, former Cmdr., 3d Air Division, SAC, is now Assistant Vice Chief of Staff, Hq. USAF, Washington, D. C. . . . **Brig. Gen. Paul S. Emrick** was reassigned from Inspector General, SAC, to be Deputy Director of Plans, SAC, at Offutt AFB, Neb. . . . **Brig. Gen. James W. Wilson** who was Cmdr., 820th Air Division, SAC, Plattsburgh AFB, N. Y., replaced General Emrick as Inspector General, SAC.

Brig. Gen. Joseph J. Preston, former Cmdr., 825th Air Division, SAC, Little Rock AFB, Jacksonville, Ark., has replaced **Maj. Gen. William K. Martin** as Cmdr., **72d** Bomb Wing (Heavy), SAC, APO 845, N. Y. General Martin has replaced **Brig. Gen. Horace M. Wade** as Director of Personnel, SAC, Offutt AFB, Neb. . . . General Wade replaced **Maj. Gen. William E. Eubank, Jr.,** as Cmdr., 4310th Air Division, SAC, APO 30, N. Y. . . . General Eubank is now Deputy Cmdr., 2d AF, SAC, Barksdale AFB, La., replacing **Maj. Gen. Charles W. Schott,** who is now the Deputy Inspector General for Inspection, TIG, Norton AFB, Calif.

Brig. Gen. Waymond A. Davis has been reassigned from Deputy Director for Production, Directorate of Procurement and Production, AMC, Wright-Patterson AFB, Ohio, to replace **Maj. Gen. Frank A. Bogart** as **Director, Plans and Programs,** AMC. General Bogart is now Director of Supply, AMC, at Wright-Patterson AFB.

Maj. Gen. Charles M. McCorkle, who was Assistant Chief of Staff for Guided Missiles, Hq. USAF, Washington, D. C., is now Cmdr., AF Special Weapons Center, ARDC, Kirtland AFB, N. M. **Brig. Gen. Robert E. Greer,** who was General McCorkle's deputy, was promoted to Assistant Chief of Staff for Guided Missiles.

Brig. Gen. Walter E. Arnold, who was Cmdr., 817th Air Division, SAC, Pease AFB, N. H., was assigned as Director, Flight Safety Research, TIG, Norton AFB, Calif., replacing **Maj. Gen. Joseph D. C. Caldara** who is Deputy Inspector General for Safety, TIG, Hq. USAF, Washington, D. C. . . . **Brig. Gen. Virgil L. Zoller,** who was Cmdr., 314th Air Division, PACAF, is now Cmdr., 832d Air Division, TAC, Cannon AFB, N. M.

The former Cmdr., AF Special Weapons Center, Kirtland AFB, N. M., **Maj. Gen. William M. Canterbury,** has replaced **Maj. Gen. Leighton I. Davis** as Deputy Cmdr., Research, ARDC, Andrews AFB, Md. General Davis is now Assistant DCS/D, Hq. USAF, Washington, D. C. . . . **Maj. Gen. Jacob E. Smart,** former Assistant Vice Chief of Staff, USAF, is now Cmdr., 12th AF, TAC, Waco, Tex., replacing **Maj. Gen. Chester E. McCarthy,** who has become Cmdr., 14th AF, CONAC, Robins AFB, Ga.

Brig. Gen. Theodore G. Kershaw, former Cmdr., 464th Troop Carrier Wing, Assault, is now Cmdr., 315th Air Division, (Combat Cargo) PACAF, APO 323, San Francisco, Calif. . . . **Maj. Gen. Bruce K. Holloway** has been reassigned from duty as Deputy Cmdr., 12th AF, TAC, Waco, Tex., to be Director of Requirements, DCS/D, Hq. USAF, Washington, D. C.

Maj. Gen. Edward W. Suarez, who was Deputy Commandant, National War College, Washington, D. C., is now Cmdr., 6th Allied Tactical AF, SHAPE, APO 224, N. Y., replacing **Maj. Gen. Brooke E. Allen,** who became Cmdr., Hq. Command, USAF, Bolling AFB, Md., upon the retirement of **Maj. Gen. Reuben C. Hood, Jr.**

Maj. Gen. Richard H. Carmichael has been succeeded as Commandant, Air Command and Staff College, AU, Maxwell AFB, Ala., by the former Vice Commandant, Air War College, **Brig. Gen. Frederick E. Calhoun.** General Carmichael is now the Commandant of Air War College, AU, Maxwell AFB, replacing **Maj. Gen. Robert F. Tate,** who became Vice Cmdr., AU. . . . **Brig. Gen. William J. Clinch** has been reassigned from duty as Deputy Cmdr. for Education, AU, to become Director, Research Studies Institute, AU, **Brig. Gen. William J. Bell,** who was Deputy Commandant, AFROTC, AU, was promoted to Commandant, AFROTC.

—MICHAEL MILLER

SIKORSKY HSS-2

U. S. Navy's new hunter-killer turbocopter

The Navy's new turbine-powered HSS-2 helicopter, developed by Sikorsky Aircraft, is this country's newest anti-submarine weapons system, the first helicopter that can both search out and destroy enemy undersea craft.

This versatile helicopter, with modifications, is also ideally suited for troop, cargo, and rescue operations of other U.S. military services.

The HSS-2 features a boat hull and can operate from land, shipboard, water, ice, snow, mud or tundra. Twin turbine engines, each rated at 1050 shp, give it superior range, speed and payload.

Improved submarine detection equipment and an advanced navigation system developed jointly by the Navy and Sikorsky, combined with anti-icing equipment for the rotor assembly and automatic stabilization equipment, make the HSS-2 an integrated weapon system capable of around-the-clock all-weather operation.

Now in production, the HSS-2 is Sikorsky's second boat-hulled turbocopter. It joins a family of Sikorsky helicopters whose service is unequaled in military and commercial operations throughout the world. SIKORSKY AIRCRAFT, Stratford, Connecticut. A division of United Aircraft Corporation.

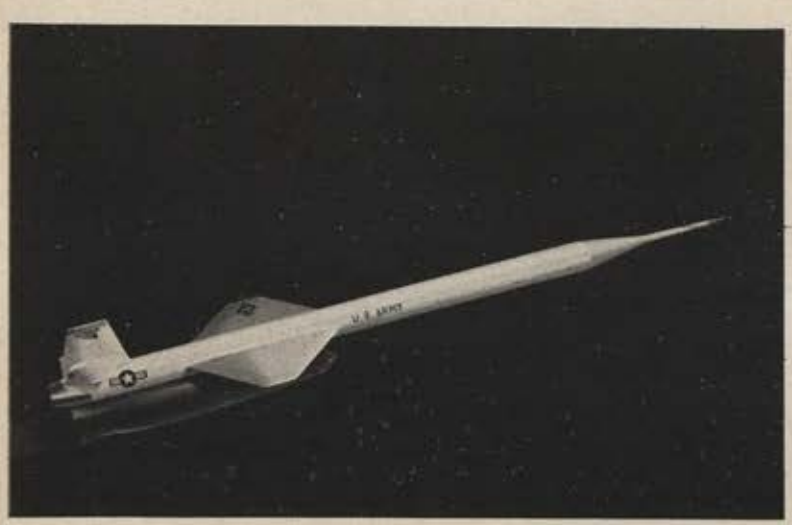
What Lockheed is doing today to develop
Tomorrow's missiles and spacecraft

The world's first polar-orbiting satellites...the world's fastest ramjet target drone...a "fuel cell" that produces auxiliary power for spacecraft in a radically different way...a TV camera-transmitter—the world's smallest—that gives engineers and scientists on the ground a televised report of what takes place in test missiles during flight. These are just a few of the many activities and achievements of Lockheed's Missiles and Space Division.

Lockheed is System Manager and Prime Contractor of the ARPA DISCOVERER satellite series—and the U. S. Navy's POLARIS missile. Both are highest priority programs of the U. S. Government. And both are ahead of schedule.

A Lockheed MSD work-force of over 16,000—including 3,500 scientists and engineers—is engaged in all phases of missile and space technology: satellite systems development; space communications; electronics; ionic, nuclear, and solar propulsion; magnetohydrodynamics; computer research and development; flight sciences; materials and processes; human engineering; electromagnetic wave propagation and radiation—and many other advanced fields.

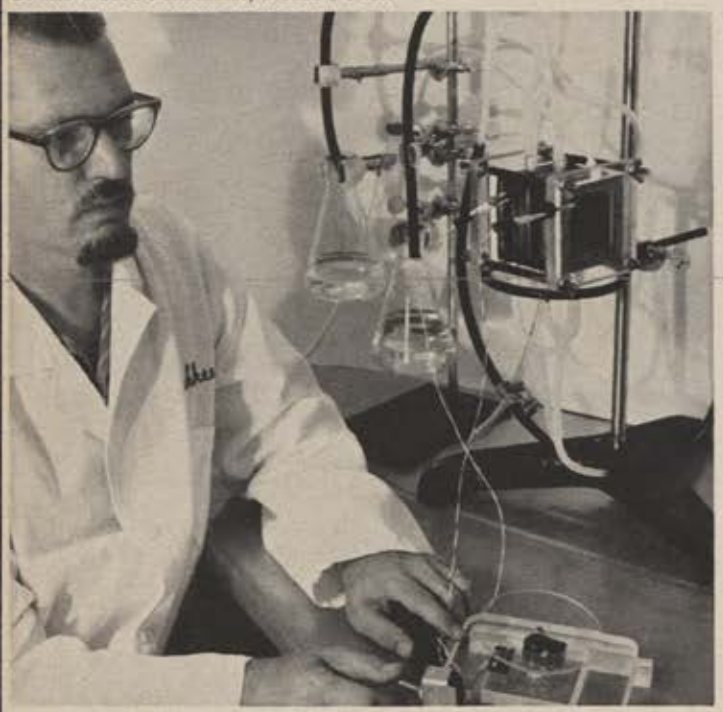
From these efforts at Lockheed will come many significant breakthroughs and scientific "firsts"—to speed the development of tomorrow's missiles and spacecraft.



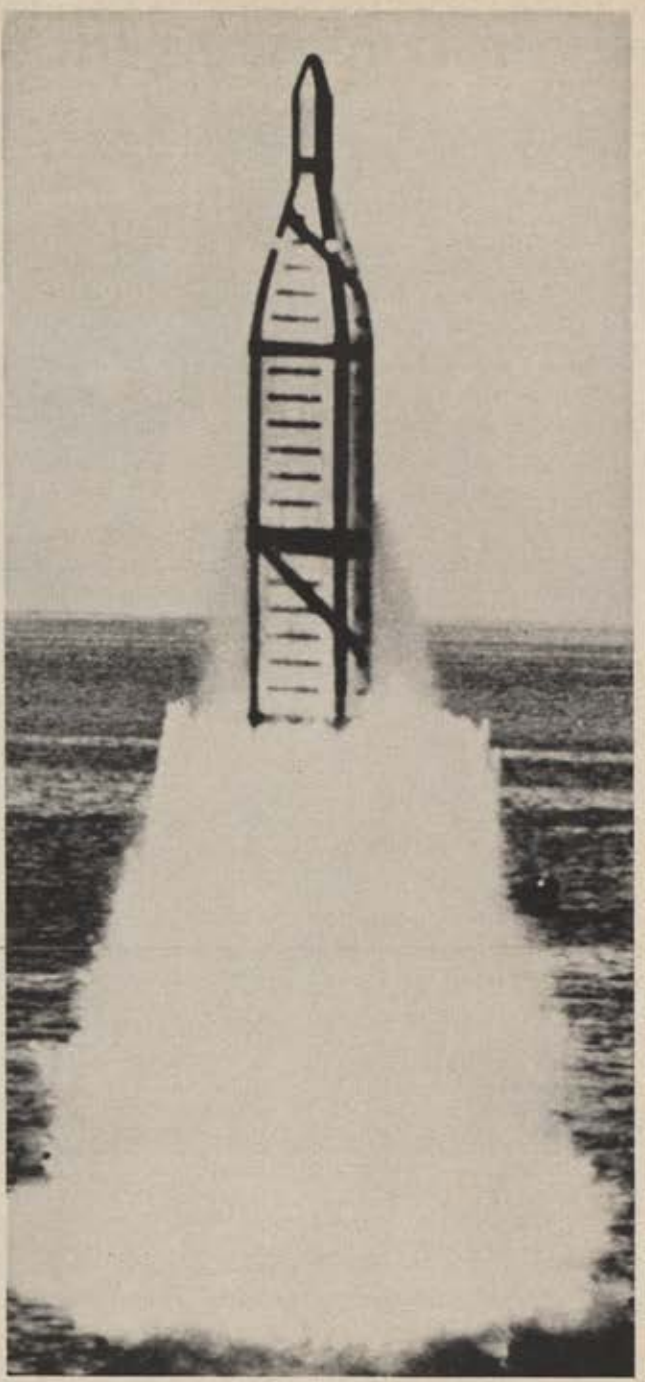
Ramjet-powered supersonic target, Lockheed Q-5 KINGFISHER electronically simulates enemy attackers—is being used by U. S. Army to evaluate and sharpen our nation's missile marksmanship, increase our defense capabilities.

First polar-orbiting satellites, the Lockheed-built DISCOVERER I and II were orbited in two successive launches. Lockheed is System Manager for this ARPA advanced scientific research program.

Transmitting performance data from missiles and test vehicles, direct to ground stations, Lockheed-developed TV camera-transmitter and PAM-FM telemetry systems are acknowledged to be the world's smallest, world's best.



Revolutionary "fuel cell," under development at Lockheed, converts chemical energy directly into electrical power—for auxiliary power requirements of miniaturized spacecraft instrumentation and space communications systems.

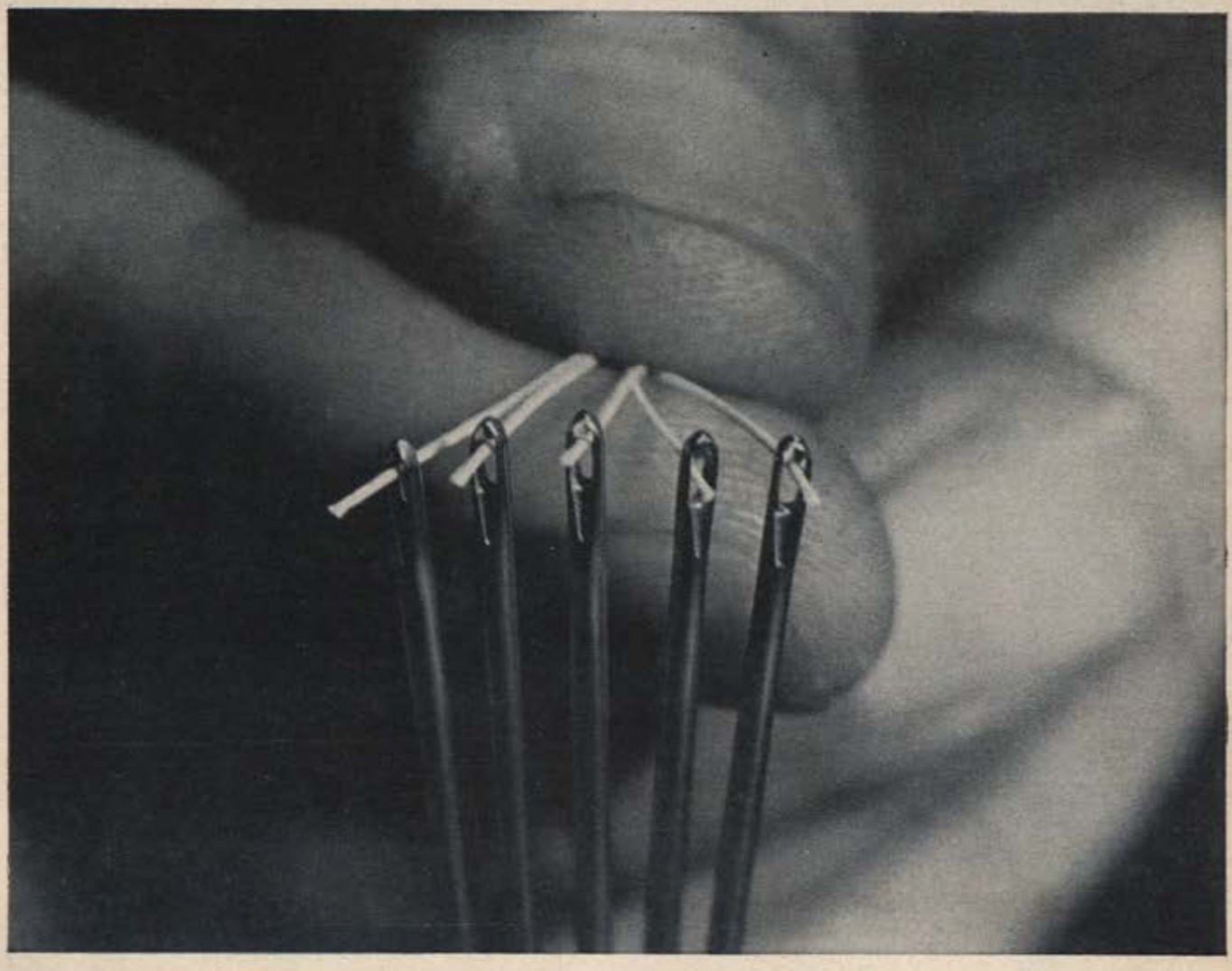


Erupting from beneath the sea, a full-scale POLARIS test vehicle demonstrates how operational missile will be launched from submerged U.S. Navy subs. Ultimate range of the POLARIS will be 1500 nautical miles.

LOCKHEED

JET TRANSPORTS • JET FIGHTERS • JET TRAINERS • COMMERCIAL & MILITARY PROP-JET TRANSPORTS • ROCKETRY
BALLISTIC MISSILE RESEARCH & DEVELOPMENT • WEAPON SYSTEM MANAGEMENT • ANTI-SUBMARINE PATROL AIRCRAFT
NUCLEAR-POWERED FLIGHT • ADVANCED ELECTRONICS • AIRBORNE EARLY-WARNING AIRCRAFT • AIRPORT MANAGEMENT
NUCLEAR REACTOR DESIGN & DEVELOPMENT • GROUND SUPPORT EQUIPMENT • WORLD-WIDE AIRCRAFT MAINTENANCE

Ever try threading five needles at once?



Cubic has, electronically speaking. And far greater precision is required of the five-target Cubic MOPTAR which will be used by the Federal Aviation Agency to evaluate experimental air-traffic-control systems. MOPTAR (Multi-Object Phase Tracking and Ranging), an *omni-directional* system requiring *no moving antennas,* provides startlingly accurate real-time position data. MOPTAR can be expanded to track *hundreds of aircraft* simultaneously with this same accuracy. The FAA installation will monitor other systems in tests at the new National Aviation Facilities Experimental Center near Atlantic City. It's a new use for Cubic's Space Age tracking systems developed under the forward-looking sponsorship of the United States Air Force. Now MOPTAR finds a non-military application in helping solve the problems of air navigation, an application that will lead to greater safety in the traffic lanes of the sky.

MOPTAR

Tracking systems by Cubic . . . reliable precision systems with Space Age capability . . . find application in air traffic control and, through the multiple-target potential of MOPTAR, in increasing the fire-power of America's guided missiles.

CUBIC CORPORATION

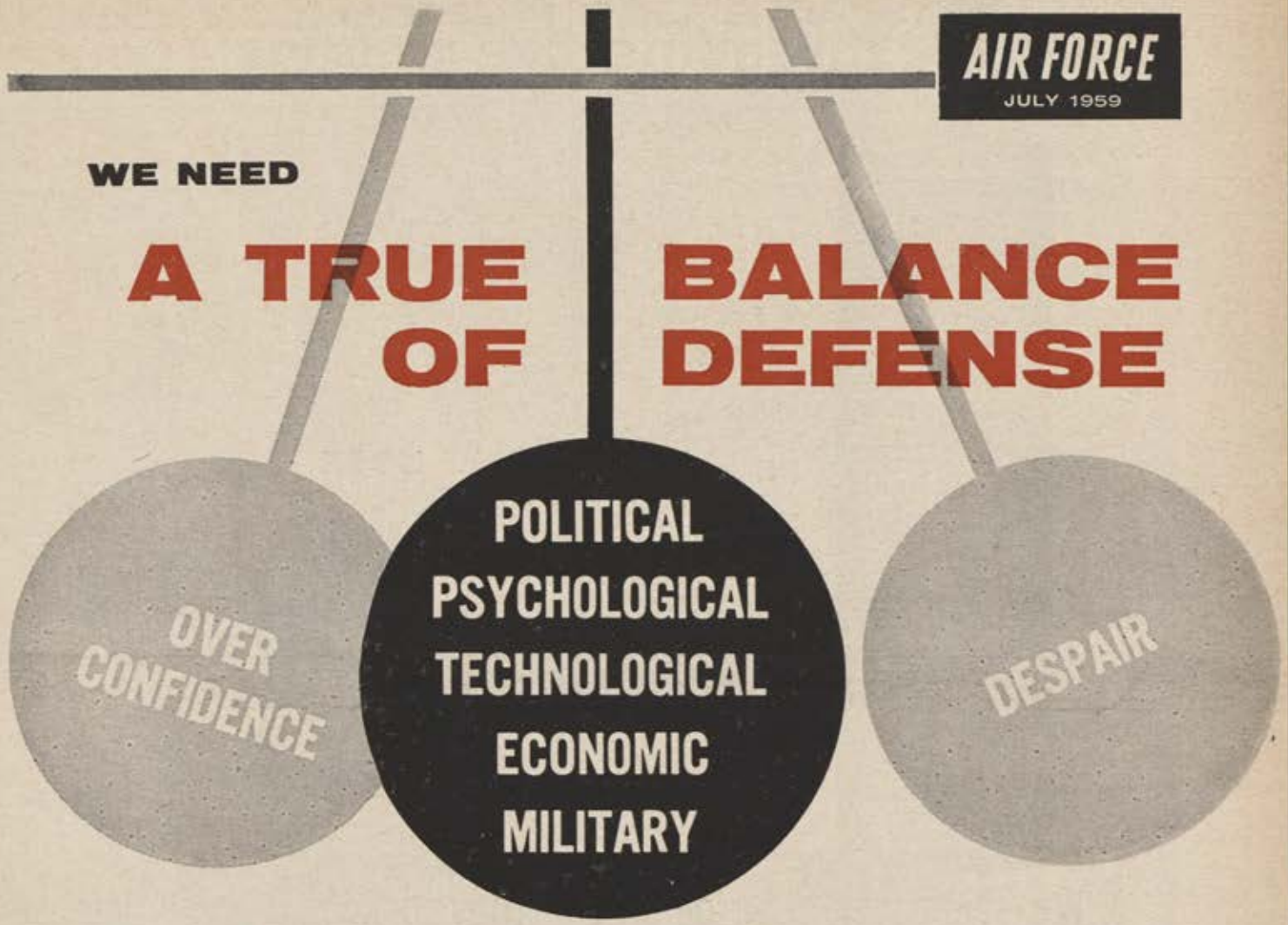
ELECTRONIC ENGINEERING — WITH A DIMENSION FOR THE FUTURE

5575 Kearny Villa Road, San Diego 11, Calif.

AIR FORCE
JULY 1959

WE NEED

A TRUE BALANCE OF DEFENSE



William C. Foster
FROM "ORBIS," A QUARTERLY JOURNAL OF WORLD AFFAIRS, PUBLISHED BY THE FOREIGN POLICY RESEARCH INSTITUTE OF THE UNIVERSITY OF PENNSYLVANIA

WHAT IS meant by "balance" in national interest and national security? There has been a tendency in the past to regard this problem primarily through a military lens; we have been prone to speak of balance as between armed forces, strategic airpower as against small mobile land units, submarine vs. carrier, or this as against that type of missile. Yet, the modern conflict in which we are unwilling participants is characterized by a multitude of phases and aspects of which shooting is only one. True, the buildup and maintenance of its military establishment is the most urgent task confronting the United States. Nevertheless, sight should not be lost of the fact that the contest may never be one of blast and heat, of searing metal and unseen rays. The present tests of strength, actively in progress, are political, psychological, technological, and economic more than military.

The success of the Communists in waging their brand of conflict has derived precisely from a broader strategic vision, from a conception of the struggle as an organic whole, the various components of which are kept in a constant and high state of coordination. At a given stage of the struggle, this or that segment of the conflict spectrum—be it political, economic, military, or technological—may emerge dominant. Communist conflict doctrine, however, does not admit to exclusive dependence upon any given method of struggle—or, for that matter, on any particular weapon system. In the balanced attack of revolutionary Communism, the means by which the struggle is waged are molded by the objective conditions of the struggle itself. As early as 1906, Lenin paraphrased this conflict doctrine as follows:

"Marxism asks that the various types of struggle be analyzed within their *historical* framework. To discuss conflict outside its historical and concrete setting is to misunderstand elementary dialectic materialism. At various junctures of the economic evolution, and depending upon changing political, national, cultural, social, and other conditions, different types of struggle may become important and even predominant. As a result of those [sociological] transformations, secondary and subordinate forms of action may change the significance. To try to answer positively or negatively the question of whether a certain tactic is usable, without at the same time studying the concrete conditions confronting a given movement at a precise point of its development, would mean a complete negation of Marxism."

The central question of our time, therefore, is how we can counter the balanced offensive of our opponent with a balanced defense of our own. In attempting to answer this question in the past, we have been all too prone to oscillate erratically between overconfidence and near despair. Five years ago—even two years ago—the warnings of those who cast doubt upon our over-all capacity to hold Communism

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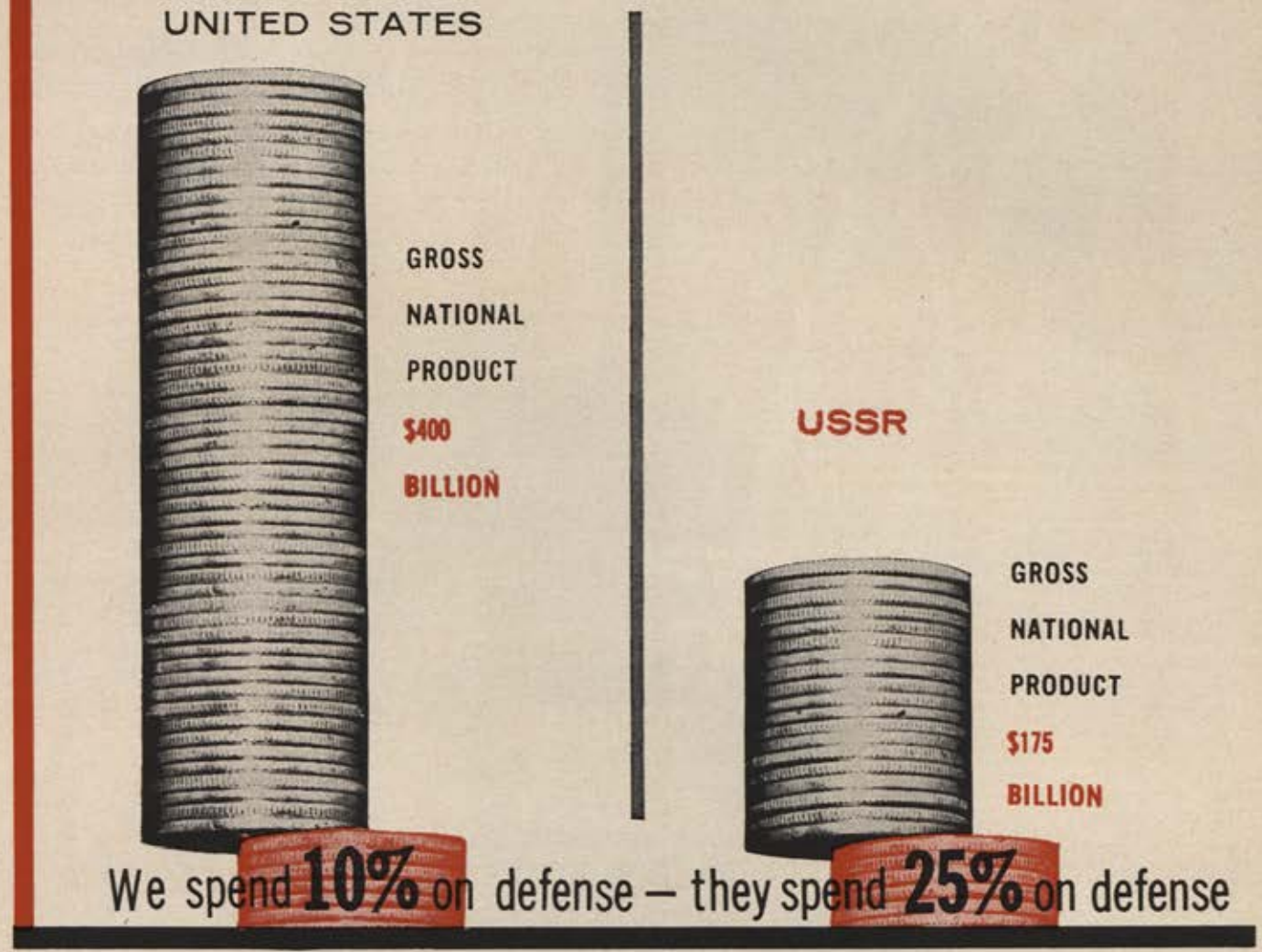
How We Can Put the Economic



A standard claim of the budget cutters is that the United States faces the danger of spending itself into bankruptcy financing an international military armaments race of indefinite duration. The author declares that, on the contrary, the US is actually in a position to drive Russia to the wall by stepping up arms expenditures. But this may not always be the case. These charts tell the story. The US and USSR spend roughly equal dollar totals on national defense. We do this with ease, expending only ten percent of our Gross National Product. Russia strains, devotes twenty-five percent of its GNP to arms. Comparative percentages, which reflect US industrial strength, could be a critical factor in the cold war.

WE NEED A TRUE BALANCE OF DEFENSE

at bay were invariably dismissed as the cries of irresponsible Cassandras. This was before Soviet victories in outer space swung the psychological pendulum to the other extreme. Today, one frequently hears the contention that free, pluralistic society lies helpless in the path of a totalitarian enemy who can ruthlessly bend his resources and energies toward the achievement of his objectives.

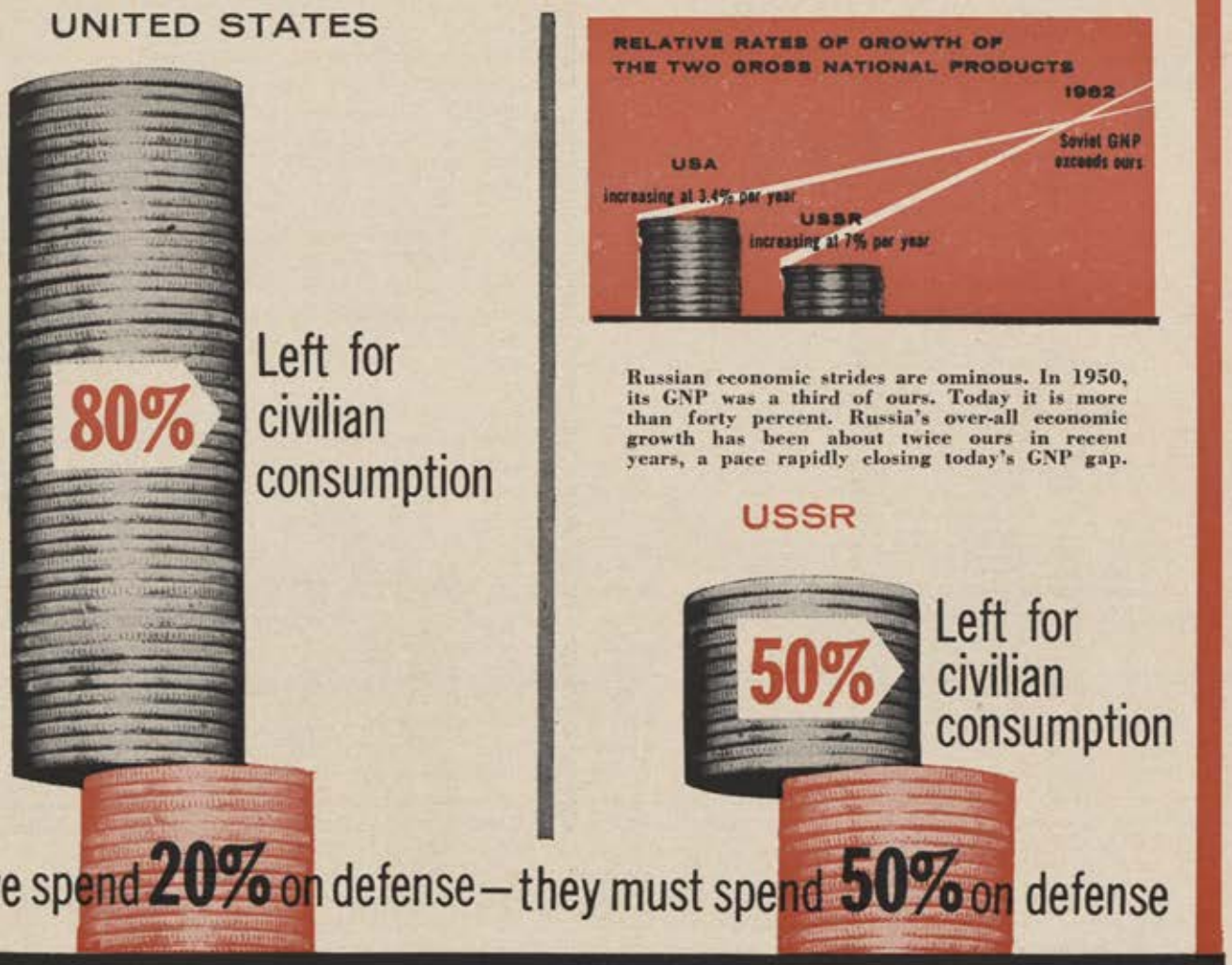
There is cause neither for complacency nor for despair; there *is* a pressing need for a sober assessment of the facts. Modern history affords ample proof that a democracy can be an infinitely superior organizational form in winning a life-and-death struggle. Advanced technology, modern logistics, machine warfare—these key factors of modern war were introduced by democratic societies, precisely because these societies made full provision for the utilization of the initiative of their most skillful and imaginative citizens. The opportunity of drawing on these millions of centers of initiative is something that the Soviet system does not possess. This probably is where our great strength lies.

Yet, it must be recognized, also, that strength does not spring automatically from a democratic way of life. To transform potential strength into actual, dynamic power requires labor and sacrifice, spurred and sustained by a sense of urgency and a firm will. It is perhaps in this area of intangibles that our balance has been lacking and that our greatest effort is required.

Our Potential

While they may be subject to varying interpretations, the basic long-range goals of this nation are clear. First and fundamental to our objectives, we want to preserve our own freedom. Second, we want to safeguard the freedom of other peoples. Third, we want to project the message of the free society to peoples now living in the darkness of oppression or in the dusk of social awakening.

Squeeze on the Soviets



Russian economic strides are ominous. In 1950, its GNP was a third of ours. Today it is more than forty percent. Russia's over-all economic growth has been about twice ours in recent years, a pace rapidly closing today's GNP gap.

The US could press its economic advantage with an increase in defense spending. For each added one percent we earmarked for defense, Russia would have to spend 2.5 percent more of her GNP to keep up. If we doubled our expenses for national defense, bringing the total of our GNP thus used to a still-comfortable twenty percent, Russia to keep pace would have to up the defense segment of her GNP to an impracticable fifty percent. Russia's already barren civilian economy would be forced to bare bone. Thus stepped-up defense spending would hurt Russia far more than the US. But a darker side of the picture exists. One part is underlined in rates of growth of US, Soviet Gross National Products *(see inset above)*.

CONTINUED

What should be the strategy aimed at achieving these long-range goals? For the foreseeable future, it must be to prevent the potential aggressor from winning the technological race. The Soviets must be barred from acquiring the capability to spring a devastating surprise attack on this country and from gaining the margin of strength to blackmail us. Beyond this, new nations must be given the hope that they can attain a better standard of living. Finally, our enemies must be convinced that we intend no aggressive action against them or any other nation, but that we will fight determinedly against any threat to our freedom.

The achievement of these objectives lies within our power. The basic asset of the United States is the vitality of its way of life and of its free institutions. Mesmerized by the dynamics of revolutionary communism, we tend only too often to underestimate the force of our own ideals. They have proven meaningful not only to Americans and to our kinsmen in the democracies of Western Europe, but to other peoples throughout the world, including those living in the shadow of Soviet oppression. The Hungarian revolt of 1956, tragic though its outcome was, proved conclusively that no man-made barrier, such as the Iron Curtain, can completely insulate the Soviet empire against the power of these ideals.

Economically, the massive industrial structure of the United States enables its people to enjoy the highest standard of living in history, even while they match the great military effort of an enemy who, in order to exert that effort, must deprive his people of all but a Spartan level of existence. The United States roughly matches the economic resources which the Soviet Union devotes to its military establishment—and does so at a cost of perhaps ten percent of the Gross National Product, while Moscow expends about twenty-five percent.

Present Soviet Gross National Product is estimated at

(Continued on following page)

the equivalent of more than $175 billion per year. When the last Russian tsar was dethroned, his country possessed the sixth largest Gross National Product in the world. Russia's GNP now ranks second to ours. In 1950, it was a third of ours; today it is more than forty percent. This means that, since 1950, the Soviet economy has been growing twice as fast as ours. To state it another way, the rate of its average annual growth has been about seven percent, with industrial production expanding about ten percent per year. Between 1950 and 1957, this over-all figure compares to a 3.4 percent annual economic growth in the United States over the corresponding period. This growth of ours may have shown a decline in 1958, and the new seven-year Soviet plan calls for an even sharper gain. Nevertheless, our Gross National Product is still very much larger than that of the Soviets. This gives us, if we are willing to use it intensively, a continuing massive advantage over Russia in the economic field.

We could press this advantage by enlarging our military expenditures in order to produce essential new weapons rapidly. Moscow, in order to match our increased output, would be forced to divert 2.5 percent more of the Russian Gross National Product to maintain the pace for each additional increase of one percent of ours. In other words, the Soviets would have to divert additional resources from an already barren civilian economy to match what would be a minor subtraction from our present standard of living. Thus, a stepped-up arms race would impose a far greater burden upon the Soviet economy than that which the US economy would assume. This, of course, should not be construed as a suggestion that appropriations be made for the sake of appropriations. Any additional allocation from our Gross National Product for military expenditures would have to be carefully weighed and applied for maximum effectiveness.

Regardless of our continued superiority, Russia's economic strides are ominous. Even more frightening, however, is Soviet progress in applied technology which is furthering Communist military goals. While we continue to hold superiority in the technological field, the current rates of Soviet advances portend real danger within the next two to five years. The Soviets clearly lead the United States in physical chemistry, polar geophysics, terrestrial geophysics, and atmospheric research. The military applications of each of these fields is obvious. By contrast, most of the sciences which are clearly dominated by the United States are concerned with disease, medicine and affiliated research, genetics, and other nonmilitary areas. But even here the Soviets are stepping up the pace. According to recent authoritative reports, for example, Moscow is training many more doctors and nurses than we are.

In many fields of science, we are regaining our balance and have begun to react to the Soviet challenge. Having shed much of our past complacency about the Soviet Union's scientific progress, we are beginning to take the measure of the serious lag in the American system of education. American political and educational leaders, and the public in general, are facing this problem in a manner which holds the promise of satisfactory results. While it is true that the USSR trains many more engineers and scientists each year than we, we continue to hold the decisive edge in the quality of training. Another of our great assets is the extremely high level of technological skill achieved by the workers who man our massive industrial establishment.

A cursory examination of the military field shows that we have the wherewithal to meet the external threat in many fields, but appear increasingly weak in others. We boast today the finest military establishment in our history. Yet the alertness and invulnerability of this military establishment to Soviet surprise attack is open to serious question. The deficiencies in our striking power vis-à-vis that of the Soviets need little elaboration. The United States, unless it matches or surpasses the Soviets in the missiles field, may forfeit the deterrent effect of its retaliatory strength and become an increasingly easy prey for Soviet nuclear blackmail.

The total outlook is by no means all black. Nor, on the other hand, is it reassuring. The United States, as the most industrialized nation on this earth, continues to dispose over formidable assets—resources and skills, however, which we have failed fully to mobilize in the struggle with Communism precisely because we have refused to recognize the struggle for what it is. While our society has devoted its major effort toward maximizing human happiness, the Soviet state has been organizing to win the world conflict. In order to demark those areas in which the most urgent remedial action is required, it may be useful to consider the change in relative positions of balance between the US and the USSR which has taken place since World War II.

The Military Balance

First, let us examine more thoroughly the balance in the military sector. Any assessment of Soviet strength produces few surprises for the highly trained civilian and military intelligence experts who for years have devoted full time to examining minute bits of information on the Soviet armed forces, gathered from thousands of sources. When these fragments are fitted into an over-all pattern, a frighteningly well balanced Soviet armaments program comes into focus.

After World War II, the US made a fundamental decision not to match the Soviets in sheer numbers of guns and troops, but to concentrate instead on technology. It is precisely in the light of these efforts that our present military imbalance is so disturbing. The Russian ground forces, for example, possess greater firepower per unit. They dispose over tactical atomic weapons and are organized and equipped to fight the same battles of wide dispersion and fast deployment as are the United States forces. They possess rockets with ranges of several hundred miles and are thus in a position to deliver nuclear warheads to targets far beyond the battlefield. Further, these weapons have the needed mobility to follow and support exploiting forces deep into enemy territory.

Almost across the board—in logistics, mobility, armor, and training—Russia's ground forces not only match ours technologically, but are superior in some respects, such as in armor and, possibly, tactical airlifts. Although US planes scored an impressive kill-ratio over the Russian MIGs in Korea, American planners were admittedly startled by the quality of the Russian aircraft. According to reliable information, Moscow's newer fighters and bombers are a much better match for our planes than they were in Korea. The Soviets have made numerous advances in jet and rocket engines for manned aircraft. They appear to be closer than we to nuclear propulsion flight.

On the sea, the United States leads Russia in antisubmarine warfare techniques, and our atomic-powered subs give us a solid advantage. But there is evidence that even this lead is shrinking. It is merely a matter of time before Russia will have nuclear subs, with all the tremendous advantages that they might give to an aggressor, and it is an open question whether US antisubmarine warfare capabilities will continue to keep pace with American submarine development.

The flexibility of the Soviet military machine derives

mainly from Soviet superiority in a decisive field, namely the ability of their defense chiefs to make faster decisions in many military matters, especially in the rejection of inferior weapon systems. One frequently hears the contention that this is an inherent advantage of a totalitarian system over a democracy. Nothing could be farther from the truth. Military and strategic decision making is a matter of organization—the kind of organization of which we are perfectly capable. There is no question that American organizational efforts have not kept pace with the complex requirements of the nuclear age. In World War I, choices had to be made from among perhaps thirty to fifty alternate types of weapons. In World War II, the range of alternatives increased to between 250 and 300 types of weapons. At the time of Korea, the number grew to about 500. Today, we are called upon to opt from between 1,200 and 1,500 weapon types. Given the cost and time of developing—and especially producing—any modern weapon systems, maximum effort must be made to discard as soon as possible those shown to be second-rate.

There is certainly little cause for optimism in this comparison of rival military technologies. There is less when straight numbers are compared. Soviet ground forces alone include two and one half million men, presumably organized into one hundred rifle and seventy-five armored-type divisions. The Russian system of universal military training produces about 700,000 fully trained reservists every year.

Lacking a large surface fleet, the Russians began building submarines at an unprecedented rate after World War II. Today they possess perhaps 500 active subs and, until recently, had been adding approximately seventy-five each year. Some of these subs are said to be capable of launching ballistic missiles at our largest cities from positions off our east and west coasts—a capability which poses one of the greatest threats to our survival in the event of total war. The Soviets have more than 20,000 combat aircraft, and Russian assembly lines have been turning out 10,000 new planes each year, most of them jets.

Against this array of Soviet strength, we have the following: approximately 2,750,000 men serve in the military and naval services of the United States, as against Russia's estimated 4,000,000 men, not counting satellite armies. We dispose over fifteen active army and three marine divisions, as against 175 for the Soviets. The Navy operates 901 active ships—the number of which is constantly being reduced—and the Air Force has about 20,000 active aircraft. Details of the strength of the United States forces beyond these figures are secret. The figures do not include the strength of our NATO allies.

There is another quasi-military front which has been sorely neglected, namely the protection of our civilian population against fallout in case of nuclear attack. Several responsible studies have concluded that top priority should be given to major fallout shelter programs—programs which will at least give those who live through the initial devastation of an H-bomb attack a chance for survival.

The logic supporting such projects seems overwhelming. Studies by research groups indicate that twenty-five to thirty million casualties can be expected from a large-scale nuclear attack, about one half of them resulting from fallout radiation injury after the initial onslaught. In other words, adequate numbers of proper shelters might save fifteen million lives. Certainly, no other defense measure promises equal life-saving potential at such a low per capita cost.

But there is another potential result from such shelter programs: They would impose a tremendous extra burden not on our resources but on Russian strategy. Shelters would mean that any Soviet missile or bomber attack would have to be perhaps double the force presently needed to paralyze the United States beyond recovery. Thus, such programs, more than merely a billion-dollar gamble against the day that the Soviet Union might attack, would act as a positive deterrent, much as do our missiles and Strategic Air Command bombers. Our leaders, instead of measuring the cost of civilian defense simply in terms of dollars and cents, might do well to assess the potential impact of an effective shelter program upon the over-all balance between the United States and Russian.

The Economic Balance

The Soviet Union, in the last three years, has committed $2 billion for economic development and military aid to countries in the non-Communist world. This is a relatively small effort when gauged by the large sums that the United States has put into similar programs. Yet, the Communists have obtained maximum effects for their expenditures. With cold calculation, they have directed their foreign aid into areas that may shift the future balance of power in their favor. More than ninety percent of Soviet assistance has gone to six key countries—Afghanistan, Egypt, Syria, India, Indonesia, and Yugoslavia. Russia has fashioned her aid and trade policies into a wedge which she is attempting to drive between the United States and many so-called uncommitted countries. Technical assistance once was one of America's unique methods for helping less advanced countries. Today, the Soviets have effectively twisted this concept to fit their own purposes. The very fact that Russia, not long ago itself a backward nation, can now extend technical assistance to less developed nations carries tremendous impact. These countries tend to be dazzled by Russia's record in breaking a short-cut to massive industrialization; they hope, consciously or not, that Moscow will somehow pass on this magic formula to them. What they fail to see or conveniently overlook is the price in living conditions which the Russian people have paid and continue to pay for Soviet industrial advances.

Whatever the reasons, Communist assistance is making strong headway in critical areas. Over 2,000 Communist bloc technicians are now at work in nine newly developing countries in which the United States has only half that many. But the difference does not lie in numbers alone. Soviet technicians make an ostentatious display of living on the same economic scale as the natives in the countries which they are assisting. Unlike their American competitors, they do not reside in sumptuous houses and apartments, nor do they engage servants. Invariably, they speak the language of the host country fluently.

This feigned humility obviously is designed to stimulate the belief that the Communists are truly interested in helping. It encourages the idea that the Soviets are close to the "masses," and, by establishing a marked contrast with the scale of living of American technicians abroad, enlarges the already ingrained belief of many countries that they can never hope to achieve the standard of living of the United States. The Soviet method points up the lesson that the Russian challenge cannot be solved by mere currency. Money alone cannot attract enough capable and responsible people who are willing to travel into the hinterlands of the world and work shoulder-to-shoulder with needy people. What is needed in our foreign aid program is something in the nature of a crusade. We

(Continued on following page)

need to enlist the services of many of our best citizens—from businessmen to teachers, to bank presidents, to doctors and electricians. We have referred before to the intangible weapons in the present conflict: a sense of urgency and a willingness to sacrifice. It is in this area of economic and technical assistance that these qualities must be—indeed, need be—applied promptly.

The United States is encountering, also, setbacks in another economic area in which we have long considered ourselves the unchallenged leaders, namely the ability to trade with other nations of the world. American salesmen traditionally have been among the best in the world. Yet, free-wheeling, fast-talking delegations from Russia and the Communist bloc are challenging this superiority. Communist "capitalists" are concluding agreements, exploring business opportunities, wining and dining prospective customers, and staging exhibitions at trade fairs throughout the non-Communist world. They try to make good Khrushchev's boast: "We declare war upon you in the peaceful field of trade. We will win over the United States."

Soviet salesmen, accountable only to the Kremlin and unfettered by the need to balance ruble losses with gains, have often been able to underbid our prices and interest rates and settle for easier repayment terms. Whatever their techniques, statistics show that Russia has climbed to sixth place in the world as a trader from her lowly position of sixteenth before the second world war. She now has trade agreements with at least thirty-one nations outside the Iron Curtain. In the past two years, Russia's trade with the West has forged rapidly ahead. In 1957 alone, seventy percent of the increase in the Communists' volume of trade with non-Communist nations was with Western Europe. Indicative of this trade offensive was a $750 million trade agreement concluded with West Germany in 1958.

In assessing the Soviet economic challenge, however, we must never lose sight of one central fact alluded to above: The stepped-up economic offensive of Moscow, like its military program, has been made possible only by the most ruthless allocation of Soviet resources. When we examine Soviet economic expansion in terms of how little it means to the Russians in human comforts, a serious weakness of Moscow's economic machine comes into focus.

Soviet per capita consumption is now about one fifth that of America. The Russian production of automobiles, refrigerators, and washing machines, for example, stands at only four percent of ours. A United Nations study reveals that city housing standards in the Soviet Union are the lowest in Europe. Russia's own official statistics show that the diet of the average Russian has improved little in the past forty years. While the agricultural establishment of the United States produces too much for Americans to consume—and does this with about one tenth of our nation's labor force—Soviet agriculture, employing half of Russia's total working force, turns out barely enough grains, potatoes, and cabbage . . . to sustain the Soviet population at a subsistence level.

There is no question that the Communist economic planners have, for some time, been walking precariously on a tightwire. They must calculate to a fine degree just how much the Russian people will endure without rebelling as did the East Germans in 1953 and the Poles and Hungarians in 1956. Stalin's heirs have openly acknowledged the need to give the Russian consumer a somewhat better life. They cannot long continue to turn a deaf ear to the demand of a growing number of scientists and technicians who have been promised cars, better homes, and more food. Thus, there is a hope—albeit not too bright a one—that a growing demand for consumer goods in Russia may force Communist leaders to reduce armament production and industrial expansion in order to make good on promises of an improved standard of living. The Soviets owe their greatly improved military position to the fact that they have been spending twenty-five percent of their Gross National Product for defense. But this rate of sacrifice has kept the Russian standard of living near the breaking point. We have it in our power to tighten the pinch on the Soviet economy by accelerating our own arms program.

The Prospects

The preceding sections have attempted to sketch in general terms our over-all balance vis-à-vis that of the Soviet Union. A balance sheet, drawn up as of today, presents a sobering picture. But any balance sheet is merely a reflection of an instant in time. We have omitted such intangibles as good will, worth billions in the achievable total of the efforts of free men. The balance sheet also contains those untapped developments which will grow out of a sense of urgency and massive effort. Four times in the last twenty years America has demonstrated its ability to spring into action when a great national need is recognized and made clear. This has been true at all levels of American national life. We did so in World War II; we did it again in 1947-48, when we rose to push back the Soviet political, economic, and military challenge in Greece and Western Europe. Finally, we rose to the occasion in 1950 when aggression struck in Korea.

Our enemy, however, cannot be expected to continue to present us with the kind of straightforward challenge which has galvanized us into action in the past. The Soviets have mastered the refinements of the indirect approach; while we keep a watchful eye on the main military front, the real attack may come around unguarded flanks. The main enemy in our midst is not a Communist fifth column but our own complacency. For too long now we have been the prisoners of illusions as to where we stand vis-à-vis the Russians. There is bland talk of "sacrifice," but even such obviously necessary things as foreign aid and reciprocal trade agreements are assailed and their purposes distorted by ignorance and apathy. Basically, our programs have been sound, but true balance has been lacking in crucial areas of our total defense.

While complacency is not justified, optimism can be. Our great inherent advantage is the presence of a massive industrial structure which can, if we choose, be geared to support a larger and more versatile military establishment than can all the industrial facilities of the USSR. We have huge reserves in both material and human resources. We have the largest industrial plant and the most productive labor force in the world. We can maintain a substantial military effort for many years—one greater than we have mustered for the last few years—and we can do so while still reserving a growing economic strength for other purposes.—END

The author, William C. Foster, is a vice president of Olin Mathieson Chemical Corp. He was chief US delegate to last year's Geneva conference on safeguards against surprise attack, and has been Deputy Defense Secretary and ECA Administrator. This article first appeared in Orbis *magazine and is reprinted with permission.*

Photostat machines, factory assembled, are protected and secured for safe shipment UNCRATED. Roy Williamson reports no major damage to any unit during four years of North American padded van service.

How Photostat Corporation solved a problem... by shipping UNCRATED in NORTH AMERICAN VAN LINES' PADDED VANS

According to Roy Williamson, Traffic Manager for the Photostat Corporation, Rochester, New York, their problem was to make fast and safe delivery of factory-assembled photocopying machines—ready for use upon arrival.

North American Van Lines had the answer: ship the assembled machines UNCRATED in special padded vans. Delivery is made directly into the office where it is to be used—and a local Photostat representative quickly makes the few simple adjustments required. As a result, the customer is happy with a machine ready for use—and there are savings in both time and labor.

If *you* have a shipping problem, it will pay you to get the first-hand facts about North American Van Lines' padded van service. Write or phone today.

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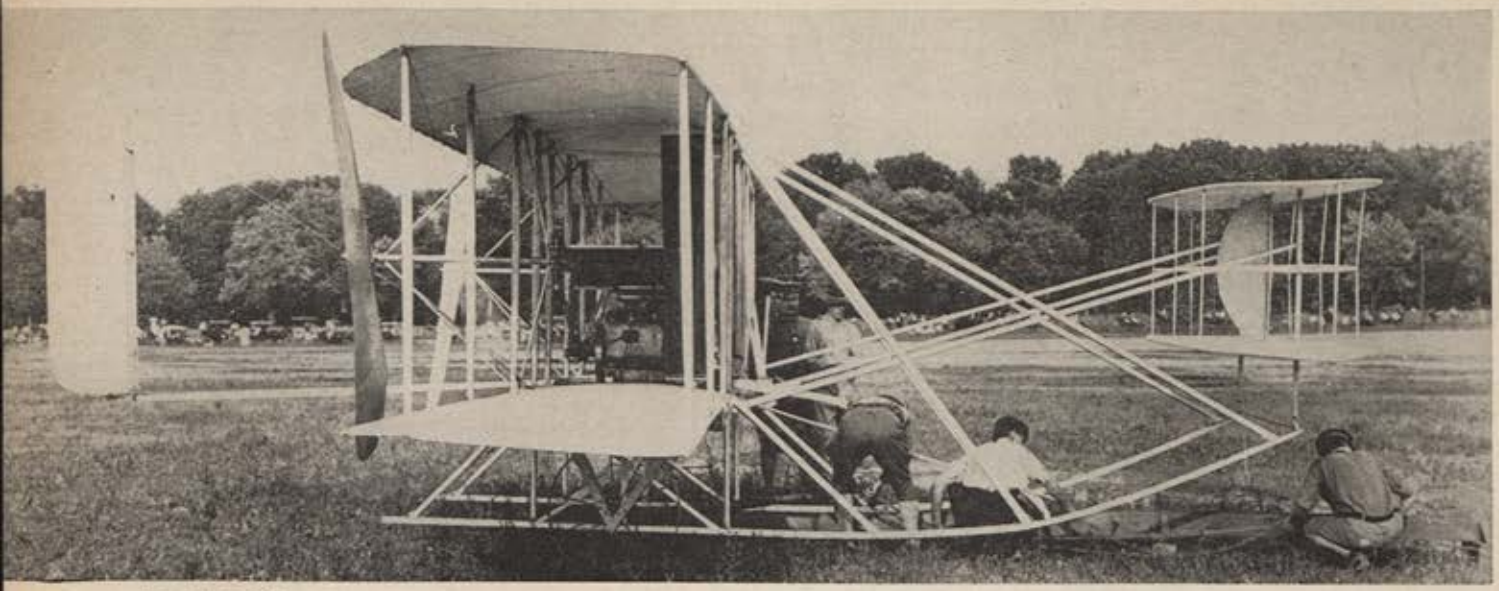


July 30, 1909: Wright brothers' mechanic Charles Taylor, Army ground crewmen ready Military Flyer for final test hop.

AT FORT MYER, JULY 1909 . . .

Brave Men and a Muslin Airplane

Frederic M. Philips
ASSOCIATE EDITOR

FIFTY years ago this month three brave men and a half ton of wood, muslin, and wire raised the curtain on military aviation.

The men were Orville Wright and two lieutenants in the United States Army, Benjamin D. Foulois and Frank P. Lahm. The materiel, along with a twenty-five-hp. engine, comprised the Wright Military Flyer—the world's first military "aeroplane."

A series of trial flights on a parade ground outside Washington, D. C., preceded Army acceptance of the plane, which was built under contract by the Wright brothers. History's first heavier-than-air, cross-country flight on July 30, 1909, provided both the final test and the climax of the preacceptance period.

The setting for this historic event, witnessed by some 7,000 spectators, has been painstakingly portrayed by the well known aviation artist John T. McCoy in a new painting entitled, "The Wright Brothers at Fort Myer, Virginia —July 30, 1909." The painting, scheduled to be presented to the Air Force Academy, has been chosen as the cover of AIR FORCE/SPACE DIGEST this month to mark the anniversary of the tests.

The Wright brothers' machine, with Orville Wright at the controls and Lieutenant Foulois flying as observer, more than met the day's challenge, a nonstop, round-trip flight between Fort Myer and a hill near Alexandria, Va. But there were some frightening moments.

After taking off to the accompaniment of loud cheering, the plane rose to the "record" altitude of some 400 feet and headed for the balloon-marked hill five miles distant. Everything went swimmingly until this halfway point, where Orville was supposed to turn and start for home.

But, for causes never completely made clear, he initially overflew the mark, then dipped low and banked particularly sharply on the turn. No sooner was the craft at even kilter once more than a downdraft dipped it precipitately.

The plane disappeared from sight behind a hillock, and the crowd at Fort Myer believed for the moment that there had been an accident. (There were no open fields available for emergency landing along the route.)

Then the aircraft reappeared and purred to a safe landing at the center of the field amid further cheering.

The entire flight took less than fifteen minutes. Average speed was recorded as 42½ miles an hour, exceeding the required figure of forty mph and earning the Wrights a $5,000 bonus. The Army had already agreed to pay $25,000 for the plane if accepted.

The plane had also achieved better than satisfactory performance three days earlier in its "endurance" test, the first of two formal trials required by the Army before completing the purchase. With Lieutenant Lahm as observer this time, Orville and his Military Flyer remained airborne for one hour, twelve minutes, forty seconds.

The specifications laid down had required that the plane be able to fly at forty mph, carry two persons, and remain in the air for an hour. The craft also was constructed so it could be readily disassembled, loaded in an Army cart, and reassembled again—another Army requirement.

Contemporary reports of the tests were exultant, in decided contrast to the strange absence of interest accorded earlier Wright flights, including the first at Kitty Hawk, N. C., six years earlier. Noting the plane's vast military potential, the Washington *Evening Star* announced impressively that the Army now had "Aeroplane No. 1, Heavier-than-air Division, United States Aerial Fleet." It was formally turned over to the service on August 2.

The plane, which looks to modern eyes like an intricate box kite with a small engine, was moved to nearby College Park, Md., then to Fort Sam Houston, Tex. It served

at both these fields as a trainer for the earliest Army flyers. Among these were Lieutenants Lahm and Foulois, both of whom are now retired generals. Lahm learned to fly at College Park. Foulois moved to Fort Sam Houston with the plane and won his wings there.

Foulois served as Chief of the Air Service in France in World War I and Chief of the Air Corps from 1931-35. Lahm was Assistant Chief of the Air Corps from 1926-30.

The Army had not, actually, moved any too quickly in acquiring its first plane. The Wrights had twice written to the War Department offering to develop a military model. Twice discouraging answers came back.

By 1907, when the newly formed Aeronautical Division of the Army Signal Corps opened bids for a plane, the Wrights had been negotiating abroad for some time. Flight pioneers other than the Wrights had also been working hard here and in Europe. In fact, five days before the final Fort Myer flight, the Frenchman Louis Bleriot flew a plane of his own design across the English Channel from Baraques, France, to Dover, England.

The Wrights moved quickly after signing a contract with the Army in 1907. They began trial flights at Fort Myer in September 1908. But on September 17 a fouled propeller put the plane out of control. Orville Wright, also at the controls on this occasion, was severely injured in the resulting crash. The Army observer, Lt. Thomas E. Selfridge, was killed in Army aviation's first fatal accident.

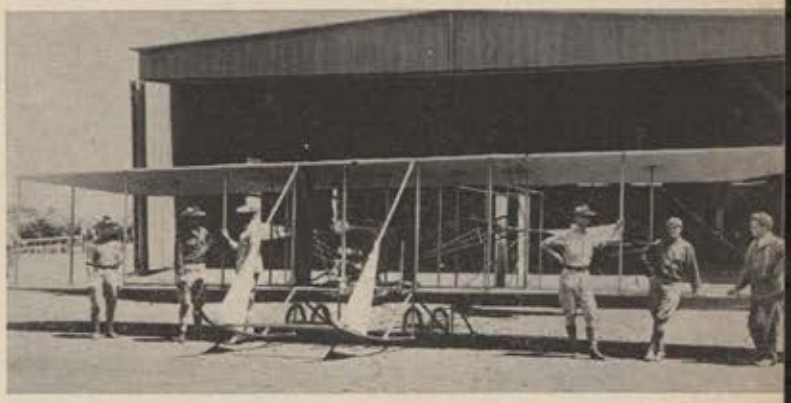
The following summer, now fifty years ago, the Wrights brought the plane, rebuilt and slightly altered, back to Fort Myer. This time it made the grade.

Its vital statistics, for the aviation antiquarian, were as follows according to Air Force records:

- Gross weight: 1,360 pounds.
- Wingspan: 36 feet, 6 inches.
- Length: 28 feet, 11 inches.
- Horsepower: 25 for the single engine powering two pusher-type propellers.
- Top speed: more than 40 miles per hour.

The plane was, in line with previous Wright designs, a canard type—its horizontal stabilizer elements were placed forward of the wing. Interestingly, this canard design has been revived half a century later in the plans for the B-70 exotic-fuel bomber.

Within eight years of the first military flight, at the time the United States entered the first world war, the Army had some 250 planes. European nations, which had by then been at war for some three years, had moved much farther ahead. And, within fifty years, the test sites were Cape Canaveral and Edwards and Vandenberg Air Force Bases rather than Fort Myer.



Foulois, second from right, crewmen stand in front of the infant Aero Division's next plane, the Wright Type B.

Artist McCoy's painting marking the fiftieth anniversary of that first plane has been executed with a careful eye for detail, so far as both the physical surroundings and the persons present are concerned. The Wright brothers and the two Army flying observers for the tests stand in a group in the foreground.

The figures represented are, left to right, Wilbur Wright holding the signal flag, Foulois, Lahm, and Orville Wright. Leaning against the plane are Charles Taylor, chief mechanic for the Wright brothers after their first years, and Carl H. Claudy, the photographer commissioned by the Signal Corps to take pictures of the tests.

The plane rests on a small truck that ran on a monorail used to catapult the plane into the air. Catapult power was provided by dropping a weight from a structure at the rear of the rail. The major building visible behind the parade ground was the Fort Myer base hospital.

"Aeroplane No. 1" can still be seen today on exhibit at the National Air Museum of the Smithsonian Institution in Washington, to which it was presented upon retirement from active service in 1911.

There, suspended from the ceiling among other history-making aircraft younger and older, it is a time-tattered reminder of the earliest beginnings of today's globe-girdling Air Force.—END

Artist John T. McCoy presents a print of his painting to Air Force Chief of Staff, Gen. Thomas D. White, right. McCoy, a Reserve lieutenant colonel and a rated pilot, has received wide recognition for his paintings of airplanes that made history. The Smithsonian's National Air Museum and several galleries have exhibited his work, and a number of his paintings are on permanent display in New York City's Wings Club. Life *Magazine has run a number of McCoy "picture essays" on flight history. McCoy was a key member of the group that produced the* Official Pictorial History of the AAF *during World War II. A limited number of color prints of the Fort Myer painting are available at $35 each through this magazine.*

Packing circuits to circle

the world

New Electronic Scanning radar antenna—Frescanar—developed by Hughes at Fullerton, positions beams in space by electronic rather than mechanical means.

Purity Plus—Hughes Products Division engineer checks semiconductor materials to insure purity.

"Project Cordwood" is a new Hughes Communications Division activity which has successfully produced low-cost, widely interchangeable circuit modules. (Note photo on left-hand page). These advanced modules are allied to Hughes automatic wire-wrapping techniques which result in more compact, more reliable equipment.

Other projects, such as the development of systems which deflect signals from meteors and artificial satellites, reflect the dynamic growth of Hughes in advanced communications. To stimulate even more progress this activity is now a separate major entity...the Hughes Communications Division.

Advanced work has already extended past the simple *transfer* of information to the *use* of information to supplement man's abilities where human resources are inadequate.

From basic theory through development and to the actual creation of working hardware, the systems approach is typical of all Hughes activities...which cover the spectrum of electronics progress: Airborne Electronics Systems, Space Vehicles, Plastics, Nuclear Electronics, Microwaves, Ballistic Missiles and many others.

In *every* Hughes activity you will find reliability is of prime importance. Hughes has delivered over $2 billion in electronics, systems and components...all built to assure maximum usefulness under even the most severe operating conditions.

Advanced concepts...reliable hardware, these are the factors which have made Hughes one of the world's largest producers of advanced electronics.

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HUGHES

HUGHES AIRCRAFT COMPANY, *Culver City, El Segundo, Fullerton and Los Angeles, California; Tucson, Arizona*

MISSILE LOGISTICS— A New for Choppers?

Flying crane helicopter has untold potentialities in the missile age. Above, Sikorsky S-60, only such crane now flying in Western World, in trial flight.

Claude Witze
SENIOR EDITOR

ABOUT six years ago an experienced military writer returned to his desk in the Pentagon news room after his first ride in a helicopter. He had ridden horses with the cavalry, tanks with armored units, and airplanes with paratroopers, all without blanching. His opinion of the whirlibird: "It's a fine machine. You just shouldn't carry *people* in it."

The particular helicopter he was talking about, still on active military service, had a high noise and vibration level, poor speed and payload characteristics, short component life, no all-weather capability, and operating costs that set a new high for flying machines. It created nightmares for the maintenance crews and spent more time in the overhaul and repair shops than it did on the line.

But the helicopter has stayed with us, sworn by and sworn at, because it can do things that no other vehicle can. It rendered distinguished service in the Korean War, limped into commercial passenger service on the crutch of a mail subsidy, and in some extraordinary cases—such as oil exploitation—proved economical as well as useful.

The helicopter appears today, in its fifteenth year of military production, ready to make new contributions to our defense posture. The manufacturers, some of whom now say they were overselling a few years ago, are convinced that the helicopter's juvenile delinquency days are at an end. They are able, in many cases, to demonstrate that 'copters now have a vastly improved capability.

The Air Force, which had practically abandoned the helicopter except for search and rescue, now is being tempted to cash in on substantial state-of-the-art advances that grew out of Army and Navy requirements. It is almost paradoxical that the new Air Force requirement may be a result of the operational needs of the most advanced USAF weapon system—the ballistic missile. The major contribution, most manufacturers seem to believe, will be made by the flying crane.

Helicopter appears today, in fifteenth year of military production, ready to make new contributions. It could prove invaluable in supplying remote strategic outposts, as above. Left, 'copter rises from central missile base serviced by C-133, hauls material to isolated missilemen.

"Whirlibird" could do some fancy hauling of "big bird" itself. Missiles, it is presumed, would have to be removed from launching sites periodically, returned to central depot for overhaul, replaced at sites. 'Copter with missile-carrying capsule would be ideal for purpose.

Helicopter is already demonstrating varied capabilities in numerous civilian projects such as oil exploitation, construction, laying power lines in rugged terrain. Here a Sikorsky S-58 helicopter plays major role in setting up transmission towers in California hills. Left, S-58 picks up hopper of cement at mixer miles from tower site. Center, 'copter carries hopper over mountains to building crews. Right, S-58 hovers, drops cement for tower footing.

Consider the dispersal of Minuteman launching sites to remote and inaccessible areas, all of which must be within a hundred miles of a central missile base or home depot. The sites may be miles from the nearest highway. To reach them by surface transportation means new and expensive roads must be built. Concealment will be impossible; sites will be opened to the threat of sabotage; and the choice of sites will be limited to areas where road construction is possible.

An analogy exists today in the oil industry, where remote drilling rigs are buried deep in the jungles of South America and New Guinea. They are operated profitably through helicopter logistics. Helicopters transport men and materials, carry massive equipment and the rigs themselves in slings, and help lay the pipelines to get the oil out of the jungle.

In the case of the missile sites it would be possible, according to industry experts, to construct the launching platforms, provide maintenance and operating personnel, and transport complete missiles to and from the launching spot—all with rotary-wing transports. It is presumed that the weapons will be removed periodically from their launching silos and returned to a central depot for overhaul. This could be done with a helicopter equipped with a missile-carrying capsule, able to lower the missile into the silo and likewise remove it.

There is the additional feature of mobility. Some concepts now on the drawing boards call for a wide variety of possible launching sites to make it possible to shift ready weapons from one spot to another according to tactical or strategic requirements. This program would add the qualities of easy camouflage and give the potential enemy a constant problem of trying to keep up with a shifting target.

The helicopter industry today realizes that this logistics concept for missile-launching sites has not been documented and that the burden of proof rests with the designers and manufacturers. USAF experts say they agree that the perfect rotary-wing carrier sounds like the answer to their problems but, so far, there has been no pudding for the eating. Past experience has also been a stumbling block for new proposals.

There are some signs that the Strategic Air Command is interested. It has, for example, stated a requirement for something under 100 new helicopters during the next three years for assignment to missile squadrons. They are needed to transport personnel from their home bases to missile-launching sites—three shifts a day will have to go back and forth—and provide transport for emergency maintenance and routine logistics.

Some of these helicopters must have a capacity of eighteen to twenty persons. Others will be smaller, with a capacity of six to eight. The bigger aircraft must operate, with payload, over a 200-mile radius and at altitudes of 4,000 to 7,000 feet on a hot day. Specifications are less rigid for smaller machines. Both requirements can be met with off-the-shelf turbine-powered helicopters now in production.

Further than this, SAC has been silent but it is watching developments with intense interest. Several manufacturers have design proposals on paper—one has a mockup—of new flying crane concepts that can serve in the Minuteman or other ballistic missile systems. Sikorsky Division of United Aircraft Corporation this spring started to demonstrate a twin-engine, piston-powered prototype designated the S-60. Capacity is six tons. Sikorsky spokesmen say it is technologically feasible to build a crane with a capacity up to fifty tons that can be operated over a radius of 100 miles at a speed of 100 knots.

The Sikorsky crane is the only one now flying in the Western World. Russia is known to have one with twice its lifting capacity. In the Sikorsky version the cockpit hangs on one end of the crane fuselage with 180-degree visibility. One pilot faces forward, the other to the rear. The latter controls the aircraft's winch and can operate it while flying the helicopter. The aircraft now is on a tour of military installations, demonstrating its capability. SAC headquarters, at Offutt AFB, Neb., is on the itinerary.

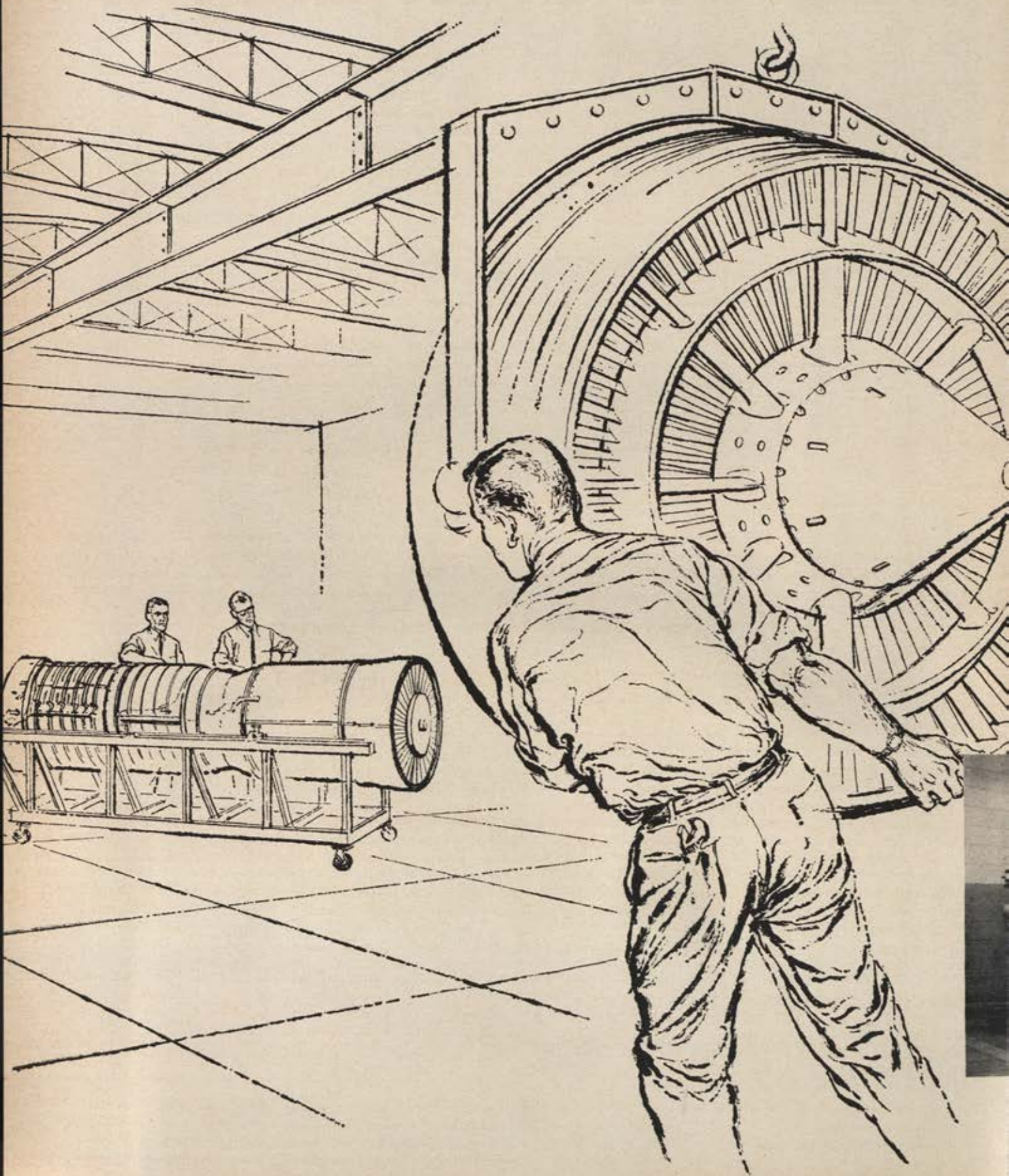
What has happened in the past few years to bring the helicopter to the seeming threshold of maturity? The primary answer is power. Early helicopters were powered by engines designed for fixed-wing airplanes and adapted to rotary wings. The gas turbine, on the other hand, is looked upon as an engine especially suited for helicopters. It has reduced the painfully high vibration level, cut noise, vastly improved the payload, and simplified structural problems.

In the case of one helicopter design, the following table shows the gain in payload that is realized with a shift to turbine from piston engines:

	PAYLOAD	
	Piston	**Turbine**
RANGE	R-2800	T-64
100 n. m.	6,900 lb.	18,500 lb.
200 n. m.	5,000 lb.	16,500 lb.

(Continued on page 48)

General Electric's AFT fan unit provides



DESIGN SIMPLICITY

By placing the fan unit *aft*, General Electric engineers produced a simple design for advanced turbofan engines. General Electric's turbofan is built around the same highly reliable, single rotor, variable-stator compressor gas generator design which has already been proven in thousands of hours of operational flying by the J79.

Aft of this basic gas generator, a single-stage turbine/fan combination is added. Addition of the fan assembly, which requires only two bearings, leaves the gas generator hardware unchanged and its operating characteristics unaffected.

Aft placement of the fan offers these important operating advantages:

- Lower fan blade tip speeds, with thoroughly proven low aspect ratio transonic blading
- Simplified thrust reversal—one reverser handles both fan and engine exhaust
- High resistance to foreign object damage—rugged single-stage fan blading has high impact strength, and its *aft* placement eliminates the possibility of fan damage causing main engine damage
- Intricate anti-icing system unnecessary—fan structure is warmed by exhaust gases
- Growth flexibility—fan and gas generator performance can be advanced independently

Turbofans offer greater fuel economy, bigger payload and longer range. The *aft* fan provides these advantages without compromising gas generator operating characteristics, and placing the fan *aft* yields the simplest possible mechanical design. For more information, write to Section 235-36, General Electric Co., Cincinnati 15, Ohio.

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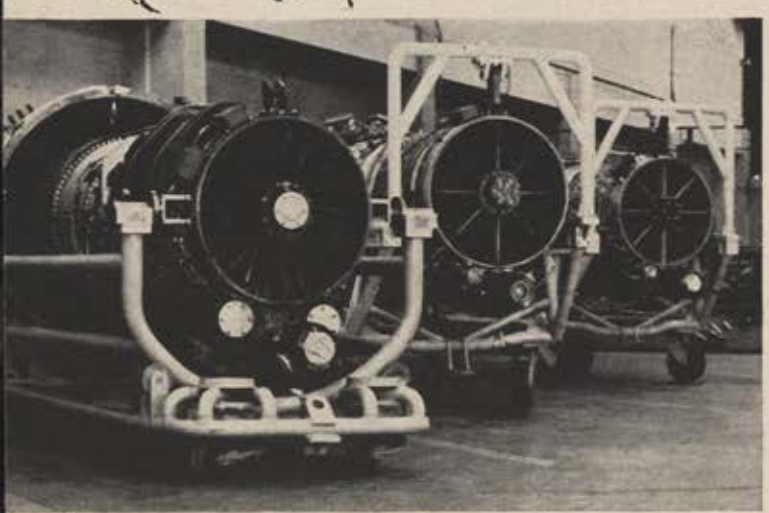
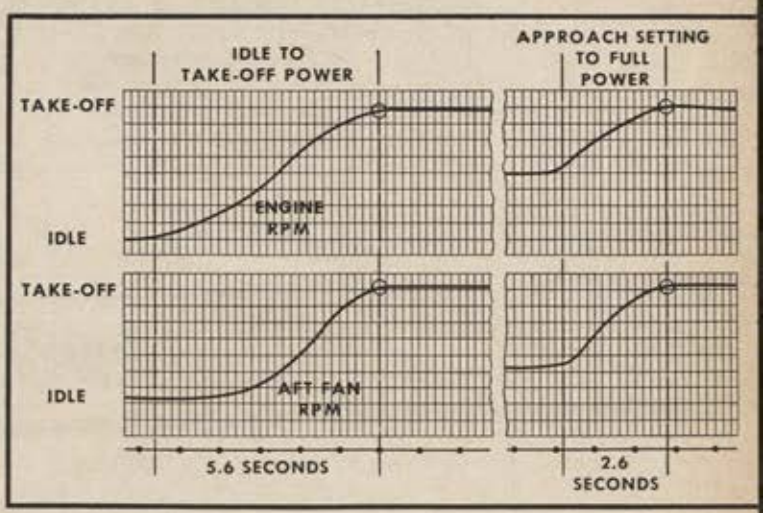


General Electric presents a line of simple, reliable turbofan engines that will deliver excellent, economical performance with low maintenance costs.



Tracing shows quick, stall-free throttle response of engine and fan during operation of a G-E aft fan engine. Aerodynamic coupling gives instant, positive, continuous control of fan speed, without mechanical connection between engine and fan rotors.

S-60 flying crane is on tour of military installations showing what it can do. Above, it hoists Army Honest John surface-to-surface rocket. Two pilots operate new S-60.

Here S-58 completes the transmission tower job it began by pouring cement for footings *(see page 45)*. Completed tower section is slung beneath the helicopter by cables. It will be carefully lowered on a fresh cement footing.

MISSILE LOGISTICS

CONTINUED

The second major improvement is concerned with all-weather capability and stability in flight. Most helicopters flying today are grounded at a slight suggestion of poor visibility or ice. The pilot must "fly" the aircraft every moment it is off the ground, working with both feet and both hands, and at times doing more than one thing with each hand.

The Navy's requirement for all-weather capability and stability in hovering for the antisubmarine warfare mission has led to vast advances in these areas. There are now in production helicopters capable of day or night flight under instrument conditions. This is made possible by radars which measure accurately both ground speed and altitude, automatic engine RPM controls, and an automatic "hover coupler." The latter uses radar to determine ground motion. It enables the pilot to place the helicopter on automatic control at two hundred feet altitude and eighty knots airspeed and automatically come to zero ground speed and hover at fifty feet altitude over a preselected spot. Automatic stabilization equipment also is being provided. This is an electronic device that relieves the pilot of much of his job and eliminates the constant adjustments needed on more conventional helicopters. It provides complete "hands-off" stability, holding the aircraft at the specified altitude and heading and preventing rolling and pitching. It differs from an automatic pilot in that it operates during manual flight, from takeoff to landing.

A third major development, and one that will appeal strongly to veteran military operators, is seen in the long list of structural improvements that will improve the economy and availability of rotary-wing aircraft. To begin with, component life of such delicate or hard-working parts as transmissions and rotor blades has been increased. Better durability brings greater reliability as a natural by-product and slashes the burden on the maintenance crews. It also cuts the spare parts requirement far below the level needed in the recent past. Blades no longer need to be replaced in balanced sets. They are now all metal, and single blades can be replaced in the field. Overhauls, once needed each four hundred hours, are now required only every 1,000 or 1,200 hours. The supply of spare parts, once a horror to every aircraft procurement officer and depot, can thus be reduced.

Not all of these features have been incorporated in all existing helicopters, but they are available. In the case of the Air Force, particularly for the SAC missile logistics mission, there remains considerable skepticism.

Against a background of poor experience with yesterday's rotary wings, USAF senior officers can point to a number of stumbling blocks. They need a system that is ready to go under any and all circumstances. "We need equipment," one officer said, "that's as fool-proof as the jeep." And he added: "Industry now says that they can do it, but they have to show us."

Missile launching sites, for example, may be located in cold, mountainous areas in the north. The terrain may be peaked and the only possible landing spot a clearing barely bigger than the helicopter itself. Finding this spot in zero visibility is tougher than finding the bigger area to drop a sonar device into the sea for an ASW mission.

How, for example, will a pilot find a pinpoint landing area at 7,000 feet, under a cloud and hampered by tricky winds? Clearly, some kind of electronic aid will be needed on the ground, and the airborne equipment must set a new record for helicopter reliability.

USAF friends of the helicopter, and there are many of them, feel strongly that a new research and development effort will be necessary. To get this, they feel, the industry must show that the new system, as compared with that of moving things over the ground, is reasonable, and this reasonable price must be tied to equipment with *unrestricted* capability.

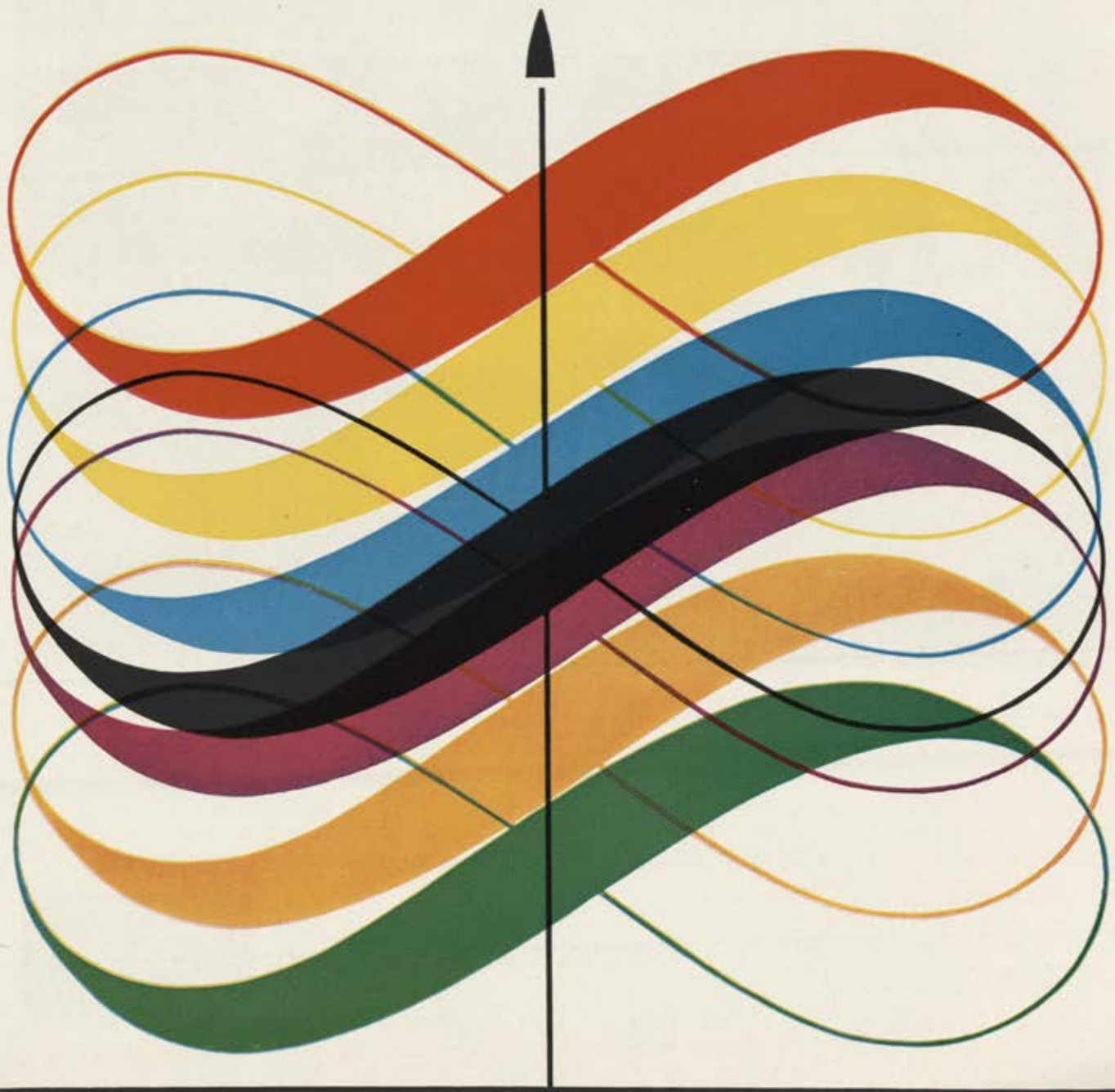
What does the industry say? It offers examples of how the helicopter is saving time and money—in operations such as the laying of power-line poles across rugged and forbidding terrain and exploitation of natural resources.

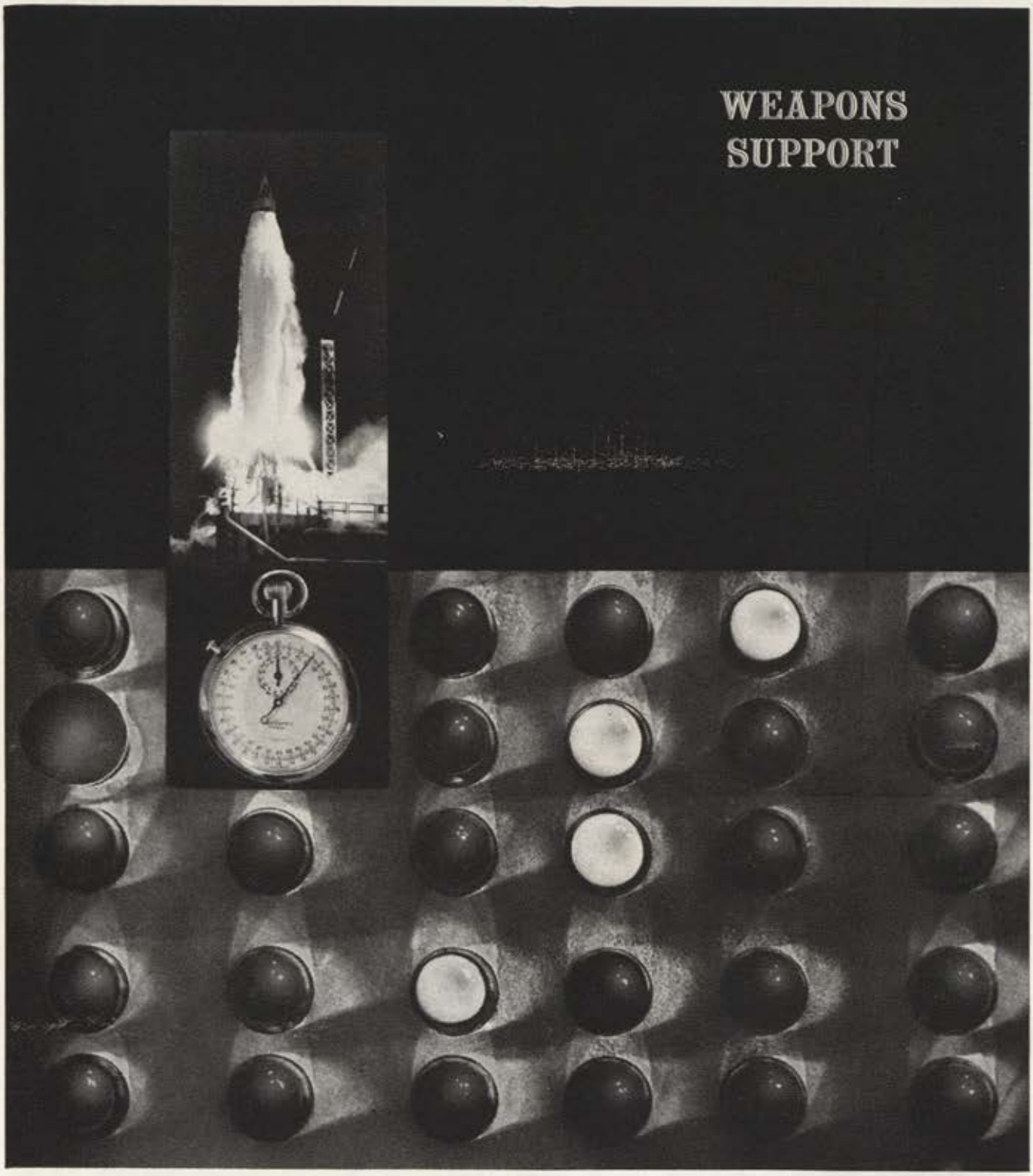
The similarity between power-line poles and ballistic missiles may seem remote, but in terms of logistic economy they are brought into close proximity. USAF must do its job as cheaply as possible and with maximum security. The helicopter may be headed for a new evaluation as a workhorse of the ballistic missile weapon system.—END

July • 1959

SPACE DIGEST

THE SPACE AGE IN PERSPECTIVE





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SPACE DIGEST

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From the Editors...

NOT LONG ago, a distinguished British scientist, A. C. B. Lovell, gave a series of important lectures on the present state of astronomy over the BBC. These lectures, now published by Harper & Brothers in a slim volume of few more than 100 pages, posed, in terms understandable to the layman, the vast question of the origin of our universe and suggested that, with the great new astronomical tools becoming available, we may well be on the verge of getting a definitive answer to that ultimate inquiry.

Professor Lovell, who is one of the world's leading radio-astronomers, says that one of the two dominant theories of cosmology now current may be proved. One of these suggests that time and space had a beginning in the expansion of a great "primeval atom." The other says that the stuff of the universe has always existed, that stars which die or disintegrate are replaced by new lumpings together of matter, that time always was and always will be.

Proof of either of these two basic theories, Professor Lovell says, could have tremendous impact on the basic religious beliefs of man, particularly Western man, whose culture is imbued with belief in a Creator. If science should demonstrate the second "no beginning" theory, he suggests that strong effects on present religious attitudes might develop. On the other hand, if the "primeval atom" theory were demonstrated, the idea of God would be greatly strengthened.

Heady stuff, and significant. We feel privileged this month to publish excerpts from Professor Lovell's important new book.

SPACE STORY
STAYS ON PAGE ONE

MEN, MONKEYS, AND MONEY

WILLIAM LEAVITT
Associate Editor

IN THE gentle days before Sputnik, newspaper readers could always expect page-one treatment of that interesting quartet of human activities: sex, sports, politics, and crime. To these four has now been added, by editors everywhere, space, probably because, aside from its intrinsic importance as a frontier, this newest human endeavor has elements of the first three activities mentioned above. We're happy to note that no correlation between *crime* and space is yet suggested, except perhaps in the minds of the most orthodox budget worshippers worrying themselves that the flood of funds going into astronautics these days is nothing more than a form of Soviet blackmail designed to break our American bank.

Able and Baker, the simian duo that came home safely from their ride in a Jupiter nose cone. Able, at left, died during surgery to remove equipment she carried during the flight. Baker is now retired.

Take sex. A significant biological experiment, or rather, two experiments, were performed during the recent successful Able and Baker monkey flight in the Jupiter nose cone. A set of vials, containing prefertilized sea urchin eggs, made the trip along with the monkeys. One experiment was designed to answer the question: Will normal gestation occur in the space environment under conditions of radiation bombardment, extreme vibration, and weightlessness? The eggs came home, still growing. Apparent success.

Even more intriguing was the collateral experiment. Ingeniously, another set of sea urchin eggs was triggered to unite with male sperm. This effort was designed to answer the question: Can normal mating processes occur during spaceflight? Unfortunately, according to the Army biologists who planned the experiment, either metal used in the triggering device or, possibly, vibration disintegrated the to-be-fertilized eggs. But it is a good guess the experiment will be tried again.

Or take politics. Able, the little rhesus monkey that died, ironically, from the effects of anesthesia on the operating table, some days after she returned safely from her ride in the Jupiter nose cone, was carefully billed as an *American-born* simian. Why? For reasons that are entirely their own business, a large segment of the population of India is very sensitive about the use of Indian-born rhesuses for experimental purposes. This has been a touchy issue for the State Department, and to provide a domestic source for the monkeys against the day the Indians give us a flat "no" on more rhesuses, we are now breeding them here. Survivor Baker, also a female, is a South American-born squirrel monkey.

On this point, no one seems to care about mice. The four mice who rode along in the unsuccessful Discoverer III recovery-from-orbit attempt made their really quite important sacrifice with only mild public attention. It's hard to think about a mouse as much more than a mouse.

Sports, in astronautical terms, are getting solid news attention these days too. Second only to the public interest in the family status of the seven Mercury Astronauts is its fascination with the "perfect specimen" status, as revealed by the screening tests, of the seven-man team. The Astronaut picture that got the widest currency in recent

weeks was the shot of the seven splashing in a Navy swimming pool. Doubtless, the newspaper reader who follows the Astronaut story cannot help but admire the tremendous combination of courage and confidence that motivates these seven remarkable men.

The concurrent USAF-NASA X-15 program also has great overtones of daring (the sort we all secretly wish colored our own lives). What manner of men are people like North American Aviation's Scott Crossfield who make a day-to-day job of such operations. Crossfield, an articulate gentleman with a keen sense of humor, is reported to have remarked that he doubted if his wife had known he was about to make the first free flight in the X-15 in early June. It was just another day at the "office."

That flight, an unpowered five-minute glide to the ground from seven miles up over the Mojave Desert in California, after the cigar-shaped black craft was released from a B-52 mother ship, was a giant step in the aerospace craft's progress. What is thought or said in admiration of Crossfield certainly applies to men like USAF's Capt. Robert White, expected to make the first go-for-broke flight beyond the aerodynamically navigable atmosphere and home through the hazardous hot reentry phase.

Space, as a new dimension of politics, is, of course, by now an old story. But probably not too many people have the time or the inclination to read definitive works on the subject. One such opus is the recently released report of the Senate Subcommittee on Governmental Organization for Space Activities. This 762-page tome, fraught with senator-witness dialogue featuring a parade of Air Force, Army, Navy, Defense Department, and National Aeronautics and Space Administration people, is really worth reading for an insight into the strange corridors of science, the military, and the government. That everyone is busy on space projects emerges clearly from the hearings. That no one has yet reduced the broad phrase "space programs" to the desired singular "space program" also is clear.

The increasing sums now being budgeted for space projects must be unnerving to people who equate home economics with the affairs of a great nation beset by steady challenge. There are probably more than a few people in Washington, and across the country, who wish the Russians would just go away, so that we could stop spending so many dollars on rockets.

But there is no turning back, nor should there be. In testimony to Congress earlier this year, T. Keith Glennan, NASA administrator, warned that space planning budgets would in the near future begin to cross over into the billions. The advance in that direction has already been underscored by the passage in Congress of the approximately $485 million FY '60 NASA budget. That figure is considerably larger than the NASA FY '59 budget, which amounted to approximately $333 million.

Wide World Photos, Inc.

X-15 aerospace vehicle sweeps in over Mojave Desert at Edwards AFB, Calif., before landing after its first free-glide flight early last month. This successful flight set the stage for the X-15 test series.

Of the $485 million, some $333 million are listed by NASA as earmarked for research and development. In some ways, perhaps, we should be thankful for the Russians; they have pushed us onto a road they would really like to travel alone to dazzle the world all by themselves.

Still hobbled as it is by a hesitancy on the highest levels to oversee its progress and plan its execution, the space effort in our country has become a daily part of our lives—"page one" because it deserves to be, not only for its "human interest" but also because it is the chronicle of our attempt to meet an uncertain future.

• • •

And, of course, with the young heat of summer came the first large-scale shipment of mail by missile—the successful delivery of 3,000 letters via the Navy Regulus, ship to shore. The obvious but still pointed question everybody asked as the item made page one: Now, if someone could only figure out how to get the mail across town in less than two days.—END

Are we on the verge of answering the ultimate question about our universe?

When Did Time Begin? ... Or Did It?

A. C. B. LOVELL
From the book, *The Individual and the Universe*

CAN WE formulate a theory in terms of known physical laws whose predictions agree so well with the present observable universe that we can predict the past and future?

Indeed, when we turn to the cosmological theories which are today seriously considered by astronomers we find a most absorbing state of affairs. Not one, but several theories can explain from acceptable postulates the present observable state of the universe. These predictions bring us face to face with the ultimate problem of the origin of the universe in ways which are startlingly different. . . .

First of all, though, I want to discuss the cosmological theories which are generally classed as the evolutionary models of the universe. I think it would be correct to say that these theories, which are a consequence of Einstein's general theory of relativity, are regarded with the most favor by the majority of contemporary astronomers. . . .

Some years after the introduction of these ideas the whole situation was altered in dramatic fashion by the discovery that the universe was nonstatic but was expanding. At about the same time the Russian mathematician, Friedman, found other solutions of Einstein's equations which predicted either an expanding or contracting universe. In fact, now it has for long been realized that the equations of general relativity cannot define an unique universe because there are three unknowns in the equations, whereas observationally we have only two sets of data. The possible types of nonstatic universes fall into three main families determined by the various possible combinations of the sign of the cosmical constant and the space curvature. These are: a universe which starts from a point origin at a finite time in the past and expands continuously to become infinitely large after an infinite time; a universe whose radius has a certain finite value at the initial moment of time, and thence expands to become infinite after an infinite time; and lastly a universe which expands from zero radius to a certain maximum and then collapses to zero again, this process of oscillation being capable of indefinite repetition. Within each of these three main categories a large number of possible models can be constructed differing in various points of detail. . . .

All that I propose to do here is to give some examples of these evolutionary models, one of which is today believed by many cosmologists to describe the past history with some degree of certainty. The first example is a solution discovered by the Abbe Lemaitre in 1927 and developed by Eddington. . . . By introducing [what was called] the "cosmical constant," Einstein was able to specify a static condition of the universe in which the Newtonian attraction and cosmical repulsion are in exact balance. However, this equilibrium is unstable. If something upsets the balance so that the attraction is weakened, then cosmical repulsion has the upper hand and an expansion begins. As the material of the universe separates, the distance between the bodies becomes greater, the attraction still further weakens, the cosmical repulsion ever increases, and the expansion becomes faster. On the other hand, if the equilibrium was upset in the other way so that the forces of attraction became superior, then the reverse would occur and the system would contract continuously. Eddington's view was that in the initial stage the universe consisted of a uniform distribution of protons and electrons, by our standards very diffuse. This proton-electron gas comprised the entire primeval universe, which would have had a radius of about a thousand million light years. At some stage an event or series of events must have occurred in this diffuse gas which determined that the universe was launched on a career of expansion and not contraction. There were many views as to how this might have happened. Eddington held that the accumulation of irregularities in the gas started the evolutionary tendency. Soon, condensations formed in the gas and those ultimately became

Small corner of vast universe, great nebula in Orion. Radio astronomy may soon reveal genesis of stars.

the galaxies of stars. On these views the present radius of the universe must be about five times that of the initial static primeval universe.

In the light of modern knowledge this theory receives little support. The time scale of its evolution is too short, and one cannot find a compelling reason why the primeval gas should have been disturbed in such a way as to determine that the universe was launched on a career of expansion rather than contraction. . . .

Although Eddington remained faithful to this idea that the universe evolved from the static but unstable Einsteinian universe, the conception was soon abandoned by Lemaitre himself. For the past twenty-five years Lemaitre's name has been associated with another model whose origin recedes even farther back in time than the static Einstein state. . . .

Perhaps we can most easily visualize this conception by taking the universe as we see it now and inquiring quite simply what might have been the situation long ago. The observations of the distant galaxies show that their light and radio emission is shifted in wave length so that, as received on the earth, the light is redder and the radio waves longer in wave length than those which are actually emitted. The interpretation of this shift is that we are separating from the galaxies at a very high speed, and that the speed of recession increases as we move out into space. At the limits of present-day observation the speed of recession is about thirty-seven thousand miles per second, which is a fifth of the velocity of light. The observation which gives us this figure is of a cluster of galaxies in Hydra photographed in the two-hundred-inch telescope. . . .

We are now seeing [the Hydra cluster] as it was two thousand million years ago moving away at a rate of thirty-seven thousand miles a second. What is the likely past history of this and all other similar galaxies? Up to a point this question is not too difficult to answer. For example, a minute ago we were two million miles closer to this cluster than we are now. A year ago we were over a billion miles closer. If we recede back into history in this manner we realize that the galaxies such as Hydra which are now almost beyond our view must have been very much closer to us in the remote past. In fact, if we proceed in this way, then we reach a time of about eight or nine thousand million years ago when all the galaxies must have been very close together indeed. Of course, the galaxies themselves have evolved during this time, but the primeval material from which they were formed must have existed in a space which is very small compared with the universe today.

With important reservations which I shall deal with now, this in essence is the fundamental concept of Lemaitre's theory; namely, that the universe originated from a dense and small conglomerate which Lemaitre calls the primeval atom. . . . It is in fact necessary to emphasize that the theory does not demand the formation of the galaxies in the first phase of the expansion. The primeval atom contained the entire material of the universe, and its density must have been inconceivably high —at least a hundred million tons per cubic centimeter. The initial momentum of the expansion dispersed this material, and after thousands of millions of years the conditions applicable to the so-called Einsteinian universe would have been reached. Then the size of the universe was about a thousand million light years, and the density would have been comparable to that with which we are familiar on earth. According to Lemaitre, at this stage the initial impetus of the expansion was nearly exhausted and the universe began to settle down into the nearly static condition which we have previously considered, where the forces of gravitational attraction and cosmical repulsion were in balance. The mathematical treatment indicates that the universe must have stayed for a long time in this condition. It is during this phase that the great clusters of galaxies began to form from the primeval material. Then the conditions of near equilibrium were again upset, the forces of cosmical repulsion began to win over those of gravitational attraction, and the universe was launched on the career of expansion which after nine thousand million years brought it to the state which we witness today. . . .

The processes of the formation and evolution of the galaxies from this early stage are the subject of very detailed mathematical treatment. There is, at present, every reason to believe that a satisfactory explanation of the evolution of the universe from that condition can be given in terms of the known laws of physics. But when we pass on to consider the even earlier stages, difficulties and uncertainties appear. How much farther do we have to go back in time to the condition of the primeval atom? The theory does not determine this with any precision, because the delay which the universe suffered during the equilibrium phase when the gaseous clouds were forming into galaxies cannot be specified. One can, however, say this—that the explosion or disintegration of the primeval atom must have occurred between twenty thousand million and sixty thousand million years ago. In other words the period of about

nine thousand million years ago, when the galaxies began to form and the present period of expansion began, represents a comparatively recent phase in the history of the universe. . . .

But when we inquire what the primeval atom was like, how it disintegrated, and by what means and at what time it was created, we begin to cross the boundaries of physics into the realms of philosophy and theology. . . .

If, indeed, the universe began in this way, then the concepts of space and time with which we deal originated at some moment between twenty thousand million and sixty thousand million years ago. Time, in the sense of being measured by any clock, did not exist before that moment, and space, in the sense of being measured by any yardstick, was contained entirely within the primeval atom. . . .

In the light of our present knowledge of atomic physics it is possible only to surmise the kind of condition which might have existed at the time of the primeval atom. I suggested earlier that the density of matter in this primeval atom was inconceivably high. . . . However, it is possible that the primeval atom was not like this, but that it consisted of intense radiation and corpuscular rays which formed the primeval gas during the first phases of the expansion. In fact, it is a fundamental concept of Lemaitre's theory that the cosmic radiation which we observe today is a relic of this early state. . . .

An alternative picture of the condition of the primeval atom has been given by Gamov, who believes that it consisted entirely of high-temperature thermal radiation. . . . On this theory of Gamov all the chemical elements which we deal with today must have been formed within the first thirty minutes of the life of the universe.

Gamov differs from Lemaitre in other important respects. In Lemaitre's theory the force of the initial disintegration was exhausted after a few thousand million years, and the expansion which we witness today came into play only as a result of the forces of cosmical repulsion which developed when the galaxies began to form. In Gamov's theory the force of the initial explosion was so great that the expansion of the universe is attained without invoking the force of cosmical repulsion. In other words, the beginning in the Gamov theory is close to the nine thousand million years which we deduce by tracing back the history of the galaxies, and there is no protracted period in the state of diffuse gas with all the major forces balanced as in Lemaitre's theory.

The most distinguished living exponent of the evolutionary theory of the origin of the universe is himself in Holy Orders. For him and for all who associate their universe with God, the creation of the primeval atom was a divine act outside the limits of scientific knowledge and indeed of scientific investigation. . . .

On the contrary, those who reject God adopt a strictly materialistic attitude to the problem of the creation of the primeval atom. They would argue that the creation of the primeval material has no explanation within the framework of contemporary scientific knowledge, but would escape from the dilemma by reserving the possibility that science will, if given the opportunity of studying these initial conditions, find a satisfactory solution. Or they would evade the problem of a beginning altogether by following a further line of thought due to Gamov that the primeval atom was not the beginning, but merely a state of maximum contraction of a universe which had previously existed for an eternity of time.

The theory which we have discussed envisages a once-for-all creation in the remote past followed by a steady evolution to the present conditions. The alternative to this theory is that the creation of matter is taking place continuously and that, although stars and galaxies evolve from this basic material, the universe, when considered as a large-scale structure, is in a steady state. We can illustrate this view by considering the future history of the galaxies which are now near the limit of observation. We are receding at great speed from these galaxies. In a billion years' time the galaxies will have passed forever from our field of view and other galaxies which are now closer to us will have moved out to our observable horizon. So much is common ground in both the evolutionary and steady-state theories. The sharp distinction arises when we compare the picture of the universe within the observable horizon now and in a billion years' time. On the evolutionary theory more and more galaxies move out of our field of view, and the number of galaxies which we can see with our instruments will forever decrease. In other words, the average spatial density of the universe is decreasing. On the steady-state theory this is not the case. Although individual galaxies recede beyond the observable horizon, others are always being created to take their place. In a billion years' time the universe will look to us very much as it does now. The individual galaxies will have changed, but their average spatial density remains the same, because matter is always in creation throughout all of space. . . .

The implications of this point of view are, of

course, profound. For example, there cannot have been a beginning in any scale of time at all. If we trace back in time the history of the galaxies, [we find] they dissolve into gas and then into uncreated matter as they move in toward us, whereas others come into view from beyond the observable horizon. . . . Indeed, however far we go back in time, there is no stage at which we can say that the universe, as a whole, had a beginning. . . . In the same way that a billion years ago the universe would look the same as it does now, so in a billion years of future existence the over-all large-scale picture will be unchanged.

The future in the evolutionary models is quite different. The total content of matter was fixed once and for all at the time of creation. The expansion is thinning out the galaxies, and in a billion years our view of space would indeed be vastly different from what it is today. In some variations of the evolutionary theory the process of expansion is expected to reverse when the spatial density has fallen to a certain value, and then the contraction of space would bring the aging galaxies into view again. But even in such variations . . . the ultimate death of the universe seems inescapable, because the energy with which the universe was imbued at its creation is relentlessly becoming less available. . . .

The conflict between the steady-state and evolutionary theories is of the very greatest significance to cosmology and to human thought. The evolutionary theory places the creation of matter at a definite moment in the remote past, beyond human investigation. Although the steady-state theory has no solution to the problem of the creation of matter, it is important to appreciate that, if this theory is correct, then the primeval gas is being created now, at this moment, and hence is open to human investigation. . . .

It seems possible that we may be on the verge of settling by experimental observation which of these two principles is correct. . . . For example, if with our telescopes we could penetrate so far into space that we could see a cluster of galaxies from which the light had taken nine thousand million years to reach us, then it would be possible to reach a clear decision. For at that time in the past on the evolutionary theory the clusters of galaxies were only just beginning to form from the primeval gas. Well, of course, such a straightforward observation is impossible because of the limited range of our telescopes. . . .

It is, however, on the verge of the regions of space and time where the universe would be expected to be significantly different if creation was still in progress compared with the conditions in an evolutionary universe. If time and space had a beginning, then when the universe was only a few thousand million years old it would be much more compact than it is today. The galaxies would be in existence, but they would be packed closer together compared with their spatial density today. The spatial density today—by which I mean the number of galaxies within, say, fifty or a hundred million light years of the Milky Way—can be determined by the large telescopes. If we could count the number in a similar volume of space at a distance of several thousand million light years, we should in effect be making a count of the galaxies as they existed several thousand million years ago. If creation is still taking place, then in the steady-state theories this number should be the same as today. If the evolutionary model is correct, then the spatial density at this distance in time and space will be much greater. . . .

It may well be that only when optical telescopes can be carried in earth satellites or erected on the moon will it be possible to look back into the past to this extent. Before the advent of such futuristic enterprises it seems likely that the great radio telescopes will give us the answer we require. . . .

The concept of continuous creation also presents us with another opportunity to make an even more direct and decisive test. If the theory is correct, then the hydrogen gas which forms the primeval material of the galaxies must be in creation at a considerable rate. . . . The presence of this hydrogen in intergalactic space may well be detectable in the near future by the radio telescopes.

As individuals we must therefore face the possibility that within the next few years astronomers may be able to speak with unanimity about the ultimate cosmological problem. Only the materialist can turn aside unmoved by this prospect. For others, a settlement of this cosmological issue might mean an affirmation or rejection of deeply embedded philosophical and theological beliefs. —END

A. C. B. Lovell is Professor of Radio Astronomy at England's University of Manchester, and Director of the Jodrell Bank Experimental Station, famed for its observatory's space tracking achievements. The above article is excerpted with permission from the book The Individual and the Universe.

THE US ARMY

THE US Army, on January 31, 1958, staked its claim in and capabilities for the space age with the successful launching of the first American satellite, Explorer I. That feat was followed by others, notably the Pioneer IV probe now in solar orbit, and the recent safe return of monkeys Able and Baker from a ballistic trajectory flight in the nose cone of a Jupiter missile.

Today the Army is still in the missile and space business, sharing billing with the Air Force, and to a lesser degree the Navy.

On the weaponry side, it runs its own show, performing the research and development and prototype construction of the family of Army missiles that range from the antitank Dart to the Redstone and Jupiter IRBMs, plus the now-under-development Pershing solid-fuel IRBM. For FY 1960, some $695 million of expenditures for missiles are scheduled by the Army. That sum is larger than the Navy figure by approximately $129 million, and it amounts to just under one-quarter of the Air Force figure, which exceeds $2½ billion.

Space experiments per se—of a scientific nature or for "far out" military applications—are, on the other hand, not funded directly by the Army. Rather, they are assigned by the country's two space agencies, the National Aeronautics and Space Administration on the civilian side and the Advanced Research Projects Agency in the Department of Defense. Hence, it is accurate to say that for space projects, as separated from missiles, not a penny is budgeted by the Army. This is true in the other services also. Under today's ground rules, NASA or ARPA calls the shots and assigns the funds to the services for "pure" space efforts.

To perform the double mission of developing military missiles and filling NASA and ARPA orders and assignments, the Army has developed an organization designed to suit its philosophy of the Army role in the new age.

Army space effort is centered in Ordnance Missile Command headed by Maj. Gen. John B. Medaris, left.

That philosophy, expressed often by top Army officers, amounts to the conviction that space is a new dimension which can aid the Army in its ground operations on this planet and transport its troops to other planets to take and hold ground, if the day and need arises.

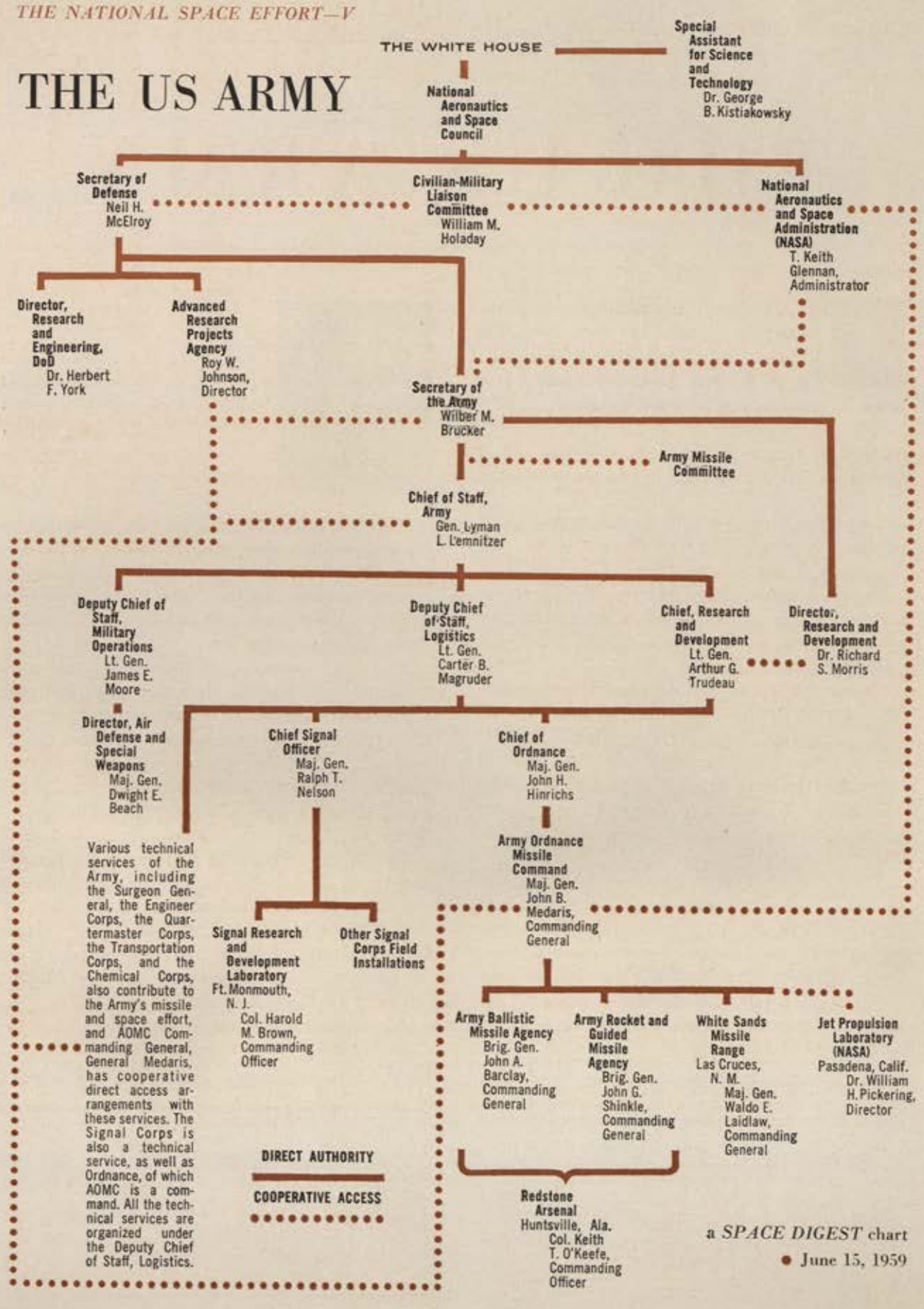
The Army's missile and space efforts are concentrated in two areas, Ordnance and the Signal Corps, with other technical services feeding in special capabilities as needed. The lion's share of the total effort is concentrated in the Army Ordnance Missile Command, commanded by Maj. Gen. John B. Medaris and headquartered at Huntsville, Ala.

Once-sleepy Huntsville is the Army's missile and space capital, the heart of the complex. As the accompanying chart shows, regular lines of authority run from Washington to Huntsville and General Medaris. More significantly—special lines of direct and cooperative access run from Huntsville and the General to Washington.

As kingpin of the Army's missile-space effort, General Medaris is somewhat analogous to the Air Force's Ballistic Missile Division Commander,

This is the fifth in SPACE DIGEST's *series on the National Space Effort. Next month the role of the US Navy will be described, and in September the Air Force's contributions and organization will be examined. Turn page for organizational chart of the Army space effort.*

THE US ARMY



a *SPACE DIGEST* chart

• June 15, 1959

Maj. Gen. O. J. Ritland. He can go "through channels" or "around channels" to make special requests or proposals. When General Medaris is wearing his "pure space" hat, he deals with NASA or ARPA. When specific Army missile programs are involved, he gets directions from the Army Staff through the Deputy Chief of Staff for Military Operations, the office in which future Army weapon systems needs are planned. Routine research and development supervision over General Medaris' shop is by the Army staff-level Chief of Research and Development, and the civilian Director of Research and Development. The latter is the equivalent of an assistant secretary of the Army.

In essence, General Medaris is "space chief of staff" for the Army and bosses three subsidiaries.

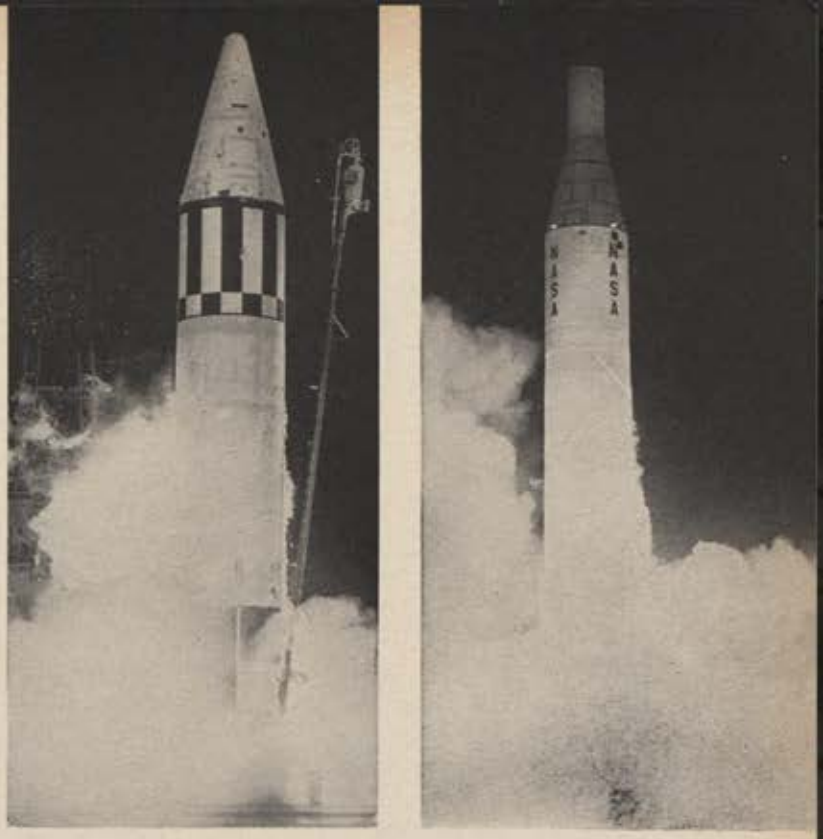
These are the Army Ballistic Missile Agency, the Army Rocket and Guided Missile Agency, both headquartered at Redstone Arsenal, and the White Sands Missile Range at Las Cruces, N. M. The Jet Propulsion Laboratory of the California Institute of Technology, located at Pasadena, now under the control of NASA, is completing commitments of long standing for the Army.

ABMA, with a strength of some 6,800, is a complex of laboratories, manufacturing areas, and test stands devoted to research and development, and prototype testing of Army missiles, in addition to training facilities for Air Force personnel assigned to operate Jupiter missiles. The top planner at ABMA is former German V-2 man, Dr. Wernher von Braun.

ARGMA complements ABMA and is essentially the "materiel command" or the "quartermaster corps" of General Medaris' operation. It is charged with development, procurement, production, industrial engineering, and maintenance of parts for the family of Army missiles, as well as contracting for research and development in the solid propellant field. There are some 3,200 people in ARGMA, approximately half of them industry-contractor personnel.

White Sands Missile Range, in south-central New Mexico, is a 4,000-square-mile area with a primary mission of testing intermediate range rockets and missiles. Some 6,000 civilians and 3,000 military personnel staff the White Sands Missile Range.

The second most important element of the Army's space operations is the Signal Corps, particularly the Signal Research and Development Laboratory at Fort Monmouth, N. J. The Signal Corps specialty is, of course, communication, and it feeds into the Army's space efforts studies and



Above, the Army's Jupiter IRBM, at the launch pad. At right, the Jupiter-C-powered Pioneer IV blastoff into solar orbit in March of this year.

designs for such items as techniques for transmission of information from satellites. The Signal Corps planned the cloud-cover experiment for the Vanguard II weather satellite. According to the Army's recently resigned Director of Research and Development, Dr. William H. Martin, the Signal Corps uses about fifteen percent of the NASA and ARPA funds assigned to the Army. Another five percent is split among the other technical services. The remaining eighty percent is in ABMA.

It is difficult to put down exactly the total sum of money scheduled for Army expenditure on "pure space" or "far out" military space applications assigned by NASA or ARPA. But the most recent contract breakdown released by NASA showed more than $30 million worth. The contracts were distributed mostly to AOMC. These range from supply of Juno II boosters to an inflatable sphere satellite. To these sums should be added the money assigned by ARPA to the Army for Army participation in ARPA-sponsored projects for FY '59, some $57 million, of which primarily in-house projects amount to more than $45 million.

In short, the Army is convinced that:

- Space is here to stay.
- The Army is going into space.

It has built an organization it hopes will take it there.—END

ORGANIZING
OUR MILITARY SPACE EFFORT

LT. GEN. BERNARD A. SCHRIEVER
Commander, Air Research and Development Command

AS [OUR space weapon] programs progress, we are certain to find many other things that we can do better and more easily in space than we can in the atmosphere or on land or sea. However, based only on existing programs and firm requirements, it appears certain that the 1960s will usher in the era in which spacepower will become synonymous with peace power. So long as the cold war continues and so long as the danger of hot war is ever present, the potential of space weapon systems must be exploited fully and expeditiously. . . .

Our timetable is, of course, equally as important to our defense posture as the systems themselves. In this connection I should like to insert two quotes:

From the Rockefeller Report: "A nation can achieve a basic advantage if it is able either to develop or to produce weapons more rapidly than its opponents. One of the major weaknesses in our strategic posture has been our inordinately long lead time."

From a statement in 1958 by A. Blagonarov, member of the USSR Academy of Sciences: "It is easy to see that precisely the time element is the decisive factor which should be grasped in the competition with the capitalist countries in the field of technology."

I know of no agency in the military which has been more aware of the importance of time—of beating the clock—than the USAF ballistic missile management complex. Our directive in 1954 was, "Achieve an operational ICBM at the earliest date that technology will permit." We have kept our eye on this objective ever since.

The Von Neumann Committee which in 1954 recommended accelerations of the ICBM program

SPACE WEAPON SYSTEMS FOR FUTURE MILITARY OPERATIONS

OFFENSIVE WEAPONS

- *Advanced Strategic Missile Systems .*
- *Manned Strategic Space System*

DEFENSIVE WEAPONS

- *Antimissile Defense System (Early warning and extensions)*
- *Satellite Defense System*
- *Satellite Inspection System*
- *Manned Defensive Space System*

RECONNAISSANCE SYSTEMS

- *Reconnaissance Satellite Weapon System and Infrared Subsystem (Alert System)*
- *Visual Reconnaissance Subsystem*
- *Mapping and Charting Subsystem*

SUPPORTING SYSTEMS

- *Communications Satellite*
- *Environmental Observing and Forecasting System*
- *Space Navigation System*
- *Specialized Test Vehicle*
- *Integrated Ground Acquisition and Tracking System*
- *Logistic Support Systems*
  - *Recoverable Boosters (Prime Movers)*
  - *Maintenance and Resupply*
  - *Space Transportation System*

recognized in their report that technology would not be the *pacing* item, but instead it would be organization, management, and administrative procedures. In the past few years that have followed, the wisdom of these findings has been proven by the test of experience.

Now the purpose of delving into history is that I consider the organizational and management concepts which have evolved in the USAF ballistic missile program to be pertinent to all military weapon systems programs where time is of critical importance. Military space systems certainly fall into this category.

To compress time there are several organizational and administrative aspects which are generally obvious, extremely important, and usually difficult to realize. These do exist to a high degree in the ballistic missile program. They are:

- Clear and vertical decision-making channels on over-all program and policy matters.
- A high enough priority to obtain adequate funds.
- Complete responsibility and authority for program direction at the operating management level.
- Highly motivated and competent personnel.

In addition, there are other and less obvious aspects of weapon systems management which require more detailed discussion.

First, the weapon systems management concept means many things to different people. In the ballistic missile program it has two characteristics which are of overriding importance in the race to compress time. First, the concept of concurrency, which optimizes the developer-operator relationship.

This is best explained by dissecting a weapon system. A weapon system consists of much more than the hardware which is developed and tested. It also consists of the industrial base required for its production, the operational facilities for its operation and maintenance, the command and communications system for its operational control, the supply and transportation system for its support, the training facilities and the instructors, and finally the people organized and trained to operate and maintain the weapon.

For the ICBM none of these weapon system elements existed in 1954. The problem, of course, is lead time, and this varies for each element, which for some exceeds forty months. For example, in both the Atlas and Titan programs, operational and training bases were under construction prior to the launch of the first test missile. Thus, a compressed timetable is made possible by the management concept of concurrency, wherein each element of the total weapon system is integrated into a single plan, program, and budget and is implemented concurrently, consistent with lead-time requirements. As an example of concurrency at work, the Atlas will become operational from one to three years earlier than had been estimated by the Von Neumann Committee in 1954.

Military space systems, just as ballistic missiles, require the establishment of a new operational environment. Here, too, literally none of the elements of the total weapon system were in existence when current programs were initiated. Therefore, to compress time it will be necessary to adopt the essential principles of the management concept of concurrency. Our ability to apply a management concept of concurrency is of some concern to me in the USAF with respect to ARPA and NASA, in the area of developer-operator relationship.

Equally as important as the concept of concurrency in compressing time is the philosophy of weapon system development itself. Here the considerations are technological and revolve around the vehicle itself. In short, they concern the state of the art or technology as related to the timing for the initiation of a weapon system development program.

For example, an all-out ICBM program was initiated based on the judgment of a group of eminent scientists, headed by Dr. John von Neumann, that such a system was technically feasible. None of the elements of the system existed in 1954. There was no lightweight, high-yield warhead. In fact, no such device had even been tested

—there existed no nose cone that had reentered at Mach 24—there existed no guidance system —there existed no suitable rocket powerplant. Though none of the major subsystems of an ICBM was in existence, there was little doubt in the minds of Von Neumann's group and other scientists that an ICBM, taking advantage of the thermonuclear breakthrough, was technically feasible.

There can be little doubt that the majority of military space systems must be developed in this same manner if we are to compress time. It would be costly in time should we adopt a policy of developing the various subsystems and then, once on the shelf, integrate them into a weapon system.

Weapon system development based on technical feasibility requires that the military do a number of things:

- Conduct a vigorous research, applied research, component, and subsystem development program.
- Conduct constant evaluation and analysis of the above programs, aided by science and industry, to ensure timely initiation of space weapon system development programs.
- Centrally manage and control space weapon system programs to ensure effective systems engineering, integration, and testing, which is essential to the intricate technical interface between and among the several subsystems comprising the total weapon system.

The ability to apply this philosophy of weapon system initiation to space vehicles will be complicated if there is an excessive division of subsystem development projects among agencies or if there is not a timely decision as to the military operator. While it is clear that excessive duplication must be avoided, the military must continue to conduct a vigorous research and development program of components and subsystems, as well as basic research, if the full potential of military space systems is to be realized on a timely basis.

Fortunately the National Space Act—which in Section 102(b) reads "... (including the research and development necessary to make effective provision for the defense of the United States)"—clearly indicates that such was the intent of Congress.

It has been and is the policy of the Air Force to cooperate and develop a close and detailed working relationship with NASA. This is now in process. There is every reason to believe that within a reasonable time the military and NASA will have established the relations to effectively complement each other and to ensure that both the military and civilian potential of space operations will be realized to the fullest.

To summarize management considerations, the progress which has been made in the accelerated Air Force ballistic missile program strongly supports the management concept which I have outlined, namely, concurrency and initiation of weapon systems programs based on technical feasibility. The key factors in my opinion, based on experience in reducing the lead time between technical feasibility and useful operational systems, from an organizational, management, and administrative standpoint are:

- The primary user should be designated as the operating service upon initiation of a weapon system development program and should be assigned management control of both development and operation of the system;
- Proper relative priority should be maintained between military and nonmilitary projects;
- Proper integration and control of military and nonmilitary scientific efforts and resources should be assured;
- Mission areas for each of the services should be clearly defined;
- The service responsible for system development should be delegated clear authority and should be given the resources necessary to do the job;
- Authority, responsibility, and resources should be placed by each service at the lowest operating management level where all factors of program implementation can be controlled and integrated on a concurrent basis;
- Administrative channels from the operating management agency to the top policy level must be clear, direct, and short;
- Budget limitations should not be arbitrary. and in the case of space development cannot be applied to space as a separate and distinct entity per se.—END

Lt. Gen. Bernard A. Schriever, now Commander of the Air Force's Air Research and Development Command, brings a wealth of experience to his new job, gained in his prior post as Commander of the Ballistic Missile Division. This article is based on excerpts from the General's testimony before the recently completed hearings of the Senate's Subcommittee on Governmental Organization for Space Activities.

As the Air Force's basic researchers in the field of space medicine prepare their expanded programs in the Aerospace Medical Center at Brooks AFB, Tex., the physician who heads the School of Aviation Medicine's Space Medicine Division reports on the state of the art in manned space travel plans—problems and possibilities, and how man must now catch up with the machines which will take him "out there"

MAN IN SPACE . . .

WHERE WE STAND

COL. PAUL A. CAMPBELL
Chief, Space Medicine Division,
School of Aviation Medicine, USAF

THOSE of us associated with research toward the goal of manned spaceflight feel that its eventual accomplishment is inevitable and that its accomplishment is a logical, rational development in the evolution of man and the evolution of the metagalactic universe.

Man has certain attributes, physiological, psychological, and sociological, which have resulted in rational, step-by-step progress toward space. A few of these are:

- His natural curiosity which constantly asks him what lies beyond the clouds, the blue sky, and the stars.
- His spirit of adventure from which he may gain enjoyment from going places and doing things outside the ordinary. In many cases he enjoys sufficient danger to separate him from the "meek who shall inherit the earth."
- His refusal to be contained by barriers which restrict him or his activities.
- His quest for achievement of which he, his family, etc., can be proud, which again sets him apart from his fellow men and improves his ego.
- His built-in desire to do that which he has been told is impossible.

How far man will go into space probably (and here we have all learned to couch our dogmatism with "probably") will be found to be limited to some extent at least by:

- The speed of light.
- The distance which he can travel and return in his productive life span. Unless he changes considerably, he will always wish to return to tell or write about his feats.
- The limits of resupply within reasonable time.
- The amount of radiation which he can be exposed to and remain in good health.
- The statistical chances of survival, etc.

This is all well and good and gives us a framework for the future and feeds fuel to the science-fiction writers, but the cold gray dawn of each morning tells us that there is much to be done before spaceflight in its broader sense can be accomplished. We are progressing in a step-by-step fashion, but at times two steps forward and one step backward. Our forward steps sometimes

bring us face to face with a new barrier, such as the Van Allen-type radiation bands, but new knowledge tempers the old and progress continues. In [our] time . . . we have seen the oxygen barrier, the bends barrier, the vapor-pressure barrier, the sound barrier, the thermal barrier, the ozone barrier, and many others appear for a time to block the extension of aviation, but each has vanished as some new breakthrough has shown the means of traverse.

Progress in each parameter has been exponential. The pauses produced by barriers have resulted in such short-lived plateaus that when viewed in the curve of progress of the twentieth century—fifty-nine years to date—they seem almost imperceivable. Aviation through rocketry, its Newtonian principle of propulsion, its lift produced by propellant rather than wings, and its ability to carry its oxidizer rather than to depend upon the atmosphere for its breath, now gives us the means for penetrating the atmospheric barrier. Where machine can go, man wishes to go and will discover, invent, or improvise the means.

But again to get back to our earth-bound laboratories and our mundane existence, let us have a look at where we stand today and point out a few of the more serious problems which slow progress toward spaceflight and require integrated, concentrated effort. Let us do a little curve watching before we look into the crystal ball.

Man and machine have been in a more or less continuous race to outdo one another since the advent of aviation. At times man, through advancements of the state of the art of protective devices and measures, has been in the lead and could go where the machine could not take him. At times the machine has been in the lead and has been able to go places and do things in which man could not participate.

Until two or three years ago the race between the aviation designers and engineers on the one hand and the flight surgeons, aviation biologists, and human factors groups on the other hand has been nip and tuck. But in these past two or three years the situation has suddenly changed, and the machine capability has advanced far beyond man's capability. Let us look at two parameters to see where we stand.

Manned altitude, or, as we must now say, distance outward, achievement has been one parameter which has been carefully watched since the Wright brothers' first flight. . . . The curve is exponential and looks good when viewed on the proper chronological base line. It ended with Kincheloe's flight [in the Bell X-2] to an altitude

of 126,200 feet. But when placed within the framework of hardware achievement, it does not look so good. The man/machine gap is tremendous and is lengthening by the month.

Let us now look at another parameter—that of speed—because as we all know man cannot orbit until he reaches a speed of some 18,000 miles per hour and cannot escape the earth's gravitational tentacles until his velocity has reached some 25,000 miles per hour. First, let us examine man's speed achievements plotted chronologically. It ends with Mel Apt's fatal flight [also in the X-2] reaching about 2,148 miles per hour. Again we have an exponential curve and man appears to be doing just fine. But again, when viewed within the framework of hardware achievement, it does not look very good, and again we see a tremendous man/machine gap.

Now why has this gap lengthened so much in the past few years. I think we can point to one situation—a comparison of resources—scientists and facilities—a comparison between the hardware development area and the human factors development area. Whereas there are several thousand scientists and facilities in hardware research, design, and production, there are still only a few in space medicine, space biology, human factors, and related disciplines, and this is taking its toll in terms of integrated progress toward manned spaceflight.

The space concept is a relatively new one and is interdisciplinary throughout. Consequently, training for those who wish to participate simply does not exist except in the in-house, or on-the-job, categories. Programs for training require the

wedding of diverse disciplines such as astronomy and biology, astrophysics and ecology, logistics and ecology. As an example, may I point to the organizational chart of our own Space Medicine Division at the School of Aviation Medicine, USAF, to illustrate:

SPACE MEDICINE DIVISION

1. *Bioastronautics*
   - Utilization of the Energies of Space
   - Protection Against Energies of Space
   - Extraterrestrial and Cosmic Radiation
   - Liaison
2. *Astroecology*
   - Ecological Systems
   - Components
   - Ecologistics
   - Synecology
   - Psychological Reactions
   - Selection
   - Training
   - Indoctrination
3. *Biogravics*
   - Biodynamics
   - Zero and Sub "G"
   - Acceleration
   - Deceleration
   - Tangential Acceleration
   - Reaction Control
4. *Bioastrophysics*
   - Instrumentation
   - Design
   - Maintenance
   - Weight and Capacity Reduction
   - Reentry

The wedding of the disciplines here is self-evident.

May I now emphasize that the primary biological problem of manned spaceflight at this time lies in the production of people trained in the required interdisciplinary techniques and with imagination, who in turn can help produce solutions to the many complex problems which plague us.

Let us now have a look at some of the other problems in the production of a reliable manned space system and see where we stand today:

The problem of *reentry* is very serious as it involves relatively rapid slowdown from speeds (in the neighborhood of 18,000 miles per hour if orbiting or some 25,000 miles per hour if in escape ellipse) to zero miles per hour. If we take the example of the orbiting vehicle, the magnitude of the total energies is some 19,000,000 foot pounds per pound of orbiting mass. Thus, approximately 24,000 BTUs per pound of orbiting mass must be dissipated in a relatively short period of time. For comparison, the energy contained in a gallon of gasoline is about 21,000 BTUs per pound. During the same period high G loads approaching man's tolerance limits will have to be sustained. Project Mercury, the first orbiting manned spacecraft, will have to meet these requirements. Its engineers say it can be done.

Radiation: Orbiting beneath the Van Allen bands, yet remaining above the levels of appreciable atmospheric drag, is possible. This requires an almost circular orbit between the altitudes of something like 140 miles and 400 miles. For travel into the deeper reaches of space, polar launching, to avoid the Van Allen bands, would require an exit passage almost identical with the path or entrance corridor of the maximum concentration of incoming heavy primaries. Again in the type of space travel of the relatively near future, orbiting within these bounds for short periods seems feasible.

Weightlessness: This is another huge question mark as our simulation capability through the use of parabolic flight patterns still remains under something of the order of sixty seconds. We cannot even guess as to the effects of several hours or several days of zero G. Several of us are of the opinion, however, that an even greater problem is for the engineers to provide an absolutely *stable platform* which will not produce some tangential G due to rotation or tumbling. Weightlessness is possibly the lesser of the two evils.

Closed ecological systems: For space travel of short duration such as a few circuits of the earth closed-loop ecological systems are unnecessary, but for long flights involving months such a system is an absolute requirement as resupply will be very difficult and the logistics will be exorbitant.

Human logistics of spaceflight other than resupply require capacity reduction through miniaturization, the conservation of everything, recycling, and reutilization wherever possible. There is much to be done here and it must be done as the weight costs, in terms of fuel and structure required for getting each pound of man, oxygen, food, containers, fluid, protective gear, etc. [into space], are very high.

Escape from a space vehicle in the event of accident, recovery, and survival present huge problem areas. The problems have been analyzed. The answer probably lies in constant improvement of the reliability of the primary vehicle.—END

Colonel Campbell is a pioneer in the aeromedical field, having twice served as Director of Research at the School of Aviation Medicine and more recently as special assistant to the commander of the Air Force Office of Scientific Research. This article is condensed from a presentation to the Federation of American Societies for Experimental Biology in April 1959. It reflects the author's personal views and is not to be construed as a statement of official US Air Force policy.

Spaceflight

. . . A NEW DIMENSION IN ECONOMICS

T. F. WALKOWICZ

THERE are two rather basic points which we might keep in mind in any discussion of space technology. The first has to do with the importance of civilian interplay and cooperation in space exploration. There is a perfect analogy for the separate development of civilian and military space programs in the historically separate development of our commercial air transportation system in parallel with the evolution of military aviation. During this initial period, the hardware of military and civilian space programs is largely common, and therefore the administrative problems arising in connection with the use of the same hardware and facilities for separate purposes tend to be vexing. These problems, however, should not cause us to lose sight of the basically diverse aims of civilian and military space programs, each of which are of sufficient importance to demand their own separate organizational treatment.

At this point, no man would dare predict with certainty that the "civilian" aims of space exploration would prove to be more important than the "military" aims, or vice versa. Not only are both programs important in their own right, but their importance calls for the highest degree of cooperation and understanding among civilian and military scientists. The history of American weapons development provides very little justification for either group to take "potshots" at the other. If we have learned anything in weapons development since the end of World War II, it is that neither civilian scientists nor military men involved in weapons development have a corner on wisdom when it comes to predicting the future.

The second basic point which is worth keeping in mind is simply this: Is there a real future in spaceflight? . . .

It is customary to expect that new science and new discoveries will inevitably lead, if properly used, to prospects for a brighter, better future for mankind. Previous discoverers, however, have been fooled in this respect. Columbus, for example, in his studies of geography before setting sail for the new world, wrote: "Beyond the Tropic of Capricorn . . . is the highest and noblest part of the world . . . Paradise on Earth," and he wrote further of ". . . the cardinal extremities of the world, where days last six months. There live the happiest peoples, who only die of weariness of living."

History has shown that Columbus was overhopeful. There is no "Paradise on Earth," there are no "happiest peoples." Rather, there are just people—various creeds, languages, customs, but just people, bound together by a common need to labor in the sweat of their brows for their daily bread, and united spiritually by a common urge to remain free of tyranny, whatever its present form may be.

In our hopes for the future of spaceflight, shall future history disappoint us, as it did Columbus? Will we encounter a benign environment in space, with only readily understood physical forces to contend with, as we dash about from one planet to another? Or, will we find the environment in space hostile and the forces encountered partially beyond present human understanding?

More important, can it be that man's initial encounters with the cosmic might induce an at first imperceptible mutation through which the good Lord begins gradually to return unto Himself that free will and intelligence which have set man apart from the animals, and with which man

has so tried the good Lord's patience down through the ages?

However unacceptable this thought may be on the surface, I submit that there is room for its thoughtful consideration in the depths of any open mind.

With this background, let us consider briefly some of the economic implications of spaceflight. . . .

Consider first the individual, the explorer or discoverer. A few centuries ago discovery was a good business. For example, Columbus' demands, granted by the King and Queen of Spain before he set sail, were: That he should be honored and armed as a Knight with Golden Spurs; that he should be granted the title of Grand Admiral of the Ocean Sea; that he be perpetual Viceroy and Governor of all islands and terra firma discovered; that he have one-tenth of all income from all goods bought, exchanged, found, or conquered within the limits of his Admiralty; and that he have the right to contribute one-eighth to the expenses of every expedition to the newly discovered lands and to derive one-eighth of the profit.

What would happen today? In the USSR the "discoverer" of a planet, returning from his initial voyage through space, would be made a Hero of the Soviet Union and given a dacha, plus enough rubles, vodka, and caviar to live like a king forever after. In the US our "discoverer" would get a ticker-tape parade, following which he would probably be advised that his life insurance had been canceled and that the paymaster was withholding his flight pay until such time as Congress and the Comptroller General ruled on the matter.

Although this comparison obviously is overdrawn, it carries an important point. Those nations which still believe in free enterprise seem to be losing their capacity to reward generously those who exhibit initiative and daring.

In this country, for example, since the end of World War II it has been uncomfortable, and at times impossible, for anyone in government to speak openly about spaceflight.

We should have had, instead—long ago, by Act of Congress—a gold medal and a million-dollar tax-free prize waiting for the return of the first successful expedition to the moon.

Well, let's assume that—sooner or later—spaceflight becomes a reality. Its heroes, the discoverers, if they be American, go off to the poorhouse for their reward, but spaceflight is now available—for those who can afford it. What about Space Mail and the Space Traveler?

The Post Office Department has traditionally provided economic support for newly developing forms of transportation. Dr. Hal Ritchey, one of the Directors of the American Rocket Society and my colleague in the Thiokol Chemical Corporation, has roughly estimated $25 as the cost of an "airmail" stamp to the moon. Considering the mileage involved, this is only some three times the cost of a domestic airmail stamp, which is about seven cents per 2,000 miles.

Now, Dr. Ritchey uses solid fuel and assumes no recovery of the metal components of the rockets. By switching to liquid fuel and assuming recovery of metal components and their amortization over a four-year period, we come up with a cost of only fifty cents for an airmail stamp to the moon! Thus, the intrepid crew members of the first manned rocket which reaches the moon need not worry about being out of touch with home. The cost of a love letter will be within easy reach, if only the Post Office Department moves promptly, in its fine tradition, to set the service up.

It's hard to visualize flight in rocket-type vehicles competing with conventional air transportation, if for no reason other than that there wouldn't be *time* to drink a free martini in a rocket, even if one *could* drink it.

However, let's look at the economics of an 8,000-mile flight in a rocket plane, where a passenger might be willing to "go dry" and accept other "incidental discomforts" for the duration of the less-than-one-hour trip. A liquid-fueled rocket weighing some 300,000 pounds, might carry, say, seven people on such a trip. Again using recovery of metal components (especially the passenger capsule!), four-year amortization, and one round-trip per day, the direct operating costs amount to roughly twenty cents per seat mile, not including insurance!

By way of comparison, the luxury steamship fares run between twenty-five and fifty cents per passenger mile, not including the bar bill, of course.

In a very imaginative study (done, incidentally, well over two years ago) Robert Cornog of the Thompson Ramo Wooldridge firm projects

rocket airplane seat-mile costs that are comparable with those of the new commercial jets. The rocket airplane earns more per dollar invested, because it travels at about 5,000 mph, compared to 500-plus mph for jets.

These terrestrial rocket flights are interesting, because the difference between an 8,000-mile rocket and a moon rocket is technically not very great. For example, using roughly our same basic rocket on a one-trip-every-three-days basis, a trip to the moon would involve a direct cost of only two cents per seat mile, or $5,000 one-way. This might surely be within the reach of some honeymooners, except for the complications of the two-day trip.

All of these figures assume the existence of a lunar rocket station. On the very first "voyage of discovery" these costs go up by a factor of about twenty, because of the extra weight of the rocket, fuel, etc., required to get the "first trip" back to earth (before refueling facilities and bases are established on the moon).

With the advent of spaceflight, certain types of industries are coming into their own: Principal among these are the rocket engine and fuel companies, the "sophisticated instrumentation" (i.e., automatic guidance) companies, and geophysics (or space environment) groups.

Quite apart from direct participation in the space program, the prudent investor should look for signs of a company's commercial application of its "space ideas." For example, missile inertial navigation is bound to be applied first to commercial aircraft and, eventually, perhaps even to automobiles. Imagine having a car in which your wife can't get lost!

As another example, the graphic data processing systems needed to make use of the large volumes of data gathered by a satellite will inevitably lead to the creation of a new industry, just as the "invention" of digital data processing created today's electronic computer industry.

These achievements mean two things: First, the creation of a giant, new "space industry"; and, second, the advent of a host of new products and companies applying the new knowledge and new technologies of the space industry to every facet of human life. This second aspect, i.e., the commercial by-product of space exploration, can today be only dimly perceived, and yet it is most apt to be the largest by far.

What about world society as a whole? The economic impact of spaceflight on the world depends, naturally, on the course of future history and, at the present moment—as it has been ever since the end of World War II—the course of future history appears very uncertain.

But what can spaceflight contribute to the avoidance of human catastrophe? In fact, it has much to contribute.

There are two big and primary dangers to peace in the world today:

First, there is the amassment by nations of weapons of surprise mass destruction, with the growing risks of accidental war and a cataclysm which neither East nor West wants;

Second, there is the creation of artificial barriers between peoples for the sole purpose of making people responsive to the propaganda of the state.

In this age, when man at last has the means to destroy man, two considerations should dominate the thinking of statesmen:

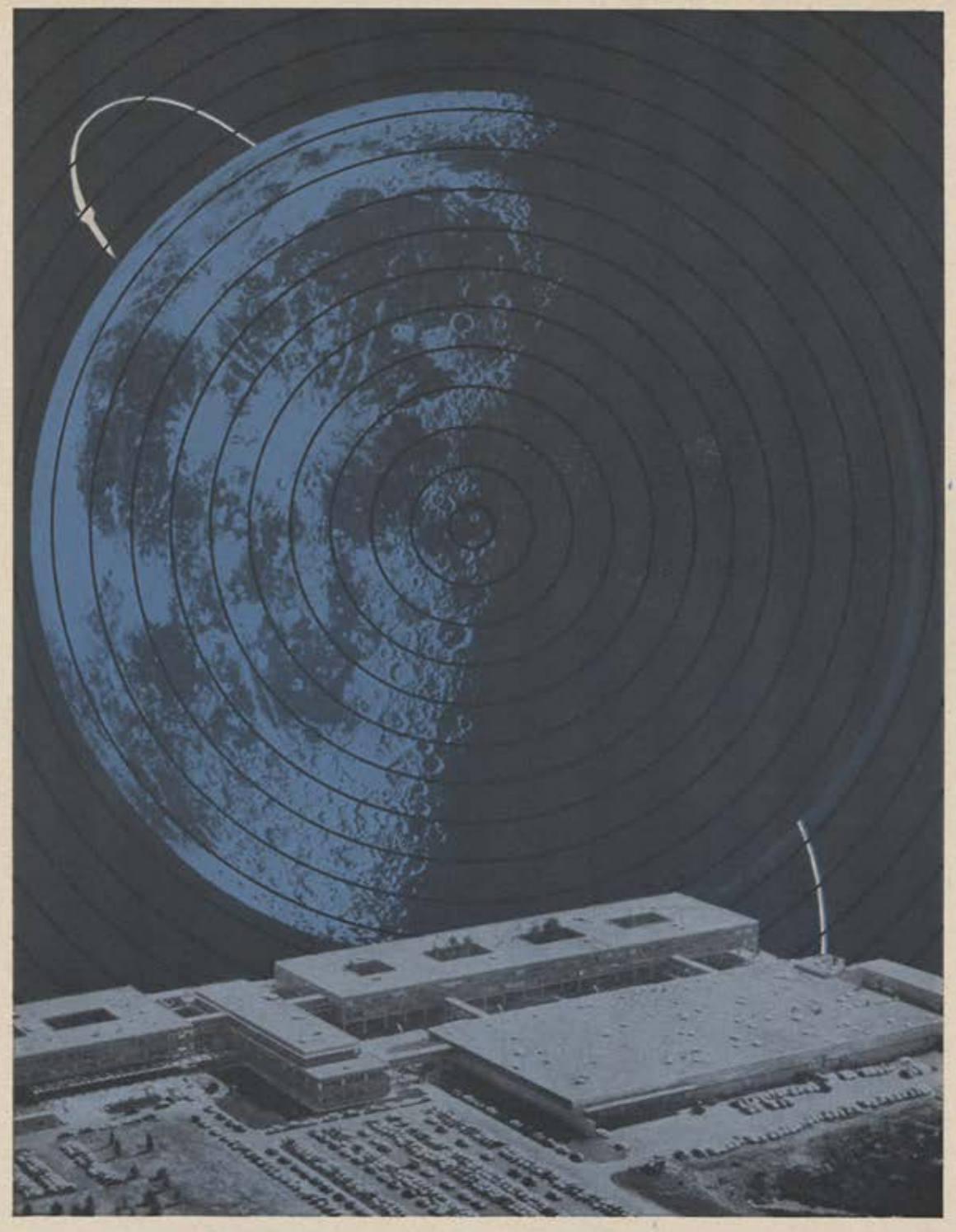
Can the world accept the risk of not knowing the total capacity of *any* nation for inflicting mass destruction by surprise on the rest of the world?

Can the world permit *any* nation to quarantine its peoples from receipt of accurate information about the real state of affairs in the rest of the world?

The answer to both of these questions is, in my humble judgment, a loud and resounding NO. Furthermore, I believe that the techniques associated with spaceflight can be used to implement "NO" answers to these questions.

If the statesmen and scientists of the free world have the vision and courage to use the arts of spaceflight to help implement arms control and to help eliminate artificial barriers to communication between peoples, we may all, the burden of arms having been eased, yet find the economic means, first, to eliminate a lot of unnecessary human misery here on earth and then, under God, in a constructive, cooperative human endeavor, to make our way to the stars.—END

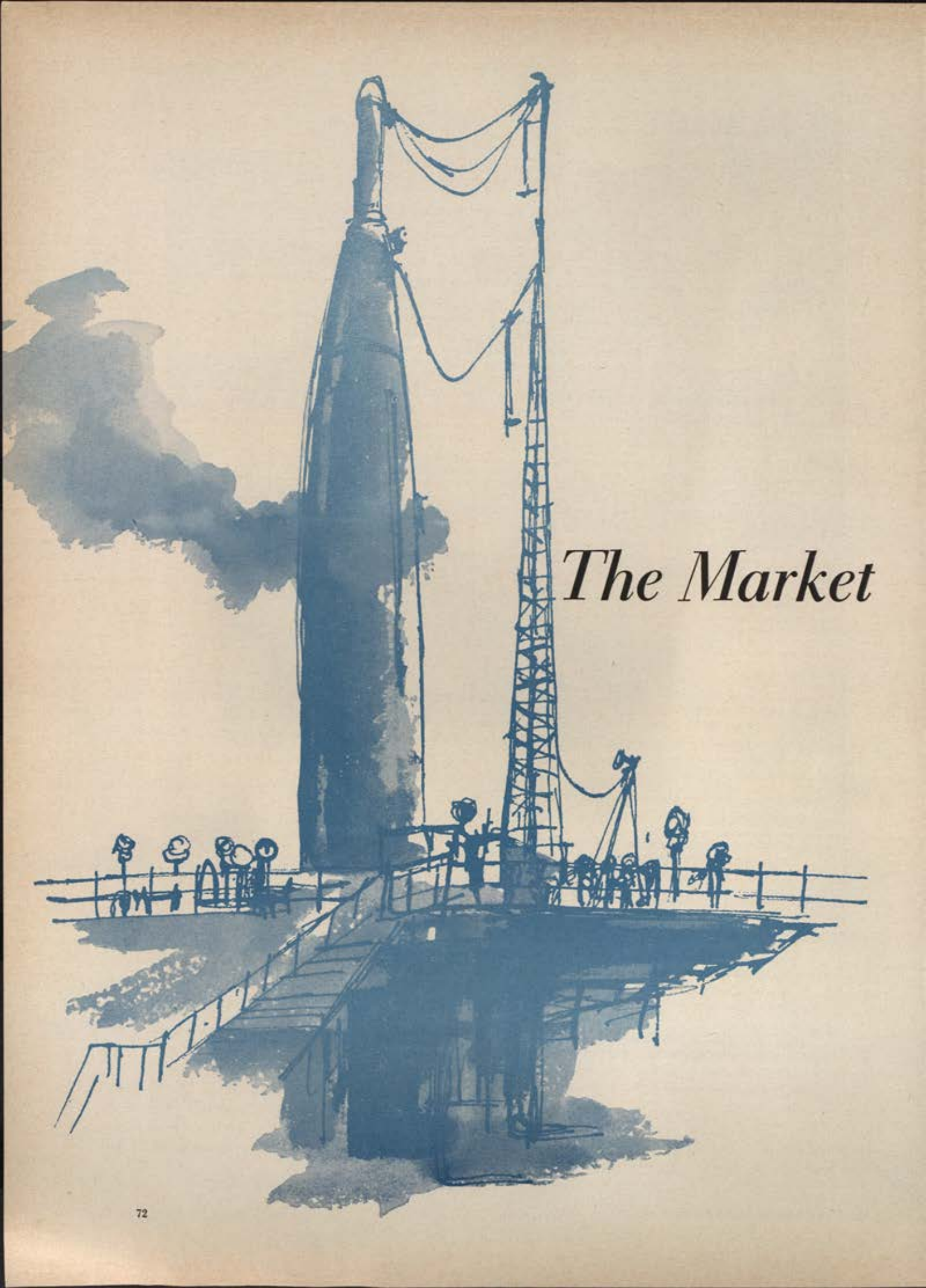
A longtime student of the impact of science and technology on economics and politics, Mr. Walkowicz is a member of the staff of Laurance S. Rockefeller in New York City. A veteran of technical assignments in the Air Force, the author holds a doctorate in aeronautical engineering from the Massachusetts Institute of Technology. The material above is condensed from his presentation to the American Rocket Society in March 1959.



Space age research gets a new headquarters—One of the largest and best-equipped research facilities in the nation is the new 16-million-dollar Avco Research Center at Wilmington, Massachusetts. Here, research and development in space age technology is already being conducted in areas ranging from missile re-entry to satellite design. From work such as this—and equally important work at the nearby Avco Research Laboratory—will come further contributions to national security and the conquest of space.

Avco

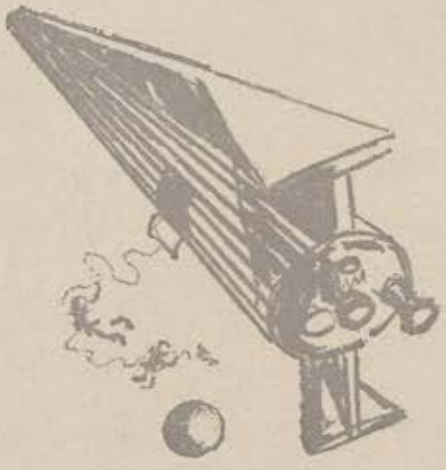
AVCO MAKES THINGS BETTER FOR AMERICA / AVCO CORPORATION / 750 THIRD AVENUE, NEW YORK 17, N. Y.



The Market

THE MARKET for space-exploration vehicles at present looks much like that for laboratory equipment. There will be a slow but continuing demand for a wide variety of tried and true components to be fitted together as the need arises. Manufacturers should find a selective market for everything from boosters with millions of pounds of thrust to miniature control systems with ounces of thrust. The assembly of these parts into complete vehicles and the conduct of actual experiments appear best suited to research organizations which can provide the required breadth of scientific and engineering background.

There is another [market] which is quite unpredictable at the moment. This is the market for space military systems. There is an obvious military requirement for reconnaissance and communication satellites. The technology of such systems



for Space Vehicles

WARREN H. AMSTER

is now quite well understood, and their implementation is largely a question of details. However, farther in the future, there are possibilities for all manner of exotic, deep-space weapon systems. At present, it is not at all clear what the requirements for such systems might be or how to achieve them. Much of this uncertainty stems from our fragmentary knowledge of what to expect in space and how to operate there. Space-exploration efforts by the armed services are an important part of learning to operate effectively in this environment should the need ever arise. Supplying the needs of operational military space systems may turn out to be an important market, but it is very difficult to predict its nature just now.

One over-all conclusion that can be drawn about the market for space vehicles is that there appear to be two kinds of markets, with the possibility of a third. One sure market is for ballistic missiles with an emphasis on development of special equipment and the need for operating convenience. The periodic introduction of new missiles, followed by extensive production, is similar to model changes in the automobile industry. Another market is for space-exploration equipment with its demands for available, versatile, and reliable components. Besides an insatiable demand for increased performance, this market will show a preference for equipment thoroughly tested through previous use. These two markets are quite different in their requirements. Organizations seeking to enter the "space business" will do well to remember whether they are competing in the new or the used space-vehicle market.—END

Warren H. Amster is a member of the senior staff of Space Technology Laboratories and is engaged in design studies for space vehicles. His article is reprinted from the December 1958 issue of SC Engineer, *published by the University of Southern California. It is reprinted with permission of that publication, and with permission of Space Technology Laboratories, copyright holders, and of the author.*

A candle in a dark room?

Transverse and/or Visible electromagnetic waves?

A universal constant?

How many wave lengths in a photon?

Is light affected by gravity?

A full appreciation of light and all its phenomena is essential to the successful completion of our energy conversion mission.

We use this knowledge constantly—as, for example, in our recent development of a photo-voltaic conversion system and a mechanical-optical system to convert light energy to electrical energy.

To aid us in our inquiries we call on the talents of General Motors Corporation, its Divisions and other individuals and organizations. By applying this systems engineering concept to new research projects we increase the effectiveness with which we accomplish our mission—exploring the needs of advanced propulsion and weapons systems.

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ALLISON

Division of General Motors, Indianapolis, Indian

Speaking of SPACE

Moon Bounce

President Eisenhower sent a message to Canadian Prime Minister John G. Diefenbaker via the moon last month, a distance of almost half a million miles. The voice recording was bounced off the moon from the Millstone Hill Radar Observatory in Westford, Mass., and was received at the new Prince Albert Radar Laboratory in Prince Albert, Saskatchewan, two and seven-tenths seconds later. The power output of the transmitter was 50,000 watts. The signal reflected to Prince Albert was one-thousandth of a millionth of a millionth of a watt.

Success in this relatively new field of communications opens up a new channel for international exchange. The obvious advantages are that the system will be impervious to jamming and to atmospheric disturbances. The limiting factor is that both the sending and receiving stations must be within sight of the moon at the same time.

The Prince Albert Radar Laboratory, a joint undertaking of the Canadian Defence Research Board and ARDC, will be used chiefly to investigate the effects of the aurora borealis on radar detection of aircraft and missiles.

Nose Cone Recovered

A Thor-Able nose cone was recovered by the Air Force on May 21, the second to be retrieved after a full-range test flight. The cone was hurled some 5,000 miles through space and back to an impact area near Ascension Island where it was picked up by an Air Force recovery team. In addition to the valuable information yielded by the data capsule, the missile firing proved a triumph for the radio-inertial guidance system developed by Bell Laboratories for the Titan ICBM.

Inner Atom

As atomic accelerators explore the subatomic world and physicists learn more of the phenomena of the inner atom, it may be necessary to revise our concepts of what time and space actually are. A panel of the President's Science Advisory Committee, headed by Dr. Emanuel R. Piore, director of research at International Business Machines Corporation, has suggested that with huge atom smashers man may relate the inner atom with the outer universe, and may even discover what is the smallest distance in space. Elementary particle physics, "the heart of modern physics," according to the report, explores the internal structure of the atom, the nucleus, the protons and neutrons, and the elementary particles called neutrinos, muons, pions, and "strange particles." As the report described this exploration of submicroscopic space, "We are peeling an onion layer by layer, each layer uncovering in a sense another universe; unexpected, complicated, and—as we understand more —strangely beautiful."

The panel's request for construction of a giant atom smasher two miles long was carried forward by the President in his announcement, in a speech to a symposium on basic research held in New York by the National Academy of Sciences, the American Association for the Advancement of Science, and the Alfred P. Sloan Foundation, that he would ask Congress for $100,000,000 to build an accelerator at Stanford University.

A giant sleeve of high-wattage quartz lamps, simulating the friction heating of flight, encloses a Titan SM-68 ICBM during the testing.

Radio Astronomy

Dr. Otto Struve will direct the new National Radio Astronomy Observatory being built at Green Bank,

W. Va., by Associated Universities under contract to the National Science Foundation. Dr. Struve, a native of Kharkov in the Soviet Ukraine, was director of Yerkes Observatory of the University of Chicago and has been Director of the Leuschner Observatory of the University of California since 1950.

The observatory will have a 140-foot radio telescope and an eighty-five foot Tatel telescope, the latter scheduled to be in operation by July.

Deep-Sky Wonders

Superb color photographs of nebulae and galaxies taken by William C. Miller at Mount Wilson

Richard E. Horner, Assistant AF Secretary for Research and Development since 1956, receiving Exceptional Civilian Service Award from AF Secretary James H. Douglas, is NASA associate administrator.

and Palomar Observatories with the 200-inch Hale reflector and the forty-eight-inch Schmidt reflector will be for sale at the California Institute of Technology Book Store, 1201 East California Street, Pasadena 4, Calif. Reproductions of six of these appeared in the May *National Geographic* and the April 27 *Life* Magazine, showing the spectacular beauty of the Crab nebula, Andromeda, the Ring in Lyra, Orion, and the Veil in Cygnus, the Swan. Slides, color prints, and transparencies will be available for the detailed study of scientists and the aesthetic delight of amateur sky gazers.

Speech Briefs:

Theodore Von Karman, at Cornell University:

"The problems we have in airplane design we have also in missile design, and in the design of any other air or space vehicle. It would be a miracle if we could make vehicles for space or vehicles for upper atmosphere and not encounter the same problems—buckling, flutter, etc.—that we have in airplane design."

Dr. Louis N. Ridenour, Jr., Lockheed vice president, missile pioneer, nuclear physicist, first Chief Scientist of the AF, who died in Washington, D.C., suddenly last month.

Dr. George Bogdan Kistiakowsky, research scientist at Harvard, has succeeded Dr. James R. Killian as the President's Special Assistant for Science and Technology.

J. R. Wiggins, executive editor of the Washington Post, *in Washington:*

"We have put into the hands of the government the power to preserve or destroy our country and perhaps all life on this planet. Therefore it does not seem presumptuous to suggest that the people should be kept informed of what the government is planning before it happens."

Rear Adm. John E. Clark, Deputy Director, ARPA, in Milwaukee:

"The issues we are facing in military space research apply directly to [this] vastly accelerated rate of change. The definition of problems of national defense in scientific and technological contexts requires, if not a new dimension in our thinking, then at least a degree of frankness and flexibility in our thought patterns which might be judged unorthodox.

"Support for defense research and development . . . ebbed and flowed according to the popular assessment of how serious was any given threat to the national security. The military departments, and the people, married under common stress, would tend to separate, if not divorce, as the crisis subsided.

"Now these careless love affairs can no longer be tolerated. They are senseless from the standpoint both of weakening our efforts to maintain concrete national safety and of ridiculing our attempts to save dollars and cents. When space breakthroughs can alter the traditional balance of power in a matter of days, the nation must be firmly united, pledged to readiness to present and future. It cannot afford any other posture."

G. E. INERTIAL PLATFORMS shrink missile readiness time to 60 seconds at –55°C

In the event of attack... we cannot expect more than minutes warning and minutes to retaliate. Heretofore ... inertial systems in air-launched missiles required as much as thirty minutes warm up time before operation and an additional amount of time before achieving specified accuracy. The new G.E. Platform is designed specifically to give satisfactory performance over a wide range of temperatures in high G environments.

It is smaller in size and weight than similar platforms and the following features are indicative of the performance to be expected:

1. Fully operable within one minute after power is applied.
2. 20 minutes after –55°C start–it achieves accuracy as specified.
3. Ambient temperature –65°C to + 100°C.
4. Tolerates high acceleration environment.
5. Platform and associated electronics total only 55.7 pounds.

This lightweight ruggedized environmentally suited platform is ideal for long range air launched missiles. The unusually low drift rate eliminates the necessity of "trimming" or adjusting the gyro before each mission.

More complete details are available on the system by contacting Manager–Control Sales, General Electric Company, Light Military Electronics Department, Armament and Control Section, Johnson City, N. Y., Dept. 12A.

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PORT OF EMBARKATION

In the decade of missilery ahead, prime contractor capability must go far beyond the requirements of hardware design and manufacture. New experience and facilities are now required in the increasingly critical launching phase—from ground handling and testing to countdown and data control.

Martin's Cocoa Division is the first organization of its kind devoted exclusively to this specialized area. Accomplishments have already established new operational standards at Cape Canaveral, one of the two U.S. ports of embarkation for the major space events of the decade ahead.

An example of the latest development in electronic fail-safe launching equipment is the new Martin Master Operations Control [MOC] system, which automatically monitors count-down procedures in the test firing of research and development-type TITAN missiles. With equipment such as this, TITAN launchings have achieved unheard-of performance reliability.

SPEAKING OF SPACE

Cosmic Ray Balloons

Two of the largest balloons ever made are to be launched over the Pacific to study the action and origins of cosmic rays. As a continuation of the joint National Science Foundation —Office of Naval Research Operation Skyhook, the balloons will be loaded with hundreds of pounds of photographic plates to "capture" the cosmic rays at altitudes of about 120,000 feet. At these heights the rays can be observed before they collide with atoms in the earth's upper atmosphere.

Space Lines

Dr. Ludwig G. Lederer, medical director of Capital Airlines, is the new president of the Aerospace Medical Association, formerly the Aero Medical Association.

The Aerospace Industries Association, nee Aircraft Industries Association, has formed a Guided Missile Council to encompass engineering and guided missile manufacturing.

The Air Force School of Aviation Medicine will move from Randolph AFB, Tex., to Brooks AFB.

NASA has formed a committee to study the need for an equatorial launching range, to advise the NASA administrator on the technical aspects and the nation's need for such a site.

Dr. Joseph V. Charyk, Chief Scientist of the AF since October 1958, has replaced Richard Horner (*see cut, page 76*) as Assistant Secretary of the AF for Research and Development.

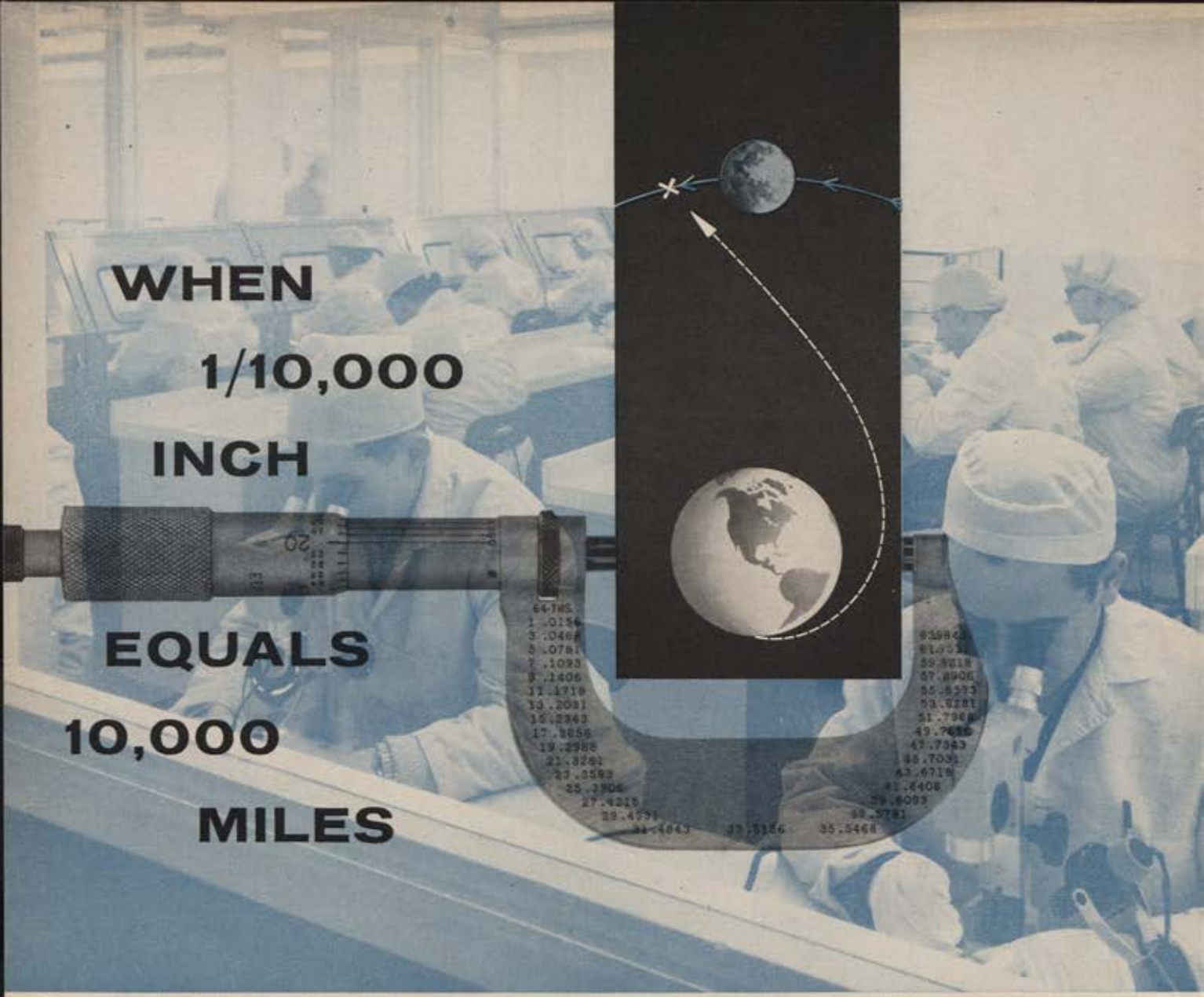
Agenda:

The Tenth International Astronautical Congress will be held in London from August 28 to September 5. Address inquiries to the Secretary, British Interplanetary Society, 12, Bessborough Gardens, London, S.W. 1.

ICAO Meterological Division will meet in a joint session with the World Meteorological Organization Commission for Aeronautical Meteorology in Montreal, Canada, from September 1 through October 7.

The American Rocket Society's Solid Propellants Conference will meet at Princeton University, N. J., September 24 and 25.

—MICHAEL B. MILLER



Hoffman's Electro-Mechanical Department delivers the extra measure that counts in precision products

The count-down starts early in precision missilry. Preparation for a successful "shoot" often begins right here at Hoffman, where many missile components are built with skilled hands, precision tools and the master craftsman's pride. This unbeatable combination results in the extra measure of care and effort which spells dependability . . . a prime reason why Hoffman has earned the reputation of a responsible source in the field of electronics.

For over 18 years Hoffman has been developing and producing electronic gear—from underwater to outer space—for all departments of the military.

To this capacity Hoffman has added the Electro-Mechanical Department to provide a real and ready capability for producing precision electro-mechanical components such as:

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These are just a few examples of complex precision products Hoffman can build for you—to your exacting specifications or created to meet your requirements.

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Significant developments at Hoffman have created positions for scientists and engineers of high calibre. Please address inquiries to Vice President, Engineering.

Present-day science education in museums is perhaps the most basic form of education there is—education for survival . . .

Telling Science's Story

WILLIAM A. BURNS

IN TALKING about education and science, I am not going to discourse learnedly on Pestalozzi, adult curves of learning, or the great need to turn out more scientists per year than can the Russians. As a worker in a science museum I am aware of, and interested in, the problems of science and education, but I am not carried away by them. All museums overlap. All are concerned with science, art, history, health, technology—whether the interest be in removing a bloodstain from a piece of Colonial lace or in properly lighting a Byzantine mosaic. We might say that all of our museums are only departments of a greater museum idea.

Science, poorly defined by the dictionary, is any branch of knowledge dealing with a body of facts or truths arranged systematically and showing the operation of general laws. The average person thinks he is interested in science. Actually, he is interested in gadgets. He can take a vacuum cleaner apart and put it together again without knowing anything about vacuums or electric motors.

Science, like abstract art, is for those who like it. Particle physics or paleontology are no more compulsory than are Picasso or Pollack in art or Hindemith in music. The abstract artist will not necessarily paint a better picture because he knows that the brilliant blue he has just used is a complex coal tar compound and not ground-up star dust. Science has no more to do with knowing how home appliances work or why the stars twinkle than being able to pick out "Chopsticks" on the piano has to do with an Isaac Stern performance of a violin concerto. Science is a state of mind and a discipline as rigorous in its novitiate as any monastic order (and as relaxed as an old shoe afterward).

Education in a science museum must needs be liberal. It agrees to the premise that everybody is not interested in science, just as art museums must agree that everybody is not concerned about art. But when it comes to the actual survival of man on this earth, then scientific education takes a definite stand. It insists, through its museums, that people be given a basic understanding of the world in which they live so that they may continue to live in it.

In a foreword I recently wrote, I said, "A writer is permitted to quote from his own works without

first obtaining permission from the author." What follows I have said and written many, many times in various ways.

The ideal natural history museum has been dreamed of but will never be built. The ideal museum represents, in logical order, the complete story of the universe, the earth and its inhabitants, together with their total relationships to each other. Practical limitations prevent such an institution from becoming a reality, but the vision is there.

We must begin with astronomy mirroring the universe, together with the theories of the earth's origins. The hardened rocks furnish the materials of geology and the life-forms trapped in that rock are the objects of the paleontologist's search. From fossils we advance to forms that are familiar today—living creatures without backbones, insects, fishes, reptiles, birds, mammals, and man himself, all against the background of a world of vegetation.

With the growth of man from primitive savagery to what we call civilization come changes in his relation to his surroundings. The first living thing was affected by its environment and affected it in turn. Man is no exception. *He is one of a species of animals, among which he is no more necessary to the continuance of life on this earth than were the dinosaur, the dodo, or the heath hen.* His very existence in the future may depend upon his understanding of this fact and of the world in which he finds himself.

Man is still a part of nature, although he controls much on earth. He is still subject to great basic forces and laws that restrict and restrain him within marked boundaries. A shift in climate from marine temperate to glacial cold could wipe out his traces over a whole continent. A movement of the ocean bed could send a tidal wave to destroy coastal towns thousands of miles away.

Closer to man's fate than great earth changes are the difficulties he makes for himself through lack of understanding of the consequences of his acts. Because he is the only living organism with the powers of reason developed to a relatively high degree, he engages in thought processes and actions that create in him needs and desires that were not shared by his early ancestors. In satisfying those needs and desires he cuts down whole forests for his industries. He mines the soil and uses up resources he cannot hope to replace. He waters the desert and makes it bloom, then plows the plains and reaps the dust bowl. Sometimes he behaves as though his generation were to be the last ever to live on this earth; this too could be true.

But the science museums are aware of the urgency of the problems of soil, water, forest, mineral, and wildlife conservation, and of the conservation of man himself. This idea is plain in their teaching, their labels, their exhibits, and their programs for children and for adults. They are concerned with the interpretation of nature rather than with its mere presentation. The day of the thousand stuffed specimens in one case is gone. The scientist-educator knows that man must see nature as a whole since he must live as a whole being within its framework. Present-day scientific education in our museums is perhaps the most basic form of education there is—education for survival. Its message is uncomplicated, blunt, to the point. It says, "If you do thus, this will happen. If you continue, this and this will happen to you."

But there is even more to education in the science museum. People are presented—not as odd, different, peculiar, with customs or colors that vary from ours—but as plain human beings whose needs are the same as ours—food, clothing, shelter, security, a little privacy, a little love. This is interpreted in terms of our understanding that these needs are the same as ours, modified only by availability of local materials and the limitations of taste and technology. When our children can see a Chinese roof with upturned corners as just another good way to keep off the rain, they will not see it as the "inferior" (being different) creation of a people who must then be "inferior" to them.

Thus education in a science museum first teaches us how to continue to live in this world by understanding more thoroughly our environment and our relation to it, and second, how to live more effectively and more pleasurably through a better understanding of our terrestrial neighbors who share the same environmental perils as do we.—END

Dr. William A. Burns is Assistant to the Director at New York's Museum of Natural History. He has written many articles on museology, as well as children's books. This article originally appeared in the April 1959 issue of Museum News, *and is reprinted here with permission of* Museum News, *and with the permission of the author.*

HOW SAC's "HOUND DOG" SCENTS ITS TARGET

The crew of the B-52G starts up the jet engine of the sharp-nosed GAM-77 Hound Dog missile hung under its wing... gives its inertial autonavigator the location of the target.

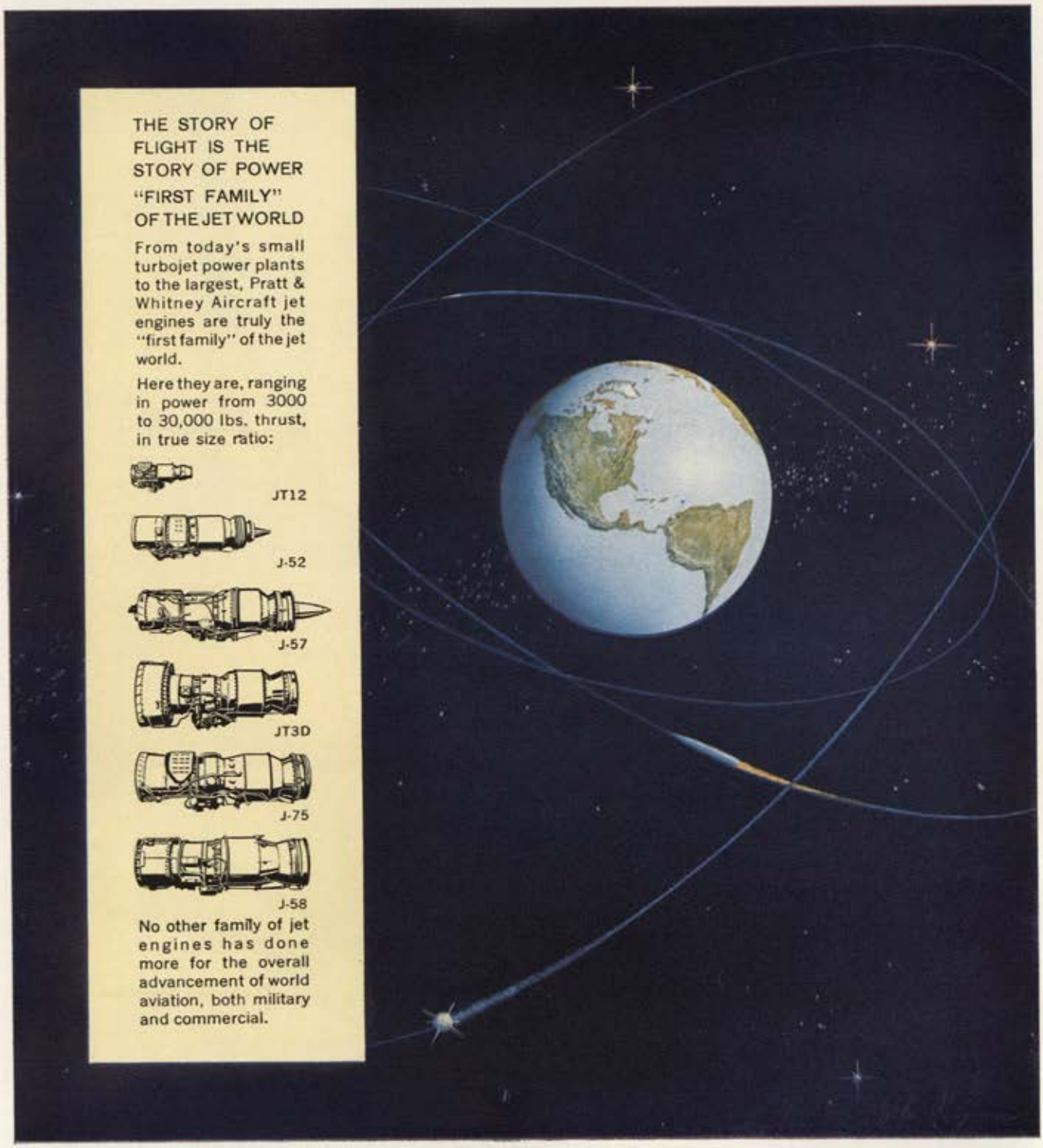
On a "for-real" mission, the Hound Dog would leap toward its target at supersonic speed—very likely a ground-defense center hundreds of miles away. Its guidance system can't be jammed... can't be decoyed.

Purpose of the GAM-77 air-to-ground jet-powered guided missile is to increase the striking power of Boeing's B-52. Sling a pair of Hound Dogs under the wings of the new B-52G—and you have what amounts to a brand-new weapon system.

The GAM-77 program was started in August, 1957. The missile has been put into accelerated development. It already is in its early flight test phase... will be deployed by 1960.

Weapon system contractor: the Missile Division of North American Aviation.

MISSILE DIVISION NORTH AMERICAN AVIATION, INC., DOWNEY, CALIFORNIA



POWER IS THE KEY!

Aviation has made rapid advances in its brief history. But only in recent years has man seriously envisioned the tremendously increasing speeds, altitudes and distances that are now within reach.

The key to this exciting prospect is power . . . dependable power, in forms or amounts adequate for any needs.

In this new era Pratt & Whitney Aircraft is continuing its traditional role of providing dependable power for flight, in whatever form it may take. For example, we have made significant advances in the fields of nuclear aircraft propulsion, solid rocket components, and liquid hydrogen rocket applications. We are also doing intensive work on even newer projects, such as storable propellant rockets, and power for space flight.

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AIR FORCE
JULY 1959

British defense policy is built around top performance V-bombers. Here Avro Vulcan leads V-formation. At the bottom of photograph is a Vickers Valiant, at the top a Handley Page Victor.

Britain's Defense Dilemma

Norman Gibbs

BRITAIN is still in the midst of a national debate on its defense posture, which is oriented to a "nuclear new look" policy instituted two years ago. British armed strength is of vast importance to the free world. The debate is pertinent to the military issues confronting our global string of anti-Communist alliances.

Strengths and weaknesses of the "new look" policy have been discussed by growing numbers of British commentators in the past two years. These criticisms generally have fallen under three heads:

First, criticism of the reasons which led Britain to become a member of the "nuclear club," and questioning of the military value of the deterrent which has been developed or is being planned.

Second, criticism of the gaps in Britain's defense preparedness which, it is argued, have been opened up by the inability to be a nuclear and a conventional military power at the same time.

Third, criticism of what are argued to be the adverse effects of Britain's policy on some of her allies and on the general strength of the Western Alliance of which she is a member.

The reasons for and value of Britain's own deterrent have been stated many times by British Governments. Since the end of World War II various reasons for the consistent view that it is essential for Britain to develop her own nuclear capacity have been advanced. The American Atomic Energy Act—the McMahon Act of 1946—raised barriers against Britain's ability to share in American research and development, and therefore her own efforts appeared to be essential. British Governments have on several occasions argued that Britain would be able to influence the decisions on international affairs of both America and Russia only if she possessed nuclear armaments of her own.

Several years ago Sir Winston Churchill claimed that Britain must manufacture her own thermonuclear bomb because, in the event of major war, it was possible that SAC, with enough work of its own to do, would not bomb those Communist targets of immediate importance to Britain; therefore, the latter must be able to do that for herself. And, more recently and more significantly, it has been argued that, as nuclear weapons and delivery systems become more deadly and destructive, there will be an increasing reluctance on the part of American Administrations to use SAC or American missiles for anything but a retaliation against a direct attack on the North American continent. In that case Britain needs her own deterrent to dissuade Russia from supposing that she can threaten Britain and that America will not use all-out war to protect her ally. Two very important articles to that effect appeared in the London *Times* shortly before last Christmas.

It would be stupid to dismiss these arguments either because they appear to be "prestige" arguments or because they appear to imply a lack of faith in America's determination to keep her promises. Prestige is something which affects most national as well as individual decisions. We've a long way to go before nations are internationally minded enough not to bother with prestige at all. And the fact

(Continued on page 87)

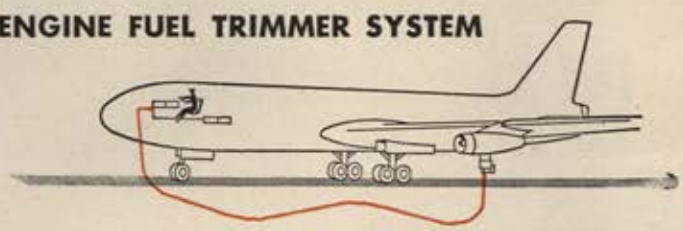
the world's longest screwdriver

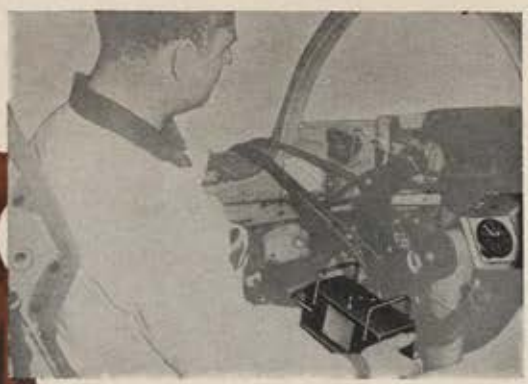
MOVES JET FUEL TRIMMING TO COCKPIT

Now only 1 man—instead of 3—trims fuel controls of all jet engines... faster... with greater accuracy... without hazard... all by remote control!

Eliminates exposure to dangerous noise and heat when trimming at the engine.

EXCLUSIVE **LEAR REMOTE CONTROL JET ENGINE FUEL TRIMMER SYSTEM**





G-6

HOW IT WORKS

In a matter of seconds, a servo-adapter combination is clamped directly to the fuel control on the engine to be adjusted. This servo-adapter is attached to a remote controller (usually in the cockpit) by means of an electrical cable. Thus one man can make all idle, military power and water injection adjustments.

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is that the more destructive the weapons become, the more reluctance there must be to use them. There is no reflection here on America's loyalty or the loyalty of any other nation.

On the other hand, there are people in Britain who argue that the reasons given so far for Britain's determination to become a nuclear power are inadequate to justify her in attempting to provide her own deterrent when, at any rate within the Western Alliance as a whole, SAC has all along been capable of doing that job without any help. This criticism has been made in Parliament and in the press on several occasions in the last two years. In other words, why do the same job twice?

The people who make this criticism frequently go on to a further and connected argument. They claim that, even if Britain were justified in attempting to build up her own deterrent, nonetheless she isn't capable, on her own, of doing the job properly.

At the moment Britain's strategic nuclear power is based on the V-bomber force of Valiants, Vulcans, and Victors, a stockpile of fission weapons which has been growing since World War II, a stock of thermonuclear weapons begun only in the last two years, and propelled standoff bombs now being developed. Public estimates of the contemplated size of the V-bomber force range from 200 to 250 aircraft. They are basically aircraft of the medium type, most nearly comparable to the USAF B-47.

The Government claims that the performance of these aircraft "in speed and altitude, remains unsurpassed by any bomber aircraft in service in any other country," and there is no serious reason to doubt the accuracy of that statement.

On the other hand, it appears that these aircraft are not dispersed on a worldwide scale as are the aircraft of the Strategic Air Command. And the British Government, unlike its American counterpart, has normally taken the view that there will be reasonable warning of any serious Russian attack. This latter view is taken to imply that Britain's Bomber Command need not normally be kept at short-term readiness. In fact, it is clear that both greater dispersal and a greater degree of readiness would be expensive. The RAF has undoubtedly been improved in both these respects in recent years; but greater efficiency, some say the necessary efficiency, is constantly hampered by limits on spending.

The critics of all this argue that these aircraft and their bombs do not constitute a genuine deterrent. Britain is a very small island. Ten one-megaton bombs could probably put the whole country out of action. Further, 200 or so bombers—particularly if concentrated at a vulnerable base and thus liable to suffer heavy casualties—are not sufficient, except perhaps in optimum conditions, to deal Russia such a crippling blow as to make an attack on Britain a hopeless gamble in Russian eyes. In such a one-to-one war, it is argued, the disparity in size between the two nations would be so much to Britain's disadvantage that Russia's leaders might think the likely damage to their own country acceptable. At that point deterrence ceases to exist. This argument is strengthened by the fact that, certainly at present and in the near future, Britain's stock of megaton weapons must inevitably be small.

For the missile future Britain is at the moment constructing sites for the American Thor IRBM. But the British Government is developing a British IRBM, Blue Streak, which, if all goes well, should be in operational use in the early 1960s. Blue Streak is to have a range of 2,500 miles. It is claimed to be more reliable and accurate than Thor, and it will be fired from underground. But it is still a liquid-fuel missile, and critics already say that it will be obsolescent or nearly so by the time it is ready for operational use.

The essential validity of all this criticism stems from the fact that, on her own, Britain can only select an occasional item from the weapons of the future and specialize in it. Delivery systems, in particular, are becoming very expensive. Russia and the United States are big enough and wealthy enough to keep several irons in the fire. At the present, for example, America can experiment with several varieties of ICBMs, Polaris, and future supersonic types of manned bombers. Britain cannot afford to do this. She is presently building a nuclear submarine which might well become a Polaris platform. But it is not clear that Britain will be able to afford to have both a land-based missile, Blue Streak, and a sea-based missile, Polaris. And it is still possible that the two may have to be regarded as competitors for limited funds.

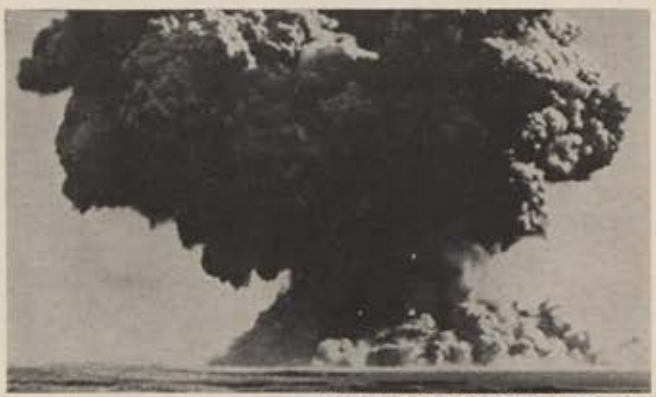

Photo courtesy of British Information Services

Immense cloud of smoke, steam, spray billows up from the first British atom test explosion in 1952 off Australia.

The people who make these criticisms are not pacifists, and they are not arguing against nuclear weapons on moral and religious grounds. They wish to see Britain in particular, and NATO as a whole, well defended with all types of weapons. Their points are that there is no need for Britain to be a nuclear power in an alliance already sufficiently strong in this way and that Britain cannot be an effective nuclear military power on her own, anyway, because the cost is beyond her resources. And remember that, apart from the United States, Britain is at present far better able to be a nuclear power than any other nation in the Western Alliance. Therefore, what is true of Britain is even truer of such countries as France, Germany, and Italy. Western Europe as a whole could develop a substantial nuclear capacity of its own in the future, and Britain's contribution could form the basis for it. But this, which would be genuine interdependence and not simply national policy, looks at the moment to be as far off as the moon.

In addition, it might be noted, there are people in Britain who advocate both the cessation of nuclear tests and the renunciation by Britain of her existing nuclear weapons as an example to the rest of the world. It was people of this persuasion who recently demonstrated against the setting up of the first Thor sites in the county of East Anglia. But these are persons and groups whose influence is not likely to affect either the present Conservative Government or the Labor Opposition, if and when it comes into power.

(Continued on following page)

The second line of criticism against the Government's defense policy, and the one which has been advanced on several occasions in the London *Times*, is that the cost involved in providing Britain with her own nuclear armament has made it impossible to provide proper quantities of more conventional weapons at the same time. Behind this criticism lies a now-familiar argument. If nuclear weapons on both sides of the Iron Curtain have the effect, as all hope, of preventing major war by a nuclear stalemate, then the Communists are likely to try to achieve their purposes (if they use force) in limited wars. If we don't want to be forced to use nuclear weapons, and if we are not to give way to blackmail, then we must have sufficient weapons of the conventional type to deal with the Communists on fairly equal terms.

This is how the *Times* put this view recently:

"If it is conceded that the likeliest threat is the tepid war in all its military aspects, followed possibly by limited war, then our defense policy should reflect this by giving priority to this side of our military preparations. Until we get our priorities right, we can hardly expect to get the deterrent right."

Defense Minister Duncan Sandys has replied that Britain is well enough equipped with conventional forces and weapons. He argues that any limited, conventional war Britain is likely to be involved in on her own in the future will be simply a minor colonial campaign or police matter. That may be true. Though it is worth remembering that, since World War II, "police matters" in the Far East, Africa, and Cyprus have, on occasion, absorbed thousands of soldiers. The immediate risk, however, lies elsewhere—in Germany.

The next few months, and probably years, will see attempts to solve the complicated German problem always with the risk of war in the background. The British Government, like the American Administration, has for some time past argued that any major Russian attack in this area, even if the Russians limit themselves to conventional forces, must be met with nuclear weapons because the NATO countries haven't enough ground forces to do otherwise. President Eisenhower has recently restated this policy quite clearly, and there is no good reason to suppose that Prime Minister Macmillan does not agree with him.

The British Government (and by no means the British Government alone) has been reasoning in something of a vicious circle in these matters for some years. First, it is said that the democratic nations can't equal the Russians in manpower and must, therefore, compensate by means of atomic weapons. Then, when there has been an investment in atomic weapons, it is argued that it is too expensive to go on spending as much on conventional weapons as before. In Britain this led, two years ago, to the decision to abolish compulsory military service, with the consequent decrease, among other things, of British ground forces committed to NATO—an unpopular move, but a tempting precedent for other nations to follow.

This is a dangerous position to be in. We must have the whole range of nuclear weapons in NATO, and Russia may compel us to use them by using them herself first. But what is implicit in the *Times* article quoted above is the belief that the democratic powers should be capable of responding to Communist aggression, at least in the first instance, in conventional terms. This same point of view was put in forcible terms by former US Secretary of State Dean Acheson in the *Saturday Evening Post* recently. For Britain this raises the doubt of whether the greater dependence on nuclear weapons and the greatly reduced size of the Army, implicit in Mr. Sandys' defense policy is, in fact, the correct line for Britain to follow.

Again, as in the first line of criticism already examined, Britain's problems are common to other NATO powers. If a more balanced over-all weapon system is desirable, can this possibly be achieved by any of the smaller nations in isolation? Are they not bound to involve themselves in a far greater degree of interdependence and sharing than at present if reasonably complete defense in all categories is to be achieved?

The final criticism of Britain's defense policy, made more often abroad than at home, is that by making Britain so openly a member of the nuclear club the Government has drawn an unfortunate and harmful distinction between Britain and her allies on the continent of Europe. In Germany, in the spring of 1957, bitter criticisms were made of Britain's decision to abolish compulsory military service just when Germany was being asked to do the opposite. The French are not willing to see themselves in a position inferior to that of the United Kingdom, and are now making determined efforts to develop their own military nuclear capacity—no doubt repeating, in the process, much work already twice done in the United States and the United Kingdom.

In the spring of 1957 the Assembly of the Western European Union (i.e. the Benelux countries, France, the Federal Republic of Germany, and Italy) received the report of its committee on "The State of European Security." This became known as the Fens Report. The report commented adversely on what it feared would be an attempt on the part of the United States to make bilateral pacts with European countries for the supply of atomic weapons, thus running the risk of treating its European allies differently.

"We must expect America," said the report, "to trust all the member states of WEU alike." It then went on:

"Great Britain is the only European power which is likely to possess megaton bombs (and a V-bomber force capable of delivering them to the target) in the foreseeable future. *But this inequality must not be extended to tactical atomic weapons or guided missiles.* Between WEU countries no division can be allowed to develop between first-class partners having the modern weapons and second-class partners dependent on the first for them."

Criticisms of British defense policy underline problems in this area facing the entire free world. The policy, obviously, is not entirely wrong and few of its critics claim so. But, at least in Britain, the debate is well joined and prominent persons have manned the verbal barricades on each side.

Britain is typical of those countries which are still substantial military powers but not in the same class with the two giants, America and Russia. Since Britain is militarily more advanced than any other nation in NATO except America, what is happening to her today may happen to France, Germany, and even Italy in the next few years. Each may face a debate on defense similar to that described here.—END

The author, Norman Gibbs, is Chichele Professor of the History of War at Oxford University and a Fellow of All Souls College, Oxford. He has contributed two previous articles on British defense matters to AIR FORCE/SPACE DIGEST: *"Britain's Defense Budget" in June 1956 and "Britain's New Defense Policy" in June 1957.*

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RESERVE AND AIR GUARD NEWS

Air Force Reservists, plagued with almost constantly **fluctuating programs and strength levels,** are seeking some way to get a **more stabilized program. A separate budget,** similar to that of the Air National Guard, has seemed to many the best approach.

At its Convention last year in Dallas, the **Air Force Association** passed a **resolution** recommending a separate budget or, if that was not feasible, the funds for the Reserve should be **clearly identified** in the AF budget.

In response to such expressions, the **Air Reserve Forces Policy Committee** last winter **requested,** and the **Secretary of the Air Force approved,** establishment of an *ad hoc* committee of Reservists to study the need for a separate budget.

The committee has now met. After hearing some sixteen witnesses, including Edward L. Wilson of AFA's national headquarters, the committee **strongly recommended that Reserve funds be identified more clearly,** particularly in **the operations and maintenance area.**

The committee noted that Reserve personnel and construction funds are already identified. Doing the same in the O&M area, it stated, would permit **full identification of Air Force Reserve requirements** and provide **an opportunity to explain those requirements** to review agencies and to Congress.

Seeking further means to solve the problem, the committee got two striking recommendations from **Lt. Gen. William E. Hall,** who has served two tours of duty with the Reserve, first as Assistant Chief of Staff for Reserve Forces in the Pentagon, and currently as Commander of the Continental Air Command.

General Hall's recommendations had to do with both jobs. First, he said, the post of **Assistant Chief of Staff for Reserve Forces,** now occupied by Maj. Gen. Richard A. Grussendorf, should be **upped to Vice Chief of Staff level.** General Grussendorf, he noted, **can only "monitor" Reserve aspects** of Air Staff activity; a Vice Chief of Staff for Reserve Forces could **exercise "total control"** over such actions.

Second, said General Hall, with a strong Reserve representation in the Pentagon it **might be feasible to do away with the Continental Air Command.**

His suggestions were incorporated in the committee's recommendations to the Secretary of the Air Force.

The *ad hoc* committee was headed by **Brig. Gen. James H. Howard,** a Washington engineer who holds a mobilization assignment as Deputy Director of Operational Forces in USAF's DCS/Operations. Eight members of the committee, including General Howard, are Ready Reservists and the other three are on extended active duty representing Reserve forces viewpoints on the Air Staff.

The report declared:

"Since the Regular Air Force plans for years ahead, the committee believes that the Reserve cannot intelligently plan its program unless it identifies its requirements with those of the Regular establishment. This means that the concept of the Reserve mission must be clearly defined, accepted, and understood by the Regular Air Force as well as the Reserve. . . .

"A single agency headed by a person fully conversant with, and sympathetic to, the Reserve program, holding a position in the Air Staff structure with appropriate prestige and authority, and whose office was properly staffed with officers equally interested in the Air Force Reserve, might help to generate a better understanding of the objectives of the Reserve program."

The nation's top Air Reserve navigator, Capt. William E. Naumann, Andrews AFB (left), is congratulated by Maj. Wilmer F. Kirkwood, who held that honor last year *(see text below)*. The decorative young lady is Miss Linda Strawn.

The Committee's twenty-four-page report was **endorsed by the Air Reserve Forces Policy Committee** at its May meeting and promptly forwarded to the Secretary.

• • •

Top honors in the third annual **Air Force Reserve navigation competition** were won by the **8499th Navigation Squadron from Long Beach, Calif.,** with a score of 58.25. Second was the **8498th from Andrews AFB,** Washington, D.C., followed by the **8500th from Hamilton AFB,** Calif. The competition, staged at Ellington AFB, Tex., involved three **six-hour, 800-mile flights** over the Gulf of Mexico.

Individual honors went to **Capt. William E. Naumann** of the 8498th who emerged as the **nation's top Air Reserve navigator** *(see cut)*, replacing **Maj. Wilmer F. Kirkwood** who had won that honor in 1958. In second and third place, respectively, were **Capt. Steven Onysko,** 8514th Squadron, Hanscom Field, Mass., and **Capt. John T. Maddox,** 8507th Squadron, Hensley Field, Tex.

• • •

Brig. Gen. Donald J. Strait, Vice Chairman, Air Guard Council, told the House Armed Services Committee on June 5 that proposed **legislation to amend the Reserve Officer Personnel Act** was desirable, but he declared that the Administration bill under consideration by the committee was **emasculated by the Bureau of the Budget** after it left the Department of Defense.

The **Air Force Association** has recommended retention of Reserve officers **through the grade of captain** or until they **complete fourteen years;** removal of the **"pusher clause";** promotion to unit vacancies **notwithstanding number of nonunit officers** by grade; retention of **Reserve technicians** until age sixty; retention of Reserve officers who can complete **twenty years of federal service** prior to attaining age sixty; and retention of **doctors, dentists, veterinarians,** and **chaplains** through the **grade of major** or twenty-one years.

Chairman **L. Mendel Rivers** concluded hearings on this legislation on Thursday, June 11.

• • •

Air Force Under Secretary Malcolm McIntyre has rejected, at least for the present, a request for **an increase of 10,000 in drill pay spaces** for the Air Reserve forces.

(Continued on following page)

He felt that such a move would be **premature** at present, particularly since the Reserve forces are **not yet manned to the present 135,000 ceiling.** He called further for a searching reappraisal of **over-all Reserve structure and policy.**

• • •

Exercise Dark Cloud/Pine Cone II, in which Air Reserve forces took part, ran into a combination of bad weather and unrealistic ground rules.

Tactical fighters and reconnaissance aircraft of the **Air National Guard** flew a fair number of sorties, but few of them were related to the ground phase of the exercise. Weather frustrated the **Air Reserve C-119 crews** who were to have climaxed the two-week exercise with a mammoth 6,000-man paratroop drop.

During simulated ground warfare the **Army was reluctant to clear the air** of its assault helicopters and other light aircraft. For safety reasons, therefore, the Air Guard's tactical fighters were ordered to maintain a **minimum altitude of at least 3,000 feet.** During one day's battle the air support operations center received **only three requests for close support.** For training, TAC fighters shot up the air-ground range at Congaree, S.C., and the air-to-air range of Cherry Point, N.C., both well out of the exercise area.

Meanwhile, heavy rains forced **postponement** first of the Air Reserve's dry run on June 2, and then the big paratroop drop scheduled for June 3. By the time the skies cleared to permit airborne operations on June 5, the **mock battle had been called off.** Reserve C-119 crews at dispersed airfields around the Fort Bragg area loaded up the paratroop forces, bivouaced with them, dropped them over the Fort Bragg reservation, and headed home.

But while it was not a particularly satisfying experience operationally, **valuable lessons were gained in administrative and tactical planning.** Since Pine Cone II was the **forerunner of a much more ambitious joint exercise** planned for 1960, departing Air Reserve Forces personnel could sound the familiar cry: "Wait till next year."

• • •

A **recommendation** that the Air Reserve forces take on **operation of long-range logistic transport aircraft** "when such aircraft can be made available" has been made to the Secretary of the Air Force by the **Air Reserve Forces Policy Committee,** which met in Washington, D.C., from May 4 to 6.

In other actions, the Committee recommended:

• That the Assistant Chief of Staff for Reserve forces study conditions under which Air Reserve technicians may be **authorized to wear the uniform while working in technician status.** (Elsewhere it was learned that the Civil Service Commission will not object to wearing of the uniform by ART personnel provided it is considered "voluntary.")

• That requirements for **mobilization assignments be stabilized** "to avoid a constant change of assignments from year to year," and that mobilization positions be **established and allocated to the Air Reserve Centers** for alignment at least three months before the end of each fiscal year.

• That **training for standby Reservists** in Air Reserve Centers be **continued as is until fiscal '60-61** mobilization requirements are published, reflecting "improved procedures" prescribed for the major commands. At that time standby Reservists with needed AFSCs will be invited to accept a Ready status. Presumably those who do not qualify for or accept mobilization assignments will be given no special training consideration after that time.

• That present legislation which prescribes a **different quarters allowance** for Reserve component airmen on active duty from that of extended-active-duty airmen be rescinded so that such **allowances would be equalized among Reserve and active airmen** of the same grade and longevity. Legislation to make this change is now pending in the Congress, in HR 3353, 86th Congress. The Air Force supports the bill.

• That **organization of "tenant" Air Guard units be reviewed** to ensure their sufficiency for sustained operation in event of mobilization. Guard units which are tenants on USAF bases now operate on a **reduced UMD** (unit manning document) **since USAF provides some support services.** The committee's concern is that in an emergency such services might not be available, thus hampering the Air Guard unit's operations.

• That **terms of enlistment for Air Guardsmen be made comparable to those of Air Reservists.** Current law restricts National Guard enlistments to **three years initially** and to **one or three years for reenlistments.** The proposed amendment would authorize **any type of enlistment** for Air Guard personnel, subject to approval of the Secretary of the Air Force, and would align enlistment periods with military obligations.

The next meeting of the committee will be held in Washington from October 19-21.

• • •

MATS has readied a big push to sign up **M-Day Reservists** this month. Many openings are available for officers and airmen.

Some positions call for twenty-four or forty-eight four-hour periods with fifteen days active duty per year, others for only fifteen or thirty days active duty annually. Contact units listed at any of the following Air Force bases: 1405th ABW, **Scott AFB, Ill.**; 1611th ATW, **McGuire AFB, N. J.**; 1607th ATW, **Dover AFB, Del.**; 1608th ATW, **Charleston AFB, S. C.**, 63d TCW, **Donaldson AFB, S. C.**; 1501st ATW, **Travis AFB, Calif.**; 62d TCW, **Larson AFB, Wash.**; 1360th ABG, **Orlando AFB, Fla.**; 1705th Air Transport Gp., **McChord AFB, Wash.**; ACIC, 2d & Arsenal, **St. Louis, Mo.**; and the 1370th Photo Mapping Group, **Turner AFB, Ga.**

The **Air National Guard's 115th Tactical Fighter Squadron of Van Nuys, Calif.,** has been designated to receive the **Air Force Association's Outstanding Unit Trophy** as the **Air Guard's top tactical flying unit for 1958.** Commanded by **Maj. Charles L. Nelson, Jr.,** the 115th also won the **Spaatz Trophy,** earning 950 out of a possible 1,000 points on a comprehensive evaluation of its combat readiness.

The **173d Fighter-Interceptor Squadron of Lincoln, Neb.,** commanded by **Lt. Col. Fred H. Bailey, Jr.,** was named winner of the **Winston P. Wilson Trophy,** awarded annually by the **Night Fighter Association** to the Guard's outstanding all-weather squadron. This trophy, named for the chief of the Air Force Division in the Guard Bureau, is donated by the **Lockheed, North American, and Northrop** aircraft companies.

Both trophies will be awarded during **AFA's Convention** in Miami Beach, Fla., September 3-6.

Second and third place in the Spaatz Trophy competition went to the **153d Tactical Reconnaissance Squadron** of Meridian, Miss., led by Maj. James L. Bounds, and the **166th Tactical Fighter Squadron** of Columbus, Ohio, commanded by Maj. Paul E. Hoover.

The Spaatz awards, named for **General Carl Spaatz,** first USAF Chief of Staff, are to be presented at a time and place designated by the winning units.—END

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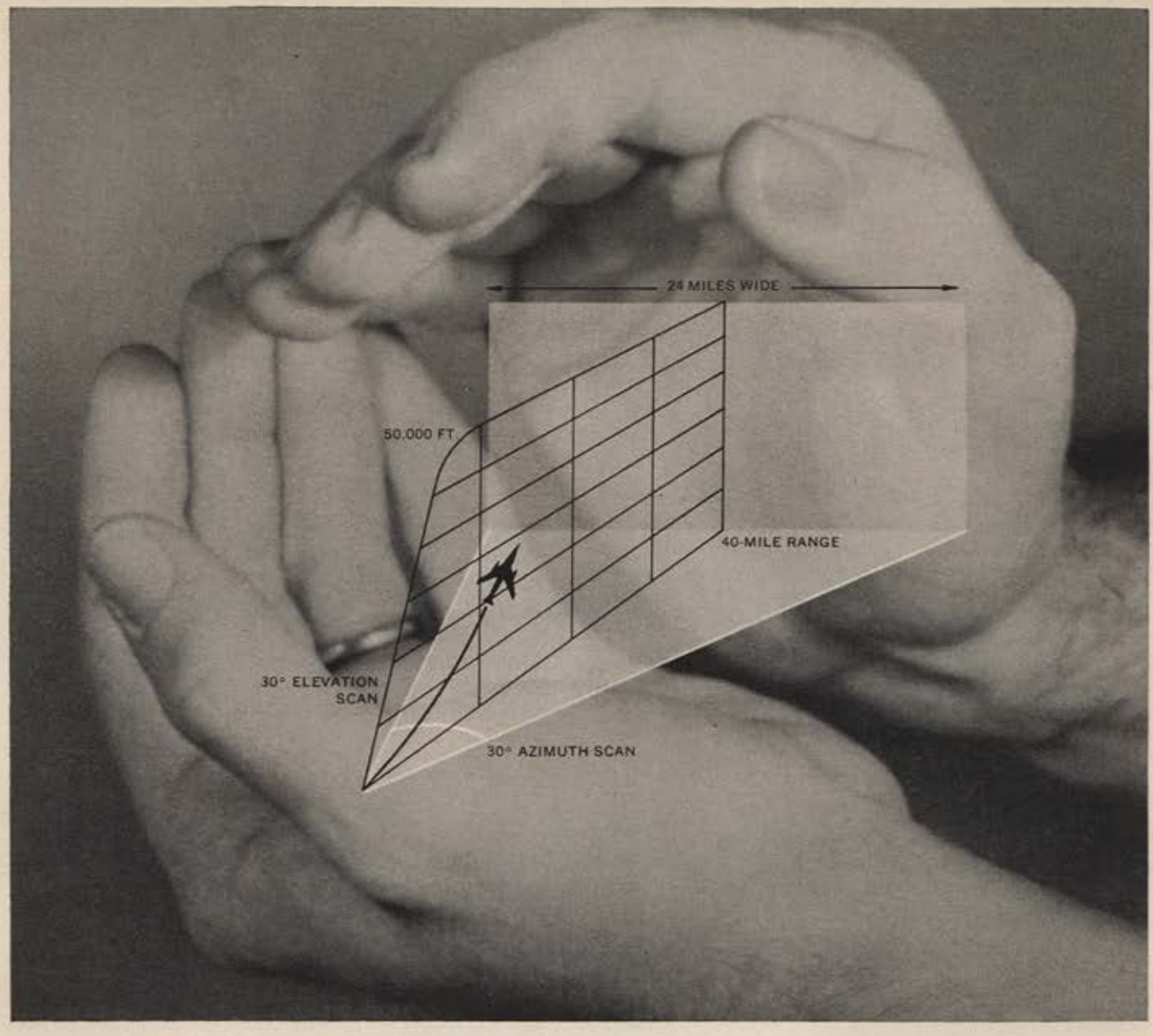

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Hawaii Air National Guardsmen, modern-day Minutemen with a uniquely heavy responsibility, man their F-86L fighters on the double in practice scramble.

ISLAND GUARDIANS

Scramble over Waikiki

Lt. Col. Walter F. Judd

SCRAMBLE! Within five minutes two F-86L Sabrejets take off in forty-second trail interval with afterburners glowing. The pilots are in immediate radio contact with their GCI controller, receive bearing and altitude directions, and climb toward target interception.

The air defense procedure is standard. But the participants make this a special story. The men at the controls of the two jets leaving the green, windwashed beauty of Hawaii far below bear a uniquely heavy responsibility—for civilians. They belong to the Hawaii Air National Guard, the strategic island state's sole round-the-clock, day-in-and-day-out air defense outfit.

The Hawaii ANG provides the only twenty-four-hour, all-weather jet fighter and aircraft control and warning functions that the Hawaiian Air Defense Division, Pacific Air Forces, has continually available and under its operational control. No Regular Air Force outfits stationed in the Hawaiian area provide these functions. Navy or Marine jet fighters are available only intermittently as air defense backup.

The Hawaii Air Guard provides perhaps the best example of how the vital Air Reserve mission has evolved during the past few years, with utilization concepts and practices in some cases almost outrunning the intent of the Armed Forces Reserve Act. The Air Guard is today counted on and used to an extent never before dreamed of. Several Air National Guard squadrons across the United States augment active-duty personnel by standing air defense alert under Air Defense Command operational control. About half of the Air Guard has mobilization assignments to Air Defense Command and the other half to Tactical Air Command.

In Hawaii the time-honored "Minuteman" heritage of the Guard is observed by a continuing twenty-four-hour-a-day air defense alert. Here is what this means, specifically, in Hawaii.

From the jet fighter viewpoint: The 199th Fighter-Interceptor Squadron, Hawaii Air National Guard, keeps a

(Continued on following page)

Sabres at the ready. These and other Guard planes, provide the strategic islands' only continuing round-the-clock, day-in-and-day-out air defense protection.

number of F-86L all-weather Sabres combat loaded with Mighty Mouse rockets on five-minute alert at the scramble hangar. A sufficient number of squadron pilots are on "active-duty" status at any one time to man these planes at the sound of the scramble horn. A limited number of air technician maintenance men strain to keep an adequate number of jets operationally ready, not only for this alert commitment but also for the combat training of the remainder of squadron inactive-duty-status tactical pilots. During practice "emergency alerts," within half an hour additional tactical pilots are suited up and their F-86Ls loaded and ready, and within a maximum of two hours the entire squadron can be assembled and ready to go.

From the aircraft control and warning viewpoint: The 109th and 169th AC&W Squadrons, Hawaii Air National Guard, man two radar GCI sites unceasingly. Full-time air technician personnel scan their scopes for blips to maintain the complex electronic equipment. One of the AC&W squadrons plotted over 50,000 tracks last year.

From the Hawaiian Air Defense Division, Pacific Air Forces, viewpoint: In the Guardsmen the Air Defense Control Center has the tools under its operational control to discharge local Air Force defense responsibilities. By "pushing the button" for a scramble on an unknown or fader, ADCC can initiate a display of smooth air defense teamwork that is the result of many hours of detailed coordination. Relations with the Guard are extremely cordial; a complete partnership attitude prevails in the common effort to achieve and maintain air defense supremacy. "Dining-In Nights" are held to cement relations on an individual basis. Should there be an emergency mobilization, operational relationships, and present procedures would remain largely unchanged. Accelerated transition to an active-duty status for the Guard would be smooth. Like its Army equivalent, the Air National Guard performs its fuctions directly under local government control.

Presently programmed for Convair F-102 Delta Daggers, the Hawaii Air National Guard looks forward to a continuing active role in the defense of the Islands.

Day-to-day Hawaii Air Guard operations are carried out by a small nucleus of full-time air technicians. These are paid civilian employees who are also members of the military units. They secure supplies, maintain aircraft and radar equipment, and supervise the inactive-duty flying training. This group is supplemented by part-time air technicians to provide the capability for around-the-clock active air defense. To all intents and purposes, a small portion of each outfit is on duty all the time and is backed up by the remainder of the squadron for full operational capability.

The outfit trains together as a whole one week end a month and during a two-week annual field training.

The oldest organization of the Hawaii Air Guard is the 199th Fighter-Interceptor Squadron which was organized in September 1946. During the past twelve years operational planes have included F-47N "Jugs," F-86E day-fighter Sabrejets, and F-86L all-weather Sabrejets. Last year's conversion to the "L" was not only an equipment change, but a mission change as well. The tactical pilots had to learn the new bird and all-weather lead collision tactics. Since the pilots were not available for ground school and flying every day—they earn their living at civilian jobs downtown—the speedy conversion was a genuine challenge. To complicate matters the squadron maintained a dawn-to-dusk, five-minute air defense alert in F-86Es until it became operational in the new all-weather fighter.

The Hawaii Air Guard AC&W squadrons, for their part, are becoming widely known for their ability during rescue operations. The Control Center was notified by CAA one afternoon last year that a civilian Piper Cub, en route from Kauai to Oahu, was lost and had limited fuel remaining. It was believed that a faint radar track

(Continued on page 99)

Guardsmen man two radar GCI sites unceasingly. One squadron plotted more than 50,000 tracks last year.

Full-time air technician personnel maintain complex electronic gear, which scans the skies night and day.

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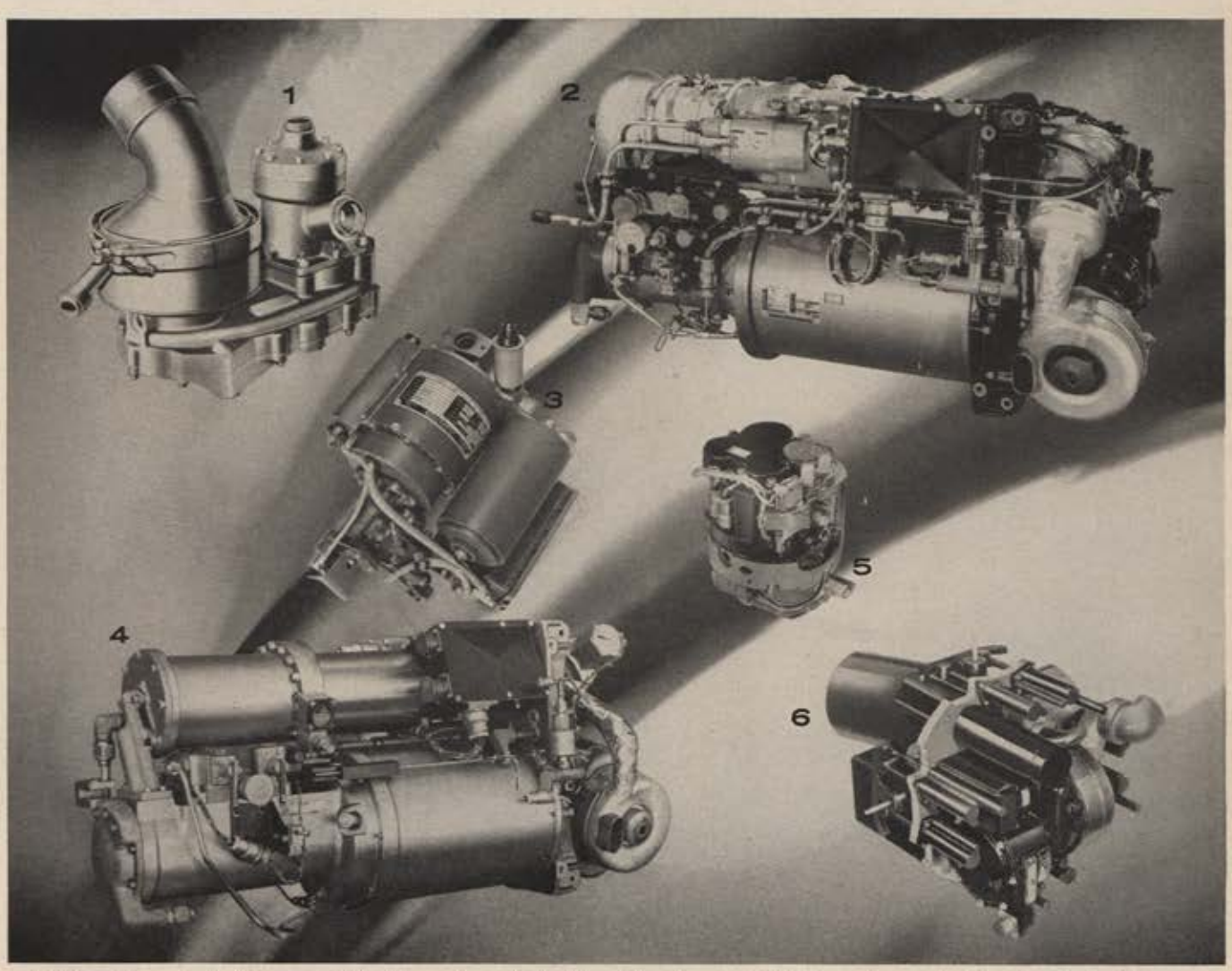

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forty-three miles north-northeast of Oahu and heading north might be the lost aircraft. If this were so, the aircraft would soon run out of fuel many miles from Oahu and would have to ditch in the ocean.

The alert flight interceptors scrambled. The track was intercepted and identified as the Piper Cub, 1,000 feet above the water, still heading north. The interceptors turned the small aircraft toward Oahu as the radar controller computed which airfield could be reached with the minimum fuel remaining. The only possibility was the deserted Kahuku airstrip. One interceptor went ahead and flew up and down the strip to clear away a number of drag-racing vehicles and spectators. The Piper Cub landed safely with its two civilian passengers and pilot.

A few months later the Koko Head radar station detected an emergency distress signal on its radar scopes 187 miles northeast of Oahu. The station made radio contact with the pilot of an Air Force jet bomber who indicated he was low on fuel and uncertain of his position. He received an immediate vector to Oahu. The radar controller, computing distance and remaining fuel, determined that the bomber would be unable to reach Oahu. He therefore directed the pilot to the closer Kahului Airport, Maui, meanwhile alerting local rescue facilities and the Kahului Airport control tower. The bomber landed successfully. It then flamed out due to fuel starvation as the pilot turned off the runway.

Guard radar operators came to the rescue once again shortly thereafter while the island chain lay under a blanket of bad weather. Two Navy jet fighters were lost and separated some thirty miles out to sea. They were running out of fuel. The Kahuku radar station made radio contact with one aircraft and guided him to a safe landing at Kaneohe Marine Corps Air Station.

The other pilot's radio had conked out. He was climbing to an altitude to eject from his aircraft. The Koko Head radar station vectored a 199th interceptor, which was airborne on a training mission, through the weather to the vicinity of the lost aircraft. The interceptor pilot made contact with his own radar and joined the lost pilot. By hand signal he directed the lost pilot to follow him and was directed by Koko Head radar station to a safe landing at Kaneohe Marine Corps Air Station. The second lost aircraft had only three minutes of fuel remaining on landing.

The Hawaii Air Guard recently worked with local Air Force officers in proposing new manning documents for itself as an air defense team of slightly more than 1,000 personnel tailored for total integration into the Hawaiian air defense system. The outfit would provide one squadron of all-weather jet fighters, two AC&W squadrons, one support squadron, one weather flight, and one headquarters organization.

Looking to the future, the Hawaii Air Guard sees a continuing requirement for participation in the active air defense of its area. The fighter squadron is programmed for F-102 Delta Daggers. The AC&W squadrons also expect better equipment as it becomes available. Further into the future, to surface-to-air missiles, the Hawaii Guard envisages a continuing need for manned interceptors for aerial identification capability in a geographic area where there is limited early warning information.—END

Full-time air technicians also are charged with maintenance of the aircraft. Paid civilian employees who belong to military units, these key personnel in addition secure supplies, supervise group's inactive-duty flying program.

Guard Sabres belong to 199th Fighter-Interceptor Sqdn., initial component of Hawaii Air Guard. Formed in 1946, the squadron has flown F-47N "Jugs" and F-86E day fighters previously. F-86L changeover in 1958 was mighty challenge.

The author, Lt. Col. Walter F. Judd, is executive officer of the 199th Fighter-Interceptor Squadron, Hawaii ANG. A veteran of service with the Army, Navy, and USAF, in World War II he served as lead navigator of the 838th Bomb Squadron, 487th Bomb Group, in the ETO. He is a 1948 graduate of the Air Tactical School and a 1952 graduate of the Air Command & Staff College. Away from his ANG duties he farms near Kaneohe on the lush windward side of Oahu. It was from this direction that the Japanese carrier planes came eighteen years ago to blast Pearl Harbor and Hickam Field. Memories of that catastrophic day help keep the Hawaii Air Guard in its present high state of combat readiness.

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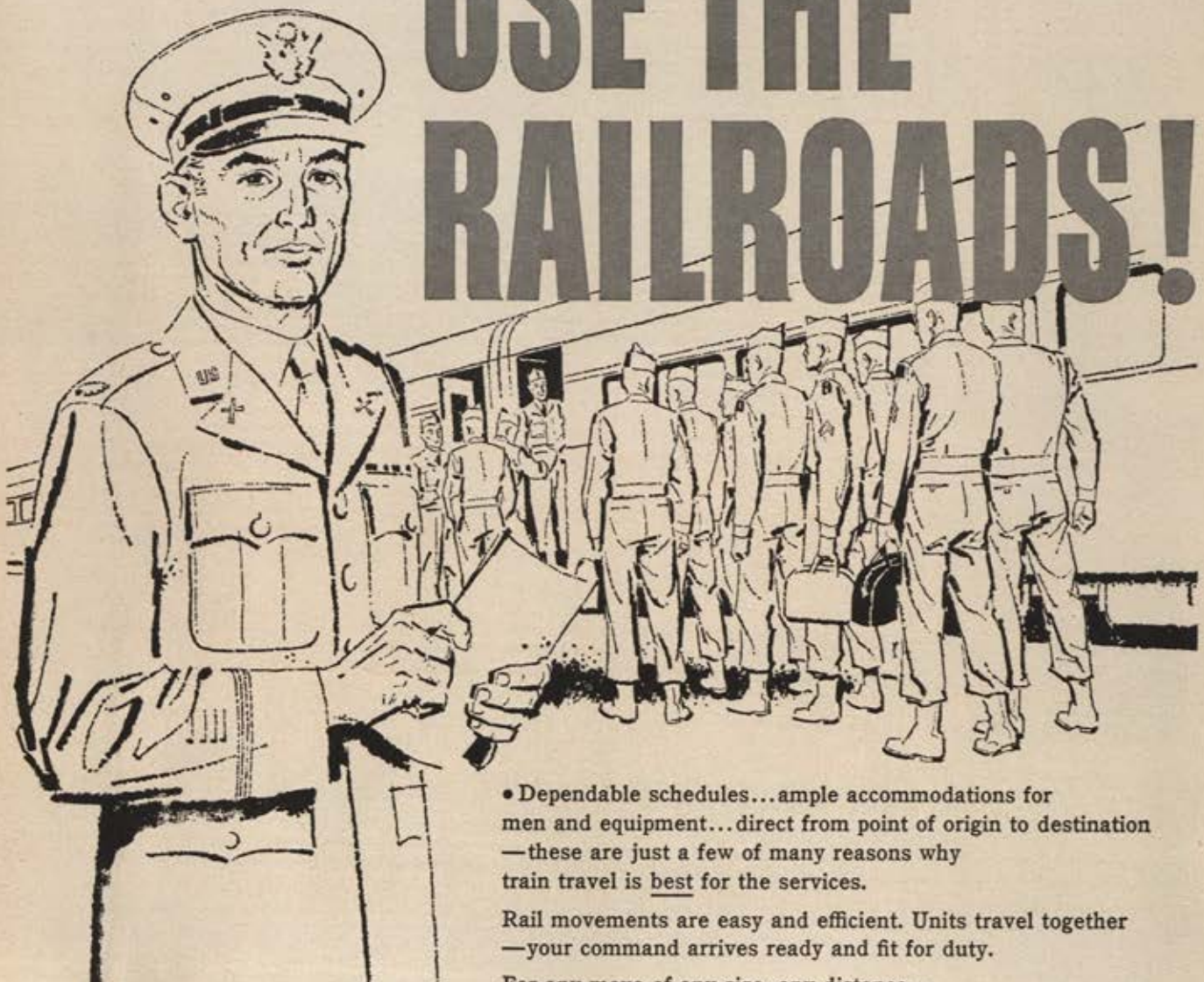

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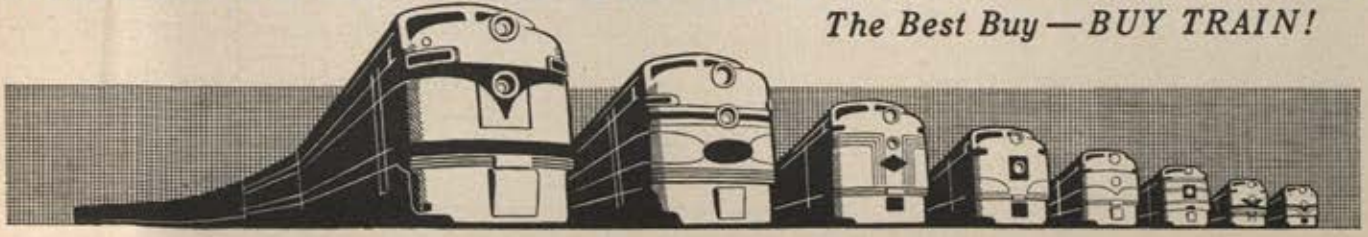

AFA NEWS

SQUADRON OF THE MONTH

San Diego, Calif., Squadron Cited for

its excellent programming schedule, whose objective is the aviation education of the community. Particularly worthy of mention are the Squadron's Air Force command briefings.

The **1959 Mid-America Missile Briefing,** an annual program sponsored by the **Illinois Wing,** the **Chicago Association of Commerce and Industry,** and the **Civil Air Patrol,** was a great success. It took place on March 5. Among the principal speakers were **Maj. Gen. Ben I. Funk,** Ballistic Missiles Center Commander, AMC; **Dr. Homer J. Stewart,** Director of Program Planning and Evaluation, NASA; and **Col. John P. Stapp,** Chief, Aero Medical Lab, Wright Air Development Center.

General Chairman for the program was **Brig. Gen. Lafeton Whitney,** USAF (Ret.). His chief assistants were **Mel Polacek,** Wing Commander, and **Harold G. "Kit" Carson,** who was elected to succeed Polacek at the Illinois Wing Convention in May.

° ° °

As this issue goes to press, we are about to inaugurate a new AFA Division. It will be composed of the graduating members of the **Arnold Air Society,** our affiliate on college campuses throughout the country. Division headquarters will be at the **University of Pittsburgh.** Leader in this movement to form a post-AAS Division has been **John D. Johnston,** a former AAS member.

° ° °

Pennsylvania high schools will provide a new course entitled **"Earth and Space Sciences"** next fall—largely as a result of AFA sessions held for educators at last year's Dallas Convention and during the recent World Congress of Flight at Las Vegas. **Bill Lunsford,** a Past Commander of the **Olmsted, Pa., Squadron,** has been told by the state's **Department of Public Instruction** that creation of this new course was directly related to attendance at the AFA meetings by Pennsylvania education leaders. The course

(Continued on following page)

Top figures at 1959 Mid-America Missile Briefing in Chicago gather around model of Air Force Thor-Able missile. Left to right, Dr. Homer J. Stewart, NASA Director of Program Planning and Evaluation; the briefing's General Chairman, Brig. Gen. Lafeton Whitney, USAF (Ret.); Maj. Gen. Ben I. Funk, Commander, Ballistic Missiles Center; Col. James J. Mitchell, Civil Air Patrol.

George P. Floyd, Jr., left, wartime bomber pilot, being installed as Commander of AFA's Orange County Squadron, Calif., by Wing Commander James Snapp, right. At center is meeting guest "Pappy" Boyington, WW II Marine ace.

At luncheon cosponsored by San Francisco Squadron: left to right, San Francisco airport manager Belford Town, FAA head Elwood R. Quesada, Walter Newman of city's Down Town Assn. Sqdn. Cmdr. Maj. Gen. L. E. Ames, USAF (Ret.).

Pennsylvania Convention: AFA National Chaplain Rev. William Laird and Philadelphia Squadron Commander Sally Downing congratulate new Wing Commander C. C. Carn after his election.

will be added to school curricula across the state in September.

° ° °

Mail in recent days has contained applications for membership in the Air Force Association from a major proportion of the **Air Force Academy's first graduating class,** the **Class of 1959.** The applications were the fruits of a campaign to bring Academy Cadets into AFA as Cadet members. The drive has been sponsored jointly by AFA's **Colorado Springs Squadron** and the **Airpower Council** there. **Don Olson,** former Commander of the Squadron and current chairman of the Airpower Council, reports plans to bring as many Cadets as possible into AFA.

° ° °

CROSS COUNTRY.... Tom Mason, Commander of the **Chico, Calif., Squadron,** has been named to the **Chico Airport Commission.** . . . The **Chico Squadron,** by the way, was doubly honored at the recent California Convention when it won the prize for having the most members at the event, and its organizer, **Sankey Hall,** was named **"AFA Man of the Year in California."** . . . The **California Wing,** already the largest in AFA, has just added a Squadron in **Monterey.** Its charter was approved May 28. . . . A new Squadron is also being organized in **Duluth, Mich.,** spearheaded by Wing Commander **Ed Kube.** . . . A whirlwind organizational tour by **Lou Ciccoli** has resulted in new Squadrons being organized in **St. Petersburg-Tampa, Orlando,** and the reorganization of the **Hollywood** unit into one

Ohio Convention: Outgoing Commander Jack Jenefsky, right, presents Airpower Award to aviation artist C. H. Hubbell. Willard L. Dougherty was elected as new Ohio Wing Commander.

that encompasses **Broward County.** These and other Florida units will be hosts for the upcoming **AFA Convention in Mami.** . . . **Frank Storm,** Amarillo, Tex., Commander, is organizing a new Squadron in the **Pampa, Tex.,** area. . . . Still another new addition is in **Colorado,** where the **Front Range Squadron** was organized by Wing Commander **Ted Stell.**

—Gus Duda

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To the left are the official hotels for AFA's 1959 Convention in Miami Beach September 3-6, listed according to their distance from the Auditorium, with the di Lido nearest. Few hotels have single rooms—most are twin rooms (two beds). The rates refer to single or double occupancy, in most cases. There are low-rate, good-quality hotels in the area of AFA's hotels, both on and off the beach, which may be requested by stating "lower-rate hotel than listed" on the coupon below. This will be of interest to budget-minded delegates.

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A Book Review

'Man in Space'

REVIEWED BY LT. GEN. ROSCOE C. WILSON, USAF

Man in Space: The United States Air Force Program for Developing the Spacecraft Crew, edited by Lt. Col. Kenneth F. Gantz, USAF (New York, N. Y., Duell, Sloan and Pearce, 1959, 303 pp., $4)

TODAY we stand on the threshold of man's greatest adventure, the conquest of space. This vision is becoming a reality because of a dedicated research effort which has extended over the years.

Man in Space: The United States Air Force Program for Developing the Spacecraft Crew illuminates the impressive program conducted over the years with the goal of putting man into space. It confines itself primarily to the problem of fitting man to the space machine and leaves the machine itself to other volumes. Air Force authorities and distinguished Air Force civilian scientists tell the story of man in space.

The first four chapters provide a necessary frame of reference for the book as well as an introduction to the physical environment of space. In chapter one Maj. Gen. Dan C. Ogle, the recently retired USAF Surgeon General, states the challenge of man's venture into space and offers some thoughtful ground rules for conducting such a complex research program.

Chapter two is by Dr. Hubertus Strughold of the USAF School of Aviation Medicine. Dr. Strughold, the "dean" of aviation medicine, traces the history of this work in the Air Force. In chapter three Dr. Strughold summarizes the physical environment of space and space-medical problems posed by manned spaceflight. Brig. Gen. Don Flickinger, Director of Life Sciences, Headquarters ARDC, in chapter four introduces the major problem areas that confront us in putting a man into space. He describes the kinds of answers that the various research programs are producing.

In chapter five Col. John P. Stapp, Chief of the Aero Medical Laboratory and widely known for his experiments on the rocket sled at Holloman AFB, tackles the problem of accelerative forces, or biodynamics.

The space cabin must generate, regenerate, and stabilize its own atmosphere for its crew to live and work in. Chapter six is devoted to this complex problem. Dr. Hans G. Clamann, of the School of Aviation Medicine, discusses the ways of providing oxygen, of controlling humidity, of maintaining a balanced diet. In chapter seven Dr. George T. Hauty, of the School of Aviation Medicine, reports on the pattern of man's work performance under prolonged conditions of confinement, detachment, sensory deprivation, a different day-night cycle, and fatigue.

One of the most provocative phenomena of spaceflight is weightlessness. What is the effect on a human being of prolonged absence of any feeling of weight? In chapter eight Dr. Siegfried J. Gerathewohl, formerly of the School of Aviation Medicine, takes up this matter in detail.

The closest that man has yet come to spending a day in space has been in the Man-High balloon flights. In chapter nine, Lt. Col. David G. Simons, formerly of the Aeromedical Field Laboratory at Holloman and pilot of the Man-High II flight, describes this test and reports on its principal scientific value—findings on cosmic radiation.

The selection and training of spacecrews is the topic dealt with in chapter ten. Dr. S. B. Sells and Maj. Charles A. Berry, of the School of Aviation Medicine, outline some of the physical and psychological problems that will face the man in space. One part of such training is given special attention in chapter eleven as Dr. Bruno Balke, of the School of Aviation Medicine, gives a report on the results of physical conditioning experiments at mountain altitudes.

In the best of flight programs there can still be emergencies. In chapter twelve Col. Paul A. Campbell, of the School of Aviation Medicine, reviews the research on escape and survival during spaceflight.

Perhaps the most exotic of all the possible phenomena that man may encounter in spaceflight is time dilation. In chapter thirteen Maj. Evan R. Goltra, of the School of Aviation Medicine, explains the theoretical and mathematical basis for the hypothesis that, as a spacecraft approaches a sizable fraction of the speed of light, time for the man in the spacecraft compresses.

Turning to vehicles at this point, *Man in Space* offers two selections on the X-15. The first, by the Editors of the *Air University Quarterly Review* with the assistance of the X-15 project office, suggests that the rocket-powered aircraft offers a possible path to the true spacecraft. This is chapter fourteen.

The second selection, chapter fifteen, presents the human factors program for the X-15. Lt. Col. Burt Rowen, of the Air Force Flight Test Center, summarizes the way man has been engineered into the X-15 system.

The final group of selections treats the near future in man-in-space research and the military implications of putting man into space. Chapter sixteen, by General Flickinger, lays out the Air Force program for research by investigative areas. He indicates the principal problems that need working on and something of the approaches being taken toward them.

"In twenty years I believe both the moon and Mars will have permanent manned outposts." This is a prediction by Brig. Gen. Homer A. Boushey, Director of Advanced Technology, DCS/D, Headquarters USAF, in chapter seventeen. He offers a variety of uses for satellites, some scientific, some military. Turning to spaceflight, he illustrates the uses and problems of exploration and colonization of our solar system by taking the reader on a hypothetical trip to the moon.

The closing chapter looks at manned space operations from the standpoint of over-all Air Force operational experience. Maj. Gen. Lloyd P. Hopwood, Director of Military Personnel, Headquarters USAF, offers certain ground rules for developing a space program that keeps the operational factor in mind throughout. Particularly, he cautions us against carrying into space our earthly preoccupation with boundaries and limitations.

Man in Space should be read by those inside and outside the Air Force who subscribe to the importance of the Air Force mission in the maintenance of peace and freedom. This is not an "easy" book. Its treatment of the subject matter is professional. But it is the specialist writing for the interested, intelligent layman, and the reward of close reading is understanding.—END

The reviewer, Lt. Gen. Roscoe C. Wilson, is Deputy Chief of Staff, Development, Headquarters USAF. He has served as Commandant of the Air War College, Commander of the Third Air Force in Europe, and Assistant Deputy Chief of Staff, Operations, for Atomic Energy. He was assigned to the atomic bomb project during the war.

airman's bookshelf

No Heroes in the Air?

***Brave Men and Great Captains*, by R. Ernest Dupuy and Trevor N. Dupuy (Harper, $5.95)**

Reviewed by Prof. W. Barton Leach

The Dupuys, father and son, both retired Army colonels, have an enviable gift of deft narrative and crisp prose in their chosen field. In thirty-odd episodes, this book reviews American military history in terms of the personalities of the leaders who made it—ranging in rank from MacArthur and Eisenhower to an unidentified Negro corporal at the Bulge, in time from Bunker Hill (Boston) to Bunker Hill (Korea), and in leadership ability from victorious genius to disastrous stupidity. The roster of the great contains unexpected names, including Sylvanus Thayer of West Point and Joseph, chief of the Nez Percés Indian tribe, who fought his battles like a War College graduate.

This is a history of the ground forces, but as a study of the qualities of leadership it is universal. It shows leaders rising to heights where a display of resolution or the simple words "Follow me!" shoots adrenalin into the bloodstream of a command. It shows others failing in crisis, often through taking counsel of their fears (McClellan), often through diverting forces in dramatic, senseless frolics of their own (Jeb Stuart). And it analyzes the qualities of character which produced each result.

The Dupuys pull no punches in their evaluations. It is gratifying to find that the Father of his Country really was first in war; that Sheridan's ride from "Winchester twenty miles away" really turned the tide at Cedar Creek; that Grant and Lee well deserve those full-length portraits in the West Point library; and that Wilkinson, "the general who never won a battle or lost a court-martial," was as inept as he was traitorous.

Three pages of perceptive evaluation of Eisenhower conclude that he "had been given a job seemingly impossible to perform. He did it, and made it look far easier than it was." The authors point out that the leadership of General Eisenhower was a compound of strategic and tactical judgment, and a vast capacity for compromise. Since they side with Ike in the post-Overlord controversy and find Patton peerless, inevitably Montgomery is sideswiped as being overly meticulous in his "full-dress, much-touted Rhine crossing."

As an admirer of Monty, I must point out that the Dupuys praise the misnamed "Mad Anthony" Wayne and William Henry Harrison for insistence on completed training, methodical planning, and a refusal to be hurried—characteristics which they seem to assess as faults in the victor of El Alamein. So, too, they find Stilwell admirable (Dupuy, Jr., was there), but Chennault gets the back of their hand. (Bob Scott's "Flying Tiger" must be talking about two other generals of the same name.)

The miracle of Remagen is a thriller. From the two PFCs who first spotted the bridge intact, through eight echelons of command (each identified by name and rank) to Ike at SHAEF, everyone acted with initiative, imagination, and professional skill. A half-hour delay at any point might have spoiled the show, but the machine functioned with the precision of an electronic brain; this was the miracle.

A final chapter sounds a warning as to organization-man thinking in the Army, "persuasive leadership" as contrasted with the inspiring voice of authority, command by consensus, and the inherent tendency of any large organization to produce conformists who don't irritate people.

Since the Dupuys are ground soldiers, it may be unfair to mention that the Army also included Mitchell, Rickenbacker, Spaatz, Doolittle, Kenney, LeMay, Weyland, Chennault (whose status as the pineapple in Stilwell's tailpipe was ancillary to his primary mission), and a flight of Andersons. If we can't produce Dupuy equivalents of our own, perhaps we should give one or both of these gentlemen a once over lightly in the skies of Texas, pin silver wings on them, make them honorary members of AFA, and see what happens.

About the reviewer: *W. Barton Leach, Professor of Law at Harvard and founder of the Harvard Defense Studies Program, served in World War II as Chief of the Operations Analysis Division, AAF, and since 1946 has been a consultant to the Secretary of the Air Force and the Chief of Staff, principally on interservice matters. A Reserve brigadier general, he is also an AFA Director, a member of AFA's Policy Committee, and a frequent contributor to* Air Force *Magazine.*

The Day the Big Balloon Went Up

***Alas, Babylon*, by Pat Frank (Lippincott, $3.50)**

Reviewed by Capt. Frank W. Anderson, AFRes.

"Alas, Babylon." To Randy Bragg these cryptic words at the end of a seemingly routine telegram from his brother, a colonel in SAC intelligence, have their own special code meaning—nuclear war may break out between Russia and the United States at any moment. After years of constant international tension and alarms it seems incredible that the big balloon is actually going up. Warm sunshine envelops Randy's little town of Fort Repose in central Florida on the day it happens. And all at once this peaceful community finds itself isolated from the rest of the country, reverting at a dizzy pace back to a primitive, defense-of-the-cave existence.

It is fitting that this book should have been published in 1959, the tenth anniversary of mutual nuclear capability. It depicts, as news stories no longer can, the point of ambivalence that we have reached during this decade. Aften ten years we are much more intellectually aware of what an all-out nuclear attack would mean. Yet we are little better prepared on the local level to cope with the sudden isolation that would result than we were ten years ago. Fort Repose has no emergency fuel supplies, no dispersed stocks of medical supplies, few standby power systems, and almost no organized community responsibility for handling what is at best a disaster situation.

As one of the handful of people in the nation with prior knowledge of the attack, Randy Bragg has a limited chance to get prepared. What could you buy in twenty-four hours that would equip you to live off the land for an indefinite number of years? He buys hundreds of dollars worth of groceries, only to find that steaks and ice cream make an interesting combination in a deepfreeze once the electricity is permanently off. He finds that insignificant items like sewing needles have suddenly become beyond price. He rediscovers what early settlers of this country had painfully known—that man can make do without most other things, but there is no substitute for common salt.

(Continued on page 109)

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This is a novel rich in technical detail, for Mr. Frank has a solid grasp of today's weapons, their application, and implications. It is rich in movement, for the story never falters in pace or falls into anticlimax. It is rich in human interest.

Rather than choosing to show the worst aspects of nuclear catastrophe, Mr. Frank shows almost the least horrible. Fort Repose, a small town off the main highways, is spared the ravages of the frantic masses fleeing from the fringes of the ruined cities. Although targets have been destroyed north and south of it, Fort Repose escapes the horror of nuclear fallout. Prevailing winds carry radioactive matter on to the east. Even nature is kind in central Florida, where almost anything will grow, where a river offers fish, and where the winter is too mild to impose a lethal penalty when fuel oil runs out.

Indeed if one had to pick one's spot for undergoing the aftermath of nuclear war, Fort Repose is almost ideal. Yet, what even "ideal" involves is pretty grim. No electricity, no gas for cars, no contact with the outside world after radio batteries have failed, no coffee, no sweets. The town banker commits suicide when he realizes that money now has no value. The town square becomes a trading center. An air-conditioned Cadillac is offered in trade for two bicycle tires, with no takers. A pound of coffee, a jar of honey, a handful of fishhooks—these are the new thousand dollar bills.

Law and order disappear. Marauding bands murder for a few chickens. The whole community turns into a sullen, distrustful sprinkling of individuals who arm themselves as best they can to protect themselves and their property. The outside world becomes a shadowy void, lighted for a time by flickering radio reports from the Secretary of Health, Education, and Welfare, the sole survivor of the top echelon of the government and now Acting President of the United States. Faint announcements from overseas tell that the new Big Three, India, China, and Japan, are debating whether Russia, France, or the United States is in most urgent need of relief supplies.

For the alert citizen who is concerned with his country's defense posture, there is much food for thought. A retired admiral in the community writes his memoirs on the strategic decisions that preceded "The Day."

"Once both sides had maximum capability in hydrogen weapons and efficient means of delivering them, there was no sane alternative to peace.

"Every maxim of war was archaic. The rules of Clausewitz, Mahan, all of them were as obsolete as the Code Duello. War was no longer an instrument of national policy, only an instrument for national suicide. We might as well have been playing on the rug with lead soldiers. . . . I think most of us sensed this truth, but we could not accept it. You see, no matter how well we understood the truth, it was necessary that the Kremlin understand it too. It takes two to make a peace but only one to

(Continued on following page)

make a war. So all we could do, while vowing not to strike first, was to line up our lead soldiers."

In the last few years several notable novels have been written on nuclear war and its survivors. These include Philip Wylie's *Tomorrow* (Rinehart, 1954) and Nevil Shute's *On the Beach* (Morrow, 1957). The most concurrent with *Alas, Babylon* is a pocketbook by Richard Foster, *The Rest Must Die* (Gold Medal, 1959). That none of them comes to similar conclusions is not surprising. If *Alas, Babylon* lacks the openly crusading tone of *Tomorrow* or the tragic poignancy of *On the Beach*'s slow but courageous demise of world civilization from radioactivity, it does show man slowly creating a new order out of the shambles of his civilization. If Fort Repose is not actually a nuclear target as New York is in *The Rest Must Die*, the treatment of the worldwide context is much superior and more credible.

Gen. Thomas S. Power, SAC Commander, said of *Alas, Babylon*: "I found it so fascinating and so extremely thought provoking that I simply could not lay it down. In my opinion it should be a *must* on the reading list for the American public and, in particular, for all dependents of SAC."

This is indeed a fair statement.

About the reviewer: *Dr. Frank W. Anderson, Jr., is Managing Editor of the* Air University Quarterly Review. *He received his Ph.D. in English literature from the University of North Carolina where he also was a member of the faculty. In World War II he served as a photo interpreter. He recently edited a popular anthology of aviation literature,* Great Flying Stories, *and is a past contributor to* Air Force *Magazine.*

Aerospace Books

Three aerospace references have appeared concurrently. Vol. V in D. Van Nostrand's ten-volume series, "Principles of Guided Missile Design," is *Van Nostrand's Dictionary of Guided Missiles and Spaceflight*, edited by Grayson Merrill ($17.50). It covers words and terms in the broad fields of missilry and spaceflight and related scientific fields. Cross referencing, illustration, and discussion of definitions add clarity to the work, giving it appeal to the specialist and nonspecialist alike.

• • •

John H. Herrick, American rocket specialist for the Space Technology Laboratories, and Eric Burgess, British-born author and space writer, have teamed to compile a comprehensive dictionary-encyclopedia of rocket and missile fact and theory. *Rocket Encyclopedia Illustrated* (Aero Publishers, $12.50), with a foreword by Theodore von Kármán, is organized alphabetically, covering words, terms and phrases, people, places, and hardware that make up the science and the world of missilry. Hundreds of pictorial descriptions cover all types of rockets and missiles, their assemblies, components, manufacturing machinery, production methods, ground and test equipment, and operations.

• • •

Sixty-five types of missiles and rockets (research, experimental, and operational) of all services appear in photo, narrative, and silhouette in *Illustrated Guide to US Missiles and Rockets*, by Stan Ulanoff (Doubleday, $3.95). This unusually practical source book on modern missilry presents general factual information needed by the reader who is a nonspecialist, including specifications, performance data, and manufacturer. Chapters cover missile powerplants and guidance systems with diagramatic explanation accompanying the text. The narrative treats the history of each missile, its mission, operation, employment, and research objective. The book is organized by missile types, and sections also cover the fantastic "new birds" coming along: manned research air- and spacecraft, satellites, and target and surveillance drones.

• • •

French writer Robert de la Croix documents Atlantic air pioneering with more than a score of stories describing the individual ocean-spanning feats of early airmen. *They Flew the Atlantic*, translated by Edward Fitzgerald (Norton, $3.95), is adventure and authentic history in one.

The first attempt to span the ocean took place a bare seven years after Kitty Hawk. In 1910 Walter Williams and his crew of five launched the airship *America* from Atlantic City. Its flight plan estimated the trip to Europe to take four to ten days. But several days after launching Williams, having meandered for 1,200 miles with dead engines and in hurricane winds, ditched off Newfoundland.

La Croix carries his narrative from the *America* through the next three decades. On July 5, 1937, the first "commercial" crossing was made. This date, according to La Croix, marks the end of the pioneering phase of transatlantic flight.

—Maj. James F. Sunderman

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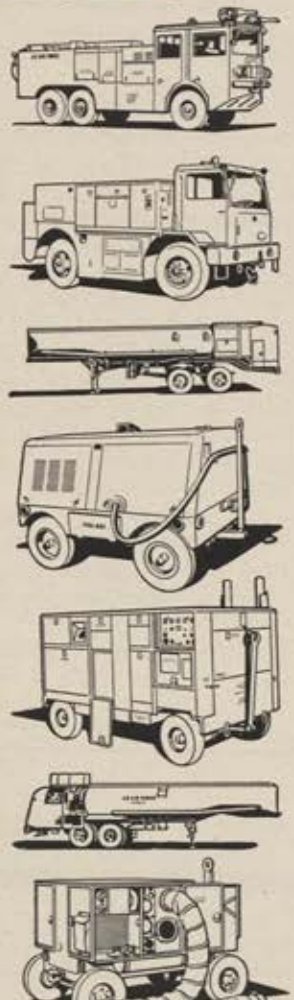

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John P. Mitchel . . . Pioneer Airman

William Gardner Bell

PHOTOS COURTESY THE NATIONAL ARCHIVES

SHORTLY after 0730 on July 6, 1918, a Spad scout plane maneuvering above Gerstner Field, La., suddenly nosed over and dived out of control. The pilot, wearing the leather flight suit, high boots, and goggles of the times, was thrown from the open cockpit.

Plane and pilot fell to destruction at the edge of the field 600 feet below.

This year, as on each anniversary of the incident, a small contingent of American Legionnaires and other persons gather at a memorial in New York's Central Park to honor the extraordinary man who thus gave his life in the service of the infant Army Air Service. The scene in the park will contrast sharply with his funeral procession, forty-one years ago, up Fifth Avenue from City Hall to St. Patrick's Cathedral.

Theodore Roosevelt, in top hat and morning dress, walked at the head of the procession for Maj. John Purroy Mitchel. A caisson drawn by six cavalry horses bore the casket slowly, ceremoniously up the avenue. Mourners lined the sidewalks along the two-and-a-half-mile route.

The Air Service wrote a postscript to Mitchel's funeral. It named the major air base in the New York area after him. Then, inevitably, Mitchel's short, brilliant life faded from view in the manner of all meteors.

Today, seen back over the past forty-one years, Mitchel's story provides a minor but arresting piece in the broad sweeping tapestry of US military aviation.

Mitchel, a "natural" as an aviator, tried to do everything and nearly succeeded in the thirty-eight years of his life. A son of the Confederacy, a grandson of Irish rebellion, Mitchel achieved unprecedented success in New York City politics early in the century. Still in his thirties, he served two terms as reform mayor of New York on the eve of the first world war.

Mitchel's grandfather was the Irish patriot John Mitchel, whose eloquence in behalf of rebellion against British rule resulted in his banishment to Australia in 1848. Slipping away in 1853, grandfather Mitchel made his way to America with his three sons, John, William, and James. Here he gravitated to the Southern cause and edited several proslavery newspapers.

All three sons served in gray as captains, and John and William—the latter a member of Stonewall Jackson's staff—gave their lives for the Confederacy. James moved north after the war to enter politics in New York City. Appointed fire marshal, he made his mark by staging a successful drive against bands of arsonists then plaguing the city.

John Purroy Mitchel was born of James' marriage with a sister of Henry D. Purroy, anti-Tammany leader of the Bronx.

John Purroy grew up as a leader. He was an attractive figure of a man, tall, slim, straight, handsome. He was an athletic man whose skill at fencing and with the pistol, as well as a sustained interest over the years in exercises requiring strength and agility, explains in part at least how he was able in his later thirties to do well in a young man's game—military aviation.

Educated at Columbia University and New York University's Law School, Mitchel was admitted to the bar in 1901, before his twenty-second birthday. A few years later he went into politics, which for Mitchel always included free-swinging controversy on a variety of issues.

Theodore Roosevelt, other dignitaries led Mitchel's slow, ceremonious funeral procession up New York's Fifth Ave.

Cavalry horses drew the casket from City Hall to St. Patrick's Cathedral. There the funeral service took place.

Mitchel, as mayor of New York City, tosses out the first ball to open the baseball season at the Polo Grounds.

Mitchel and V. K. Wellington Koo, former ambassador from China, receiving honorary doctoral degrees at Columbia.

In 1906, then Mayor George B. McClellan, son of the Union general, appointed Mitchel special counsel to investigate the offices of the five borough presidents of New York. The investigation soon led to the removal from office of three of the borough heads. Mitchel's reputation was firmly established.

Elective office came next. The reform-platform Fusion party nominated Mitchel for president of the city's Board of Aldermen in 1909. He won then, against a Democratic tide that swept Tammany Hall's William J. Gaynor into City Hall. When a discharged city employee shot and seriously wounded the mayor, Mitchel, only thirty-one, took over as acting chief executive. He made use of the unexpected authority to lead a successful crusade against a vice ring thriving at Coney Island.

Three years later, in 1913, Mitchel won the mayoralty in his own right in a tough campaign against Tammany.

Under Mitchel, New York City became something of a model for students of municipal affairs. Mitchel brought economists, social scientists, and scholars into his administration.

He administered New York City as a business enterprise, on a pay-as-you-go basis—instituting innovations which included a personnel management program and a zoning plan which became models for other municipalities.

Bitter public debate over national preparedness before American entry into World War I precipitated the close of Mitchel's mayoralty career and his entry into the Air Service. Mitchel spoke out for a general military buildup, including compulsory military training, at a time when such views were far from popular. The national Administration was itself steering a course of strict neutrality.

He stepped on more toes than usual in connection with this issue. Among them were those of the extremely popular state senator from New York City, Robert F. Wagner, father of the city's present mayor.

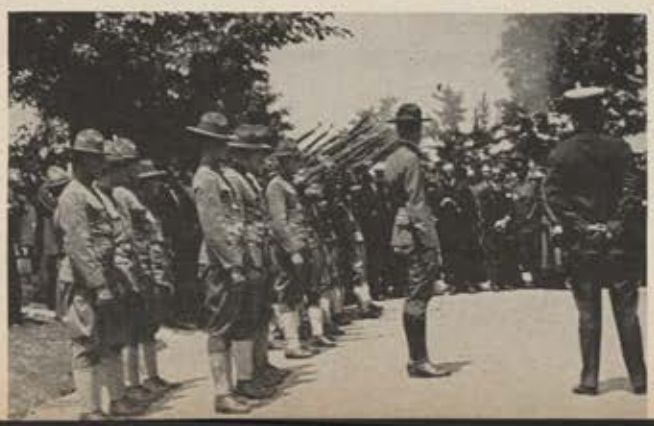
Wagner had Mitchel summoned before the state legislature, acting as an investigative body, to explain some of his sharply expressed views. Especially biting so far as the German-born senator was concerned was Mitchel's denunciation of those who, under the "guise of pacifism," were "working more in the interests of Germany than the United States." The specific matter in question was whether the state should purchase tracts of land along the sea coast for erection of fortifications.

The proceedings ended inconclusively, their content a matter of academic interest as the nation moved

(Continued on following page)

Addressing war bond rally some months after US entered first world war. An early advocate of national preparedness, Mitchel made some powerful enemies.

During the graveside services for the former mayor of New York, an Army rifle squad renders final military honors.



The Air Service presents its own stirring, sentimental tribute. Army plane dropped flowers along funeral route.

Major Mitchel and his flying class line up before a "Jenny" trainer at Rockwell Field, San Diego, Calif. Although 38 years old when he entered training, Mitchel, fourth from left, learned quickly. A lifelong athlete, he proved a "natural" aviator, was widely judged to be one of the most promising new flying officers in the Army Aero Division.

into war with Germany. The mayor proved to the satisfaction of all that he had not attributed treason to Wagner. But memories of this controversy and others in which he took part alienated large segments of the voting public at the next election, in 1917, and Mitchel lost.

By then, the United States was at war and hurriedly preparing for it. Eleven days after he left office, Mitchel received a direct commission. A few days after that, he was on the way to Rockwell Field, San Diego, Calif., for flight training.

The oldest cadet in the Air Service (his age barred him from the Infantry), Mitchel brought to his flight training the same qualities he showed in public life. After a few weeks of ground school instruction, Mitchel made his first flight on February 26, 1918, and following twelve hours of flight training he soloed on March 16. On May 4, Mitchel won the aviator's coveted double wings.

Still mayor, Mitchel stands before New York National Guard camp tent.

Next came transfer to Gerstner Field, near Lake Charles in Louisiana, a step on the road to France and active duty against the Germans. The plan called for a month's training in pursuit planes before shipping out.

Major Mitchel made his first flight at Gerstner Field in a fast scout-type plane, an American version of the French Spad, on July 5. An unusually large audience watched from the field, for Michel was not only a man of national fame but judged to be one of America's most promising new military aviators.

He was out early the next day, Saturday, July 6. By 0730 he was rolling down the runway in the same Spad he had flown the previous day. Climbing smartly, he put the Spad into a sequence of maneuvers.

It went well—for a while. Then all at once, the plane's nose turned down and it began its final dive.

The cause of the accident was never positively determined. A variety of possibilities existed.

Many of Mitchel's friends inclined to the belief that he suffered a spell of severe headache and lost control of the plane—headaches had plagued him for some years. It appears that Mitchel's safety belt probably was not fastened during the flight. Mitchel's wife, with him at Gerstner, reported that he did not use the belt the previous afternoon because it hampered his movements.

Black headlines reported the accident across the country. "No man of his generation has written for himself such a brilliant public record in such a short space of time," the New York *Times* observed in reviewing his meteoric career.

What might have been John Mitchel's destiny had he lived? Imagine that he got to France by late summer of 1918. Grant him several combat missions carried out with the verve and brilliance and competence so characteristic of everything he tackled in life. Who is to say that he might not have gone to the top of the infant Air Service or even, as his closest supporters suggested, to the highest office in the land?

A crazily diving Spad raised the questions and left them unanswered.—END.

The author, Maj. William Gardner Bell, US Army, is a decorated combat officer who has achieved considerable success in concurrent careers as a writer, historian, and editor. Presently assigned as an historian under the Army's Chief of Military History, Major Bell has served as editor of Armor *magazine and the* Armored Cavalry Journal. *During the war he fought in North Africa and Italy, earning among other decorations the Bronze Star with two Oak Leaf Clusters. He has written for some two dozen publications.*

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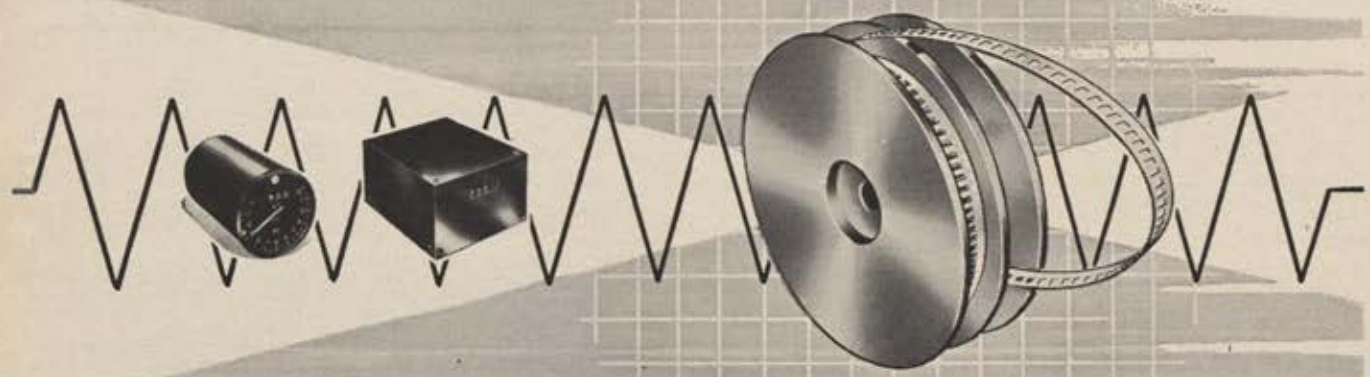

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