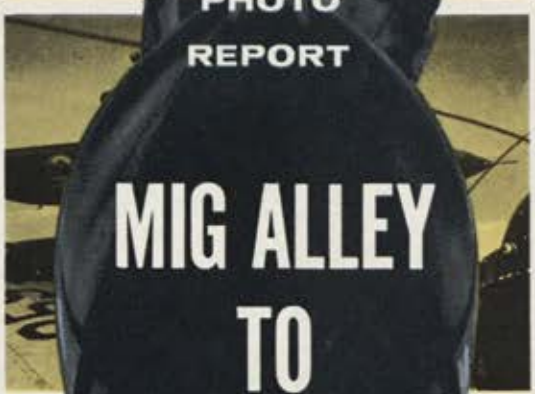
AUGUST 1959 / 50c

AIR FORCE

and **SPACE DIGEST**

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



A PHOTO REPORT

MIG ALLEY TO MISSILES

USAF on Guard Across a Troubled World

1957
Kaman flew the first helicopter to be powered with a gas turbine designed specifically for helicopters

1954
First to fly a helicopter powered by twin turbines

1951
First to fly a shaft turbine helicopter *anywhere*

1959
Kaman converts its production 100% to turbine powered helicopters, becoming the first major helicopter company to take this forward step.

KAMAN

In National Defense Kaman is part of the plan

THE KAMAN AIRCRAFT CORPORATION • BLOOMFIELD, CONN.

FAST, SMOOTH, DEPENDABLE

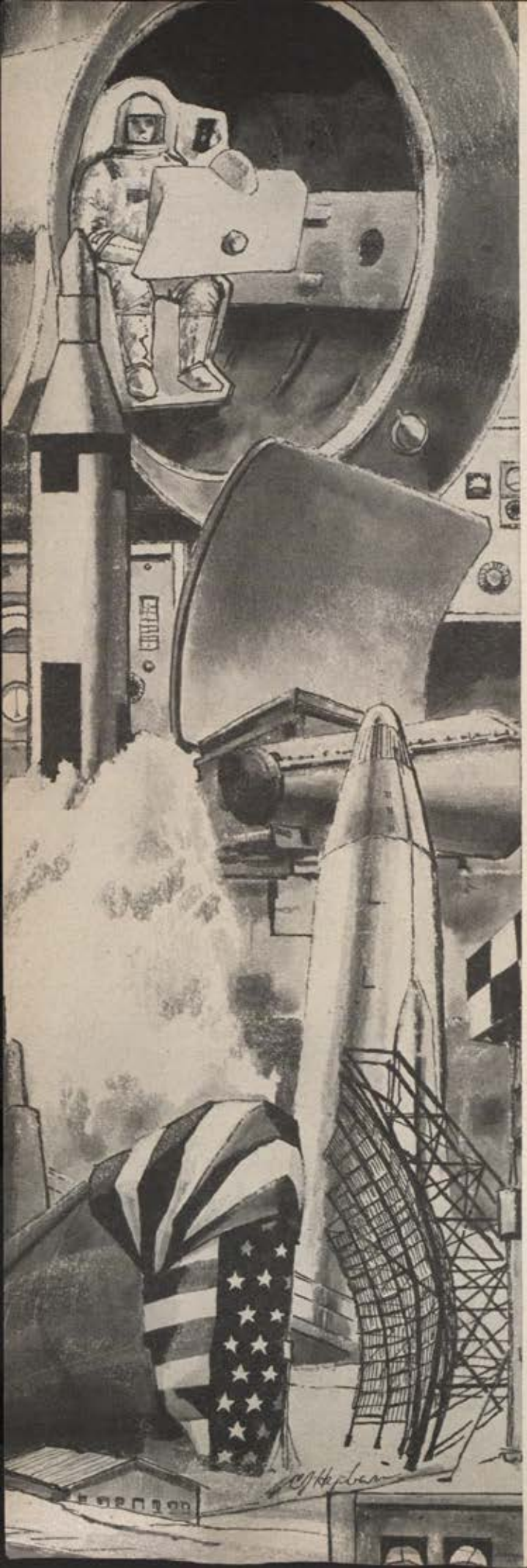
Fast, smooth, dependable... that sums up Convair's new 880 and the B. F. Goodrich Cladheat De-Icers that protect the empennage of this near-sonic jetliner.

Fast-acting ribbon type electrical heating elements with built-in temperature sensors are sandwiched between layers of resin-impregnated glass fabric. Then they are molded into a single unit and capped with a stainless steel skin. Six-foot sections bonded to empennage leading edges of the Convair 880 form a smooth, integral airfoil.

B. F. Goodrich Cladheat units reduce the possibility of re-freezing runback—cut power consumption to 15-18 watts per square inch by cycling small sections one at a time. And lightweight B. F. Goodrich Cladheat De-Icers are designed to function dependably, despite external impact damage.

B. F. Goodrich Cladheat De-Icers are available in metals of various thicknesses with power densities to meet *your* specific needs. *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Dept. AF-89, Akron, Ohio.*

B.F.Goodrich ***aviation products***



General Electric moves to provide a more effective

DEFENSE

Top systems management, technical talent are concentrated in Defense Systems Department with a charter geared to modern defense needs for:

- **Systems-oriented management**
- **Pinpointed authority, responsibility**
- **Full back-up resources**

KARSH, OTTAWA

RICHARD L. SHETLER
General Manager
Defense Systems Department

Richard L. Shetler is General Manager of the Defense Systems Department. One of the Company's outstanding system managers, Mr. Shetler's experience has included responsibility for some of the longest range radar systems ever built in this country.

SYSTEMS CAPABILITY

Accelerating technological change, coupled with the increased complexity and wider variety of choice of weapons and weapons systems, has profoundly altered the defense requirements on industry.

In line with this requirement, General Electric's Defense Systems Department, headquartered in Syracuse, New York, draws together under one roof, the systems capabilities and long-range planning functions required to draw on all of General Electric to provide the total solution to specific defense problems of the military departments of the Department of Defense and other government agencies.

UNIQUE SYSTEMS ORGANIZATION

The Defense Systems Department is a unique department within General Electric's Defense Electronics Division. Completely systems-oriented, DSD has no need for equipment design or fabrication facilities. While it determines the specifications to be met, the Defense Systems Department assigns design and fabrication functions to other General Electric departments or to some subcontractors among the 45,000 suppliers to General Electric.

But overall responsibility to the customer for the complete weapon or support system always remains within the Defense Systems Department. This responsibility is fulfilled through the Department's

- Systems-oriented program management
- Competent systems engineering
- Continuous program evaluation
- Efficient specification and procurement

These specific capabilities permit the Department to deliver the total system requirement on time, with the right quality, and at the specified price.

AUTHORITY, ACCOUNTABILITY

As the focal point within the Company for a specific system effort, the Defense Systems Department program manager has complete responsibility and accountability plus the authority necessary for the timely execution of the particular program.

OUTSTANDING COMPETITIVE ADVANTAGES

The Defense Systems Department offers its customers outstanding qualifications for meeting total prime and support system requirements including long-range planning and feasibility studies. For example, it has . . .

Demonstrated systems competence: Recent examples include the highly successful radio-command guidance system for the USAF's ATLAS ICBM which precisely guided the Atlas into orbit around the earth on December 18, as part of Project SCORE.

Full back-up resources: The full range of General Electric's scientific, engineering and manufacturing skills supports DSD capabilities.

For example, the Company's research and development programs, carried on by over 100 laboratories at an annual cost of 300 million dollars, provide the depth of knowledge for vital technological break-throughs.

For more information—or for a copy of brochure GED-3760, describing the Department's defense systems capabilities—write to R. L. Shetler, General Manager, Defense Systems Department, P.O. Box 457, Syracuse, New York. 226-1

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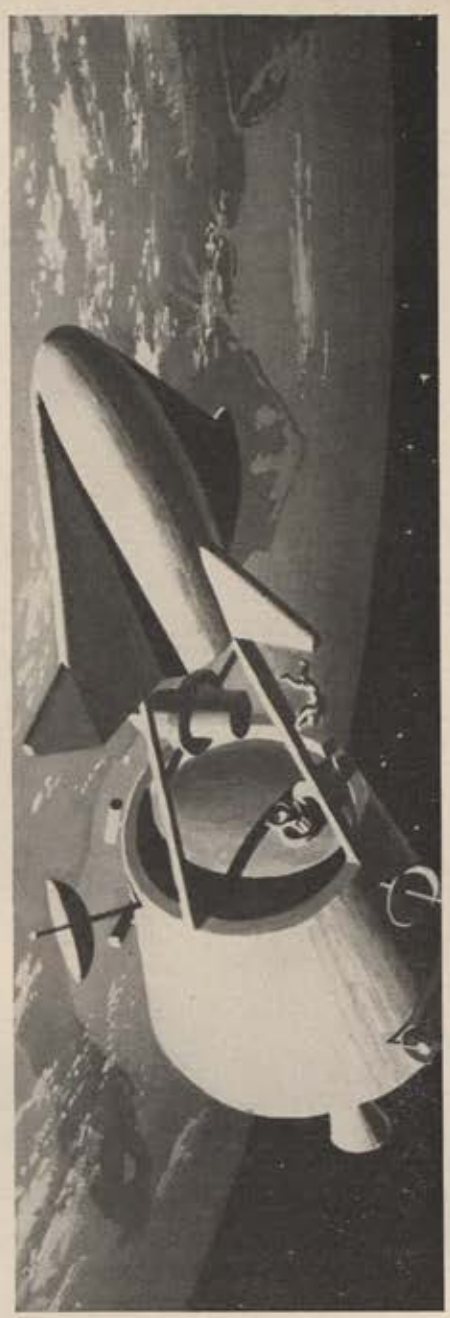
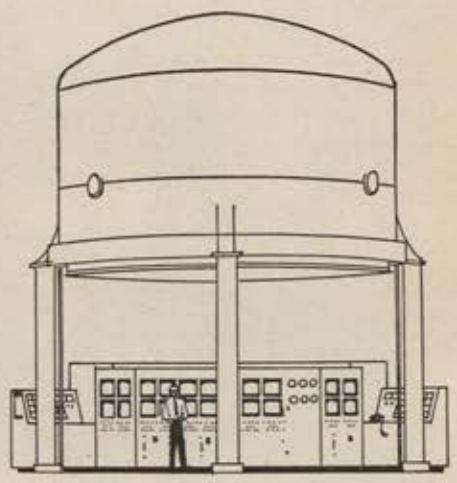
The man:

...a U.S. airman-engineer—carefully selected through rigorous test procedures from Military personnel. He will have the combination of mental acuity, superb physical condition and emotional stability necessary for pioneering in space exploration.



The mission:

...satellite observatory—a vehicle arrangement similar to this could orbit a three-man astronomical crew for several weeks. Empty fuel tank is used for living quarters. Nose section serves as re-entry vehicle for return to earth. The astronomical telescope is gimbal-mounted. External equipment shown is mounted after orbit has been attained.



The means:

...Space projects are accelerated by research equipment like the Douglas high-altitude chamber at Tulsa, largest in the U.S. In it, space environment problems can be worked out under near-operational pressure conditions, shortening the time required for development.

Depend on **DOUGLAS**

The Nation's Partner in Space Research

AIR FORCE

THE MAGAZINE OF AEROSPACE POWER

Volume 42, Number 8 • *August 1959*

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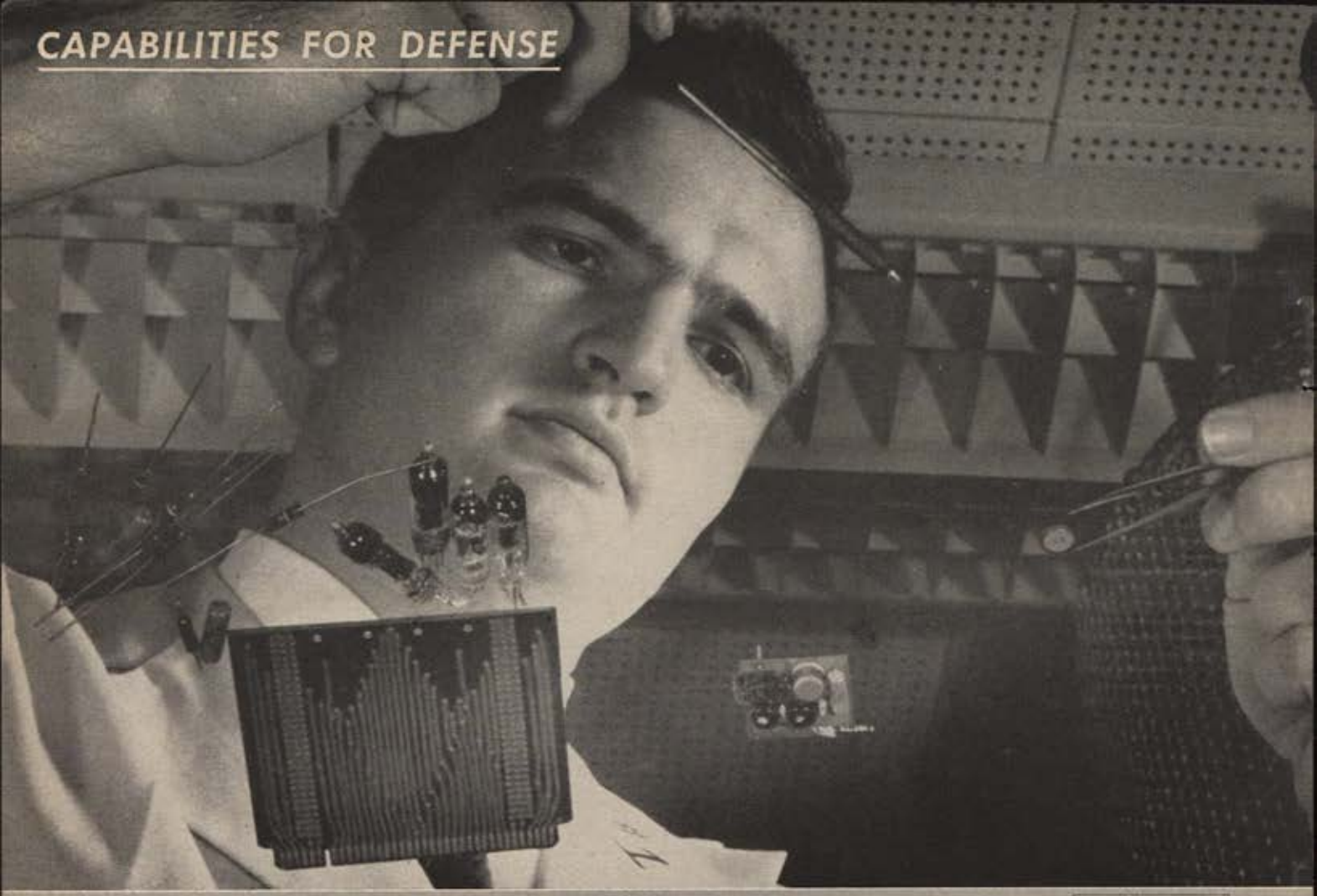
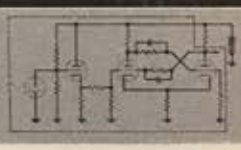


THESE THREE LIGHT SENSING SYSTEMS PERFORM EXACTLY THE SAME FUNCTION

	SIZE	WEIGHT	INPUT POWER	COMPONENTS	SOLDERED CONNECTIONS
VACUUM TUBE	4 cu. in.	26 grams	5 watts	16	18
TRANSISTORIZED	1 cu. in.	7 grams	0.75 watts	14	15
MOLECULAR SYSTEM	0.001 cu. in.	0.02 grams	0.06 watts	1	2



Westinghouse laboratory produces molecular electronic systems 1/1000th of present size

Molecular electronics—a technological breakthrough at Westinghouse—is producing electronic systems 1,000 times smaller and lighter than anything now in existence.

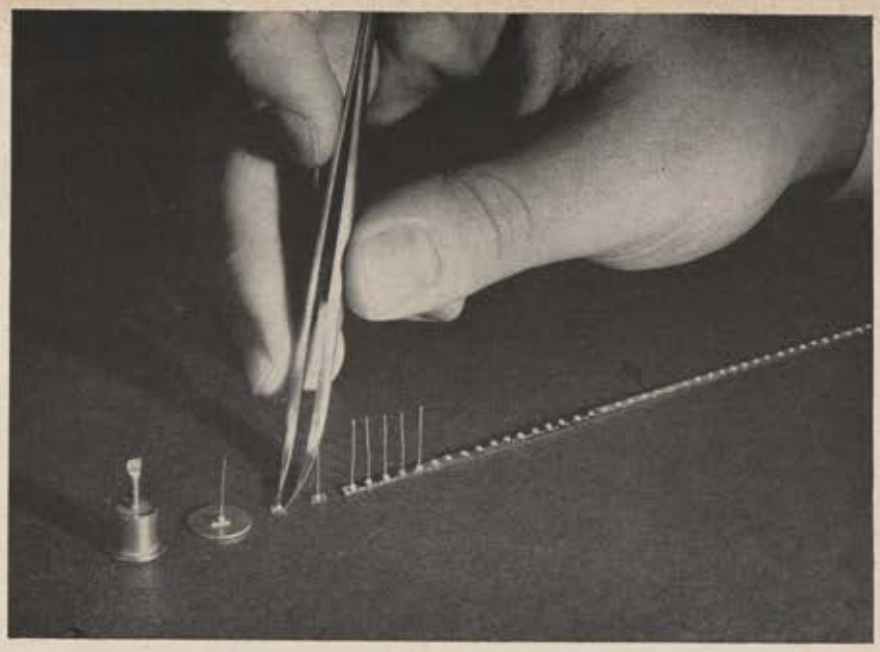
Recently, the Air Research and Development Command of the U. S. Air Force awarded a development contract to Westinghouse as a part of a broad program effort in this new electronic area. Experimental "hardware" is being fabricated by Westinghouse for infrared, reconnaissance, communications, telemetry, flight control and other military applications for the Air Force.

For some time, the Solid State Advanced Development Laboratory of the Semiconductor Division, located at the Baltimore defense divisions, has been producing for special equipment applications a single material which accomplishes all the functions normally performed by several components in a conventional assembly.

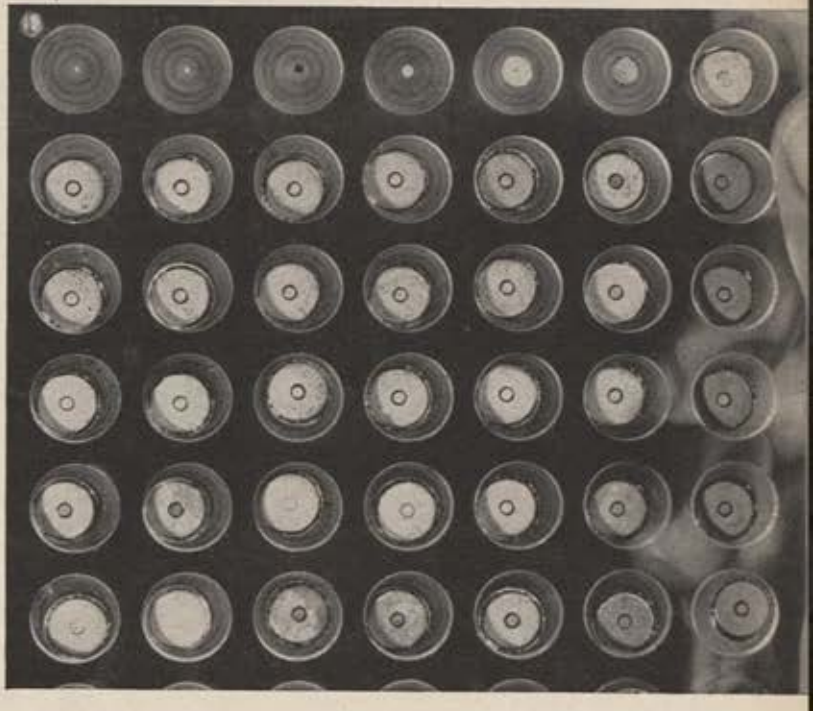
Pictured above at right, a single wafer—less than ½" in diameter and about 1/100th of an inch thick—performs all the functions of much larger conventional and transistorized light modulated oscillators shown at left and center. This tiny complete functional system, a light sensing device for satellite telemetry, is one of several including pulse generators, multiple switches and similar subsystems built and demonstrated by Westinghouse.

Through molecular electronics, drastic reduction in weight, size, power, and heat dissipation requirements will permit space vehicles and satellites to perform a greater number and wider range of tasks. Greatest advantage is vastly improved reliability achieved by the replacement of numerous components by a single solid state unit.

Westinghouse arrangement of component laboratory side by side with systems manufacturing divisions—unusual in industry—is providing a steady flow of information between component and systems scientists and engineers. A coordinated program involves the Air Arm Division, the Semiconductor Division, the Materials Engineering Department and the Research Laboratories. At all of these locations, continuing research is determining greater uses for this new approach to the building of better, more efficient electronic systems.



AUTOMATIC PRODUCTION of diodes at high speed and with great reliability may be possible as a result of molecular electronics. Shown above, individual diodes are sliced from ribbon following electrical connections. Each crystal in photo below is a self-contained subsystem, performing all the functions of a component-assembled unit. Row at top shows varying sizes to almost the vanishing point.



HIGH-SPEED GROWTH of semiconductor crystals has been achieved by Westinghouse. Crystals are formed as a mirror-finish ribbon of required width and thickness. Method eliminates costly and time-consuming sawing and polishing of germanium ingots, drastically cuts normally large loss of original material.

Westinghouse

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AVIATION GAS TURBINE DIVISION
ELECTRONICS DIVISION
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Your remote viewing, inspection and testing problems can receive the careful attention of this completely integrated facility. A simple sketch is enough to get us started. Inquiries should include such information as the size and nature of the objects to be observed, the presence of adverse conditions such as temperature extremes, blast and explosion, radiation, etc. For information on particular instruments, please write Dept. 258.

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Continuous strip fuel inspection cameras. Hot cell periscopes, underwater periscopes.

Periscopes can be provided with Radiation Resistant Optics, Internal Radiation Shielding, Corrosion Resistant Materials, Pressurized Construction, Interchangeable Viewing Heads, Interchangeable Eyepieces, Microscope Relays and Camera Attachments.

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Kollmorgen's well-equipped optical shops produce all types, shapes and sizes of lenses, prisms and mirrors to meet the most exacting requirements of industry and defense. Quantities from one of a kind to production runs of thousands. Individual elements or complete optical systems.

SUBMARINE PERISCOPES

The Nautilus and her sister ships of the atomic fleet, like almost all other U. S. submarines, are equipped with periscopes designed and manufactured by Kollmorgen.

SPECIAL PRODUCTS

Borescopes—in lengths from a few inches to forty feet, diameters from .100" to two inches. Motion picture and television lenses. Riflescopes for the military. Optical training devices. Collimators. Transit optics. Electronic devices (classified). Aerial camera and bombsight lenses.

KOLLMORGEN
optical corporation
NORTHAMPTON, MASSACHUSETTS

An Editorial

Farewell to the Troops

THERE is no denying that there was something sad about the curtain calls taken by Gen. Maxwell D. Taylor, retiring Army Chief of Staff, when he stepped out of uniform on July 1. He told the National Press Club he was withdrawing "one obsolescent general from the inventory." He said he was frustrated and that his efforts at Army modernization had failed.

The General's main pitch was that America's—and the free world's—massive retaliation policy is not valid. But his attack on massive retaliation was more of an admission that the Army had tried, and failed, to become an important part of the massive retaliatory force.

It has been pointed out in commentaries, if not in text books, that a strategic concept of this import is not a thing that comes out of the Joint Chiefs of Staff and wins endorsement from the Secretary of Defense and the President. Our reliance on massive retaliation as a deterrent to war stems from the National Security Council. It is a national policy and was not enunciated by a military leader but by the Secretary of State.

Pursuit of this policy naturally has called for major reliance on airpower even as missiles have entered the arsenal, and the transition to aerospace power stands just around the corner. It has been clear from the outset that the Army has recognized this and tried to take a maximum part in the program. It may be that a substantial part of General Taylor's frustration can be traced to what one of the news weeklies recently called the "Army's ill-starred attempt to leap beyond its earth-bound mission and become a guardian of strategic missile walfare."

If General Taylor—and Gen. James M. Gavin before him—saw a disintegration of tools for the troops, one of the major reasons could be the emphasis the Army was placing on weapons that the Army was not going to use. The Jupiter IRBM is a good example. This project was continued even after Defense Secretary Charles Wilson decreed that it would not be funded out of the Army budget. Jupiter is a weapon that is considered part of the Air Force's deterrent arsenal, but this intermediate-range missile represents a lot of development money that came out of the Army's budget.

The history of the Jupiter project, it seems to us, is proof that the Army *did* believe in massive retaliation until it became obvious that the Air Force, with ninety percent of the deterrent power in its Strategic Air Command, is the service that will retaliate if the need arises. How much progress for the *real* Army was washed down the drain in its missile effort never will be known.

One Army division commander is credited with the comment that he'd be willing to trade Huntsville—home of the Ordnance Missile Command—in a minute if he could get some good equipment for his troops out of the swap. This constitutes a nasty crack about the Army's space effort, and it is clear that a lot of intelligent Army men have doubts about the program. Yet the Army's pursuit of space ambitions goes on with the same verve that it put into Jupiter a few years ago.

If General Taylor's lament were merely a tale of woe from an old soldier it could win our deep respect and sympathy. But it is more than that. We have on our desk his biennial report, published as the August issue of *Army Information Digest*, the Army's official in-house magazine. This document is a challenge to the nation's reliance on massive retaliation and sets this challenge down as a matter of *Army policy*. Although the language is not specific on this point, it most certainly is intended as an argument for curtailment of the Strategic Air Command in favor of greater emphasis on our limited-war capability. As if to put the spotlight on this argument, General Taylor also told the Associated Press that "there are excessive expenditures in some areas, namely on manned aircraft, both bombers and interceptors, belonging to the United States Air Force and aircraft carriers."

Before many weeks are out there could be a crisis in Europe that will test the unvarnished value of this approach. Without hazarding a guess on the outcome of the Berlin imbroglio, it is clear from what has been put on the record that we do not expect to fight a ground war in the general area of the Brandenburger Tor. We are depending on massive retaliation to keep the Russians from pushing us around, and the Secretary of State, Mr. Herter, has made it clear we are not willing to be pushed around. The recent decision to move US fighter bombers out of France and into nations where nuclear warheads will be available should be sufficient proof for the most rigid skeptic.

For anyone, including the Army Chief of Staff, to imply that Russia may attack with conventional weapons on the gamble that there will be no nuclear retaliation is to ignore the announced NATO determination to use whatever weapon is necessary. Anyone who ignores that determination is truly obsolescent.

—CLAUDE WITZE

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GPL combined guidance

A.I.D. Navigation Systems

Combining state-of-the-art equipment in several fields to create new and superior systems for aircraft and missile guidance is still another GPL capability. One case in point is GPL's Astro-Inertial-Doppler A.I.D. navigation system—a stellar monitored, doppler tuned and damped inertial system—in which each element refines the others, and the system as a whole provides far greater inherent accuracies.

A.I.D. and other combined guidance and integrated systems now under development at GPL are particularly significant because they utilize *existing* systems and elements, *existing* components of proven reliability and accuracy, *existing* techniques for manufacture and maintenance. Yet continuing study of progress in the state of the art and continuing study of new system concepts keep these systems as advanced as the aircraft and missiles they will guide.

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GPL Avionic Division/airborne navigators/missile guidance/radar/airborne computers/data handling systems/communications equipment/infra-red/closed-circuit TV.

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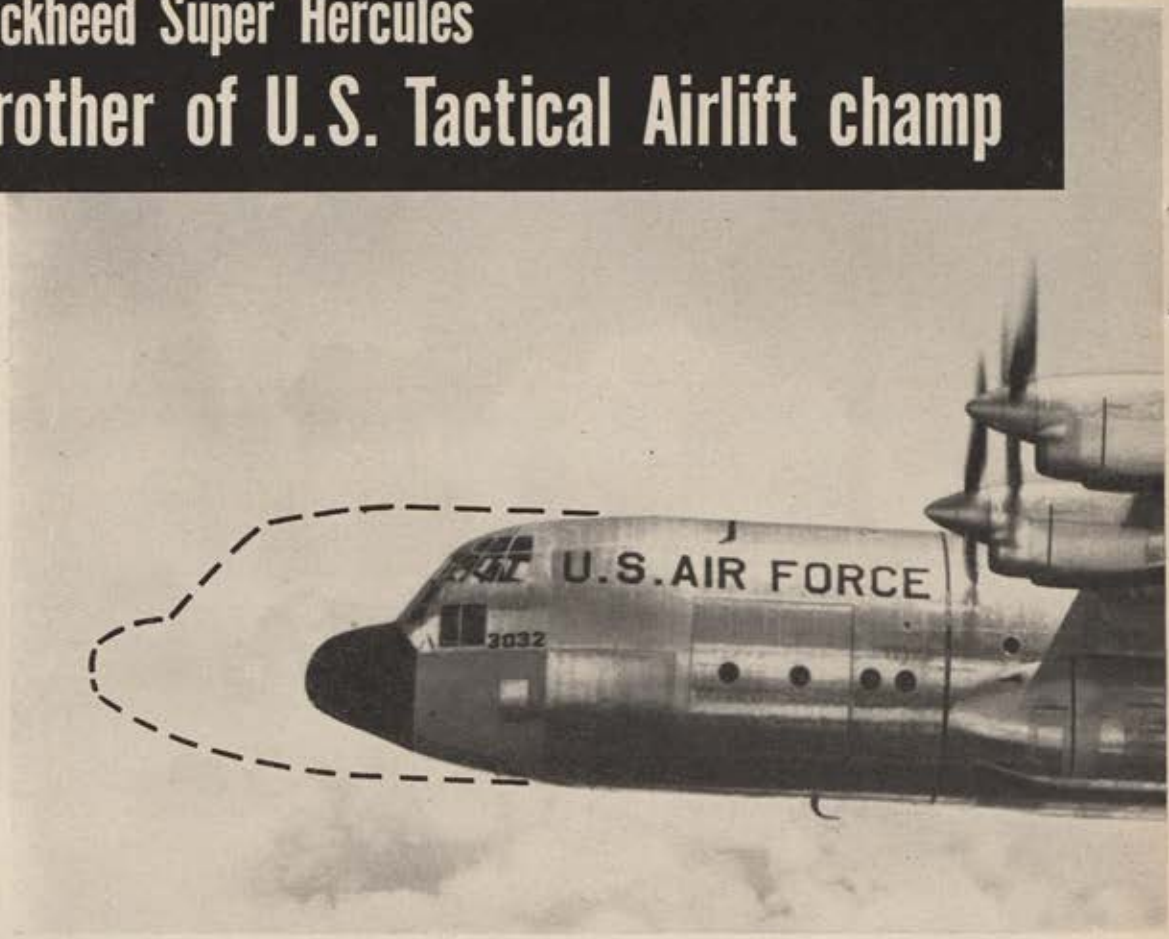
A GENERAL PRECISION COMPANY

GENERAL PRECISION LABORATORY INCORPORATED, Pleasantville, N. Y.

A Subsidiary of General Precision Equipment Corporation

New Lockheed Super Hercules
Big brother of U.S. Tactical Airlift champ

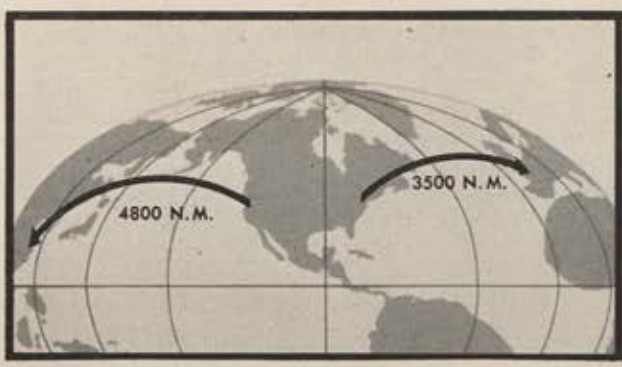


An ocean-spanning logistic support transport, the GL-207 Super Hercules is a "stretch" version of the C-130 Hercules—famous for its headline-making feats in over two years of service with USAF's Tactical Air Forces.

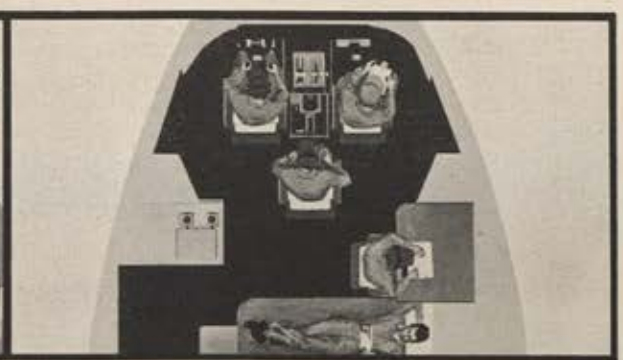
The GL-207 Super Hercules has a fuselage 23 feet longer than its brawny brother's. Its wing span is 12 feet greater... its propeller-diameter has been expanded by 2½ feet... internal fuel capacity has been increased to 10,236 gallons for greater range (pylon tanks add another 1800 gallons).

Powered by four new GM-Allison T-61 Prop-Jet engines, the Super Hercules provides nonstop trans-Atlantic and trans-Pacific transport for personnel, vehicles, palletized/containerized freight, missiles, and general cargo. Maximum payload: 78,000 pounds.

The GL-207 Super Hercules will come off production lines at Lockheed's Georgia Division. Like all Lockheed aircraft, the Super Hercules is designed for long life, easy maintenance, and low cost of operation. Result: maximum airlift, for minimum dollars.

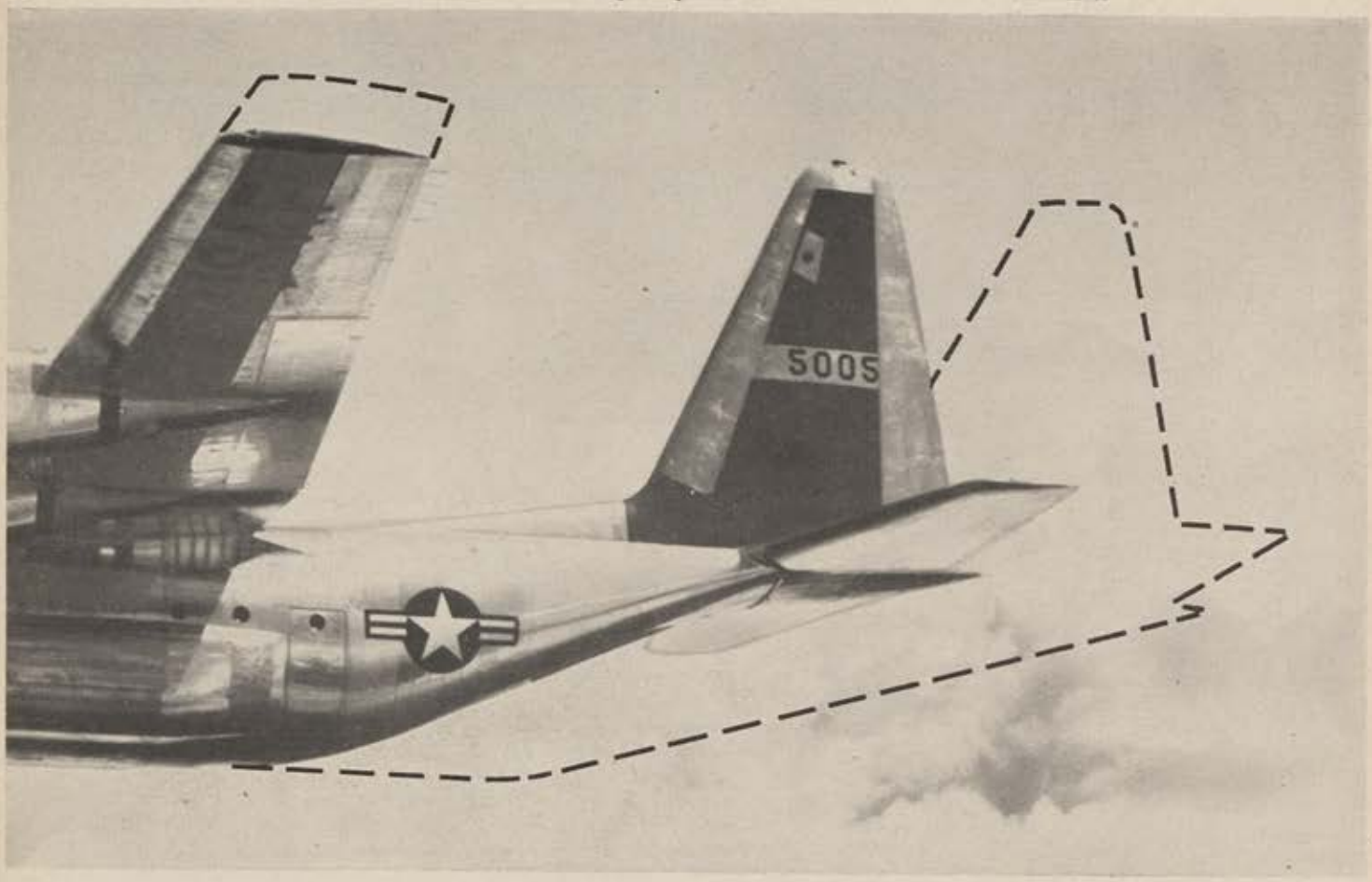


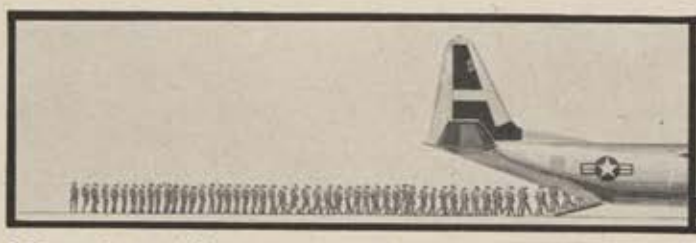
Transporting 50,000-pound MATS cargoes nonstop across the Atlantic—or, with pylon tanks, spanning the Pacific nonstop carrying 16-ton loads 4,800 nautical miles—is Super Hercules' mission.



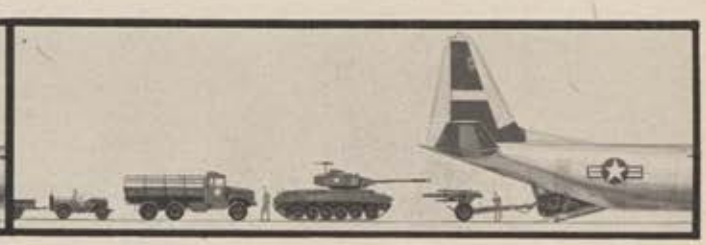
Crew efficiency on long flights is assured by flight station design approved by experienced transport pilots. Super Hercules' crew compartment includes relief crew sleeping space, galley facilities for hot meals in flight.

Dotted line shows size of GL-207 Super Hercules, superimposed over now-in-service C-130 Hercules.

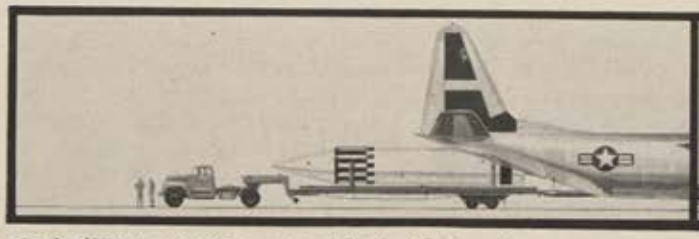




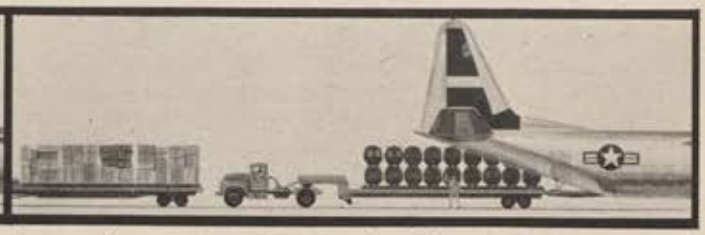
152 combat-ready troops, or 116 paratroopers can be transported in the GL-207. With airline type seats, the Super Hercules can carry 105 persons comfortably.



Combat vehicles can be driven up the hydraulically controlled ramp-door of the end-loading GL-207 Super Hercules—a vital time-saver in emergency situations.



Big ballistic missiles—assembled, with boosters, on trailers, or dollies—fit easily into the huge pressurized cargo compartment of the GL-207 Super Hercules.



Assorted cargo—runway matting, jet engine containers, fuel and oil drums, etc.—can be speedily loaded onto Super Hercules' truck-high cargo floor.

LOCKHEED

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BALLISTIC MISSILE RESEARCH & DEVELOPMENT • WEAPON SYSTEM MANAGEMENT • ANTI-SUBMARINE PATROL AIRCRAFT
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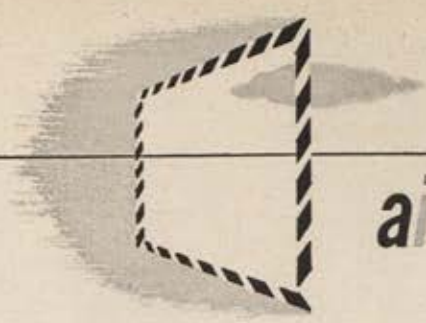
NUCLEAR REACTOR DESIGN & DEVELOPMENT • GROUND SUPPORT EQUIPMENT • WORLD-WIDE AIRCRAFT MAINTENANCE



air mail

AF Academy Report

Gentlemen: I would like to thank the members of your staff for the splendid job they did in putting together your special report on the Air Force Academy. The report is one of the most comprehensive presentations that has ever been made on the Academy's program and objectives.

With this report AIR FORCE Magazine has done a great service to the Academy, the Air Force, and the country, by disseminating accurate and complete information as to what we are trying to do.

Maj. Gen. James E. Briggs, Supt.
Air Force Academy
Colorado Springs, Colo.

Gentlemen: . . . I have received the June issue of AIR FORCE/SPACE DIGEST and want to congratulate you on this copy, especially the report on the US Air Force Academy.

Maj. Gen. Frederick L. Anderson
USAF (Ret.)
Palo Alto, Calif.

Gentlemen: Thank you for the "Special Air Force Academy Report."

It covered all the main things one wanted to know and details which were most interesting.

It fills one with pride in the wisdom shown in the curriculum, choice of instructors, physical plant, and in the cadets and the graduates, too. A man who has successfully spent four years at the Academy should indeed be able to meet and conquer many of the difficult decisions which later will surely confront him.

A word of caution to all graduates: Never show in any way that you feel superior to those officers who have not attended the Academy, for it will keep our school humping to produce another Jimmy Doolittle.

Capt. Harry C. Drayton
USAF (Ret.)
Cambridge, Md.

Gentlemen: Your June '59 issue is of exceptionally high quality in its coverage of the USAF Academy.

I'd like to recommend that a copy of this issue be donated to each CAP cadet organization's reading or study file. I am a Commandant of Cadets for the CAP cadet organization during my off-duty hours. Part of our mission is to sell the USAF and general aviation education to these teen-agers.

In the past, I've found it most difficult to find adequate material to brief and advise the CAP cadets on the extent of the Academy's academic curriculum so that they (the cadets) could properly plan their high school study program.

These donated magazines could be paid for from USAF Recruitment Funds or by some philanthropist interested in flying and the USAF. This would also afford wider publicity for the Air Force Association.

M/Sgt. Henry H. Day
Civil Air Patrol

Stop the Bickering

Gentlemen: We know you will be pleased to see that there are some folks in the Rocky Mountain area who think kindly of you and your editorial efforts [June '59].

As a personal comment, your approach to the present unpleasantness on the Hill is a logical one which, if implemented, might go a long way toward eliminating the waste and bickering that has become a hallmark of our present-day military establishment. It is not my intention to bite the hands that feed me, but as a centurion with my twenty years in, I'd hate to see the defense trough go completely dry. I fear that if the present practice of name calling and "po' mouthin'" of each others weapons and capabilities continues, we may be reduced to a defense posture based on what is determined to be politically expedient, rather than on actual assessed requirements.

Maj. Sammy A. West
Ent AFB, Colo.

Morality of Airpower

Gentlemen: I have been a member of the Air Force Association since the end of World War II and have enjoyed reading AIR FORCE Magazine. While I know the location of most of my back issues from recent years, many of my older copies have been lost or discarded.

As a Reservist I feel an obligation to interpret the significance of airpower to the people with whom I have contact. The most difficult problem is to reconcile the use of force with morality. An article appeared in your magazine and it was the answer.

The article was entitled "The Morality of Airpower" and was written by an Air Force Chaplain. Oh, how I have sought in vain for this article! I have made inquiries at the library at Mitchel AFB, the New York Public Library, and others.

There are many idealistic, well intended people who raise their voices against conscription, armaments, and nuclear testing. When a person feels righteous and assured of the virtue of morality, he can argue from a position of strength. I would not like to see any more Americans be exposed to brainwashing without the firm conviction that we are a nation working under God.

Maj. George L. Stockinger, AFRes.
Valley Stream, N. Y.

● *The article to which you refer appeared on page 156 of the August 1956 issue of* AIR FORCE Magazine. *Written by Chaplain (Lt. Col.) Warren E. Ferguson, it was entitled "How to Use Airpower Morally." We're sorry, though, that this issue is now out of print.*—THE EDITORS

Our Friend from the Boondocks

Gentlemen: First off, my son and I would like to register a complaint about the "Tech Talk" department having been dropped from your issues. We found this department very informative and pursued it to the last word. It is our hope that you will get so many complaints of this sort that you will reinstate this column in your superb publication.

Enclosed find a couple of snapshots which were taken here at the river's edge, with the big dugout and a small dugout in the background. We thought that you might find it interesting to note that at least one of your readers has no windshield or window on which to attach his AFA decal, and so the paddle seemed the most logical place

(Continued on page 16)

How Avco/ Nashville helped put a mighty airlift in the sky

Almost overnight, the USAF airlifted thousands of troops and millions of tons of cargo to Middle East and Far East trouble zones last year.

Backbone of this—and practically all tactical Air Force operations today—is the famous prop-jet C-130, the Lockheed Hercules. It flies to any spot in the world in 36 hours or less . . . loads 20 tons of cargo in 40 seconds . . . carries missiles to launching sites anywhere in the world.

To produce empennages for the Hercules, Lockheed called on Avco/Nashville. Long experience in airframe tooling by the Nashville Division assured Lockheed of positive fidelity to design, uniform quality, perfect interchangeability.

Avco/Nashville's facilities include such advanced manufacturing techniques as *Avcomb*, stainless-steel honeycomb structures, aluminum honeycomb, chemical milling, and metal bonding.

Supporting these facilities is an engineering staff that devotes its full time to airframe and missile structures, with "on site" service, and fast, economical project completion.

For more information on the Nashville Division's capabilities in aircraft, missiles, and ground support structures, write: General Marketing Manager—Structures, Nashville Division, Avco Corporation, Nashville, Tennessee.

Avco / Nashville

to put it. Actually, the paddle is more for looks than anything else as we use an outboard motor, but we do carry the paddle for emergencies. The Indians all think that the AFA emblem is real pretty and would like to have one for their own paddles. It would not stick for long, though, as they use theirs for propulsion.

Since sending in my latest renewal I have not received any magazines, so we are hoping that one will be in the next mail. We get mail every two weeks by Catalina Amphibian. It would be very helpful if you folks would send us our renewal reminder by air mail as surface mail takes from one to three months to reach us.

We enjoy the magazine very much and think it is very informative, but we would also like to register our complaint about the reversion to the beat-up use of the old foreign word "aero." What in the world is the matter with plain old air? Do you intend to rename the magazine "Aero Force"?

Incidentally, my son says that I should inform you that when LeMay's bombers passed over here on the way home from their historic trip to Argentina it almost frightened some of the natives out of their wits. There was complete cloud cover so all we got was the scream of the jets, and some of the natives were quite certain that Judgment Day was at hand. Those who were away from home ran for home and those who were at home wished they were elsewhere; and for a long time it was the main topic of conversation. The sonic boom may be rough on the folks in the States, but I'll tell you that just plain jet scream is enough to spook the Indians hereabouts. It is quite a job to explain a jet airplane to them even though most of them have seen a Catalina Amphibian.

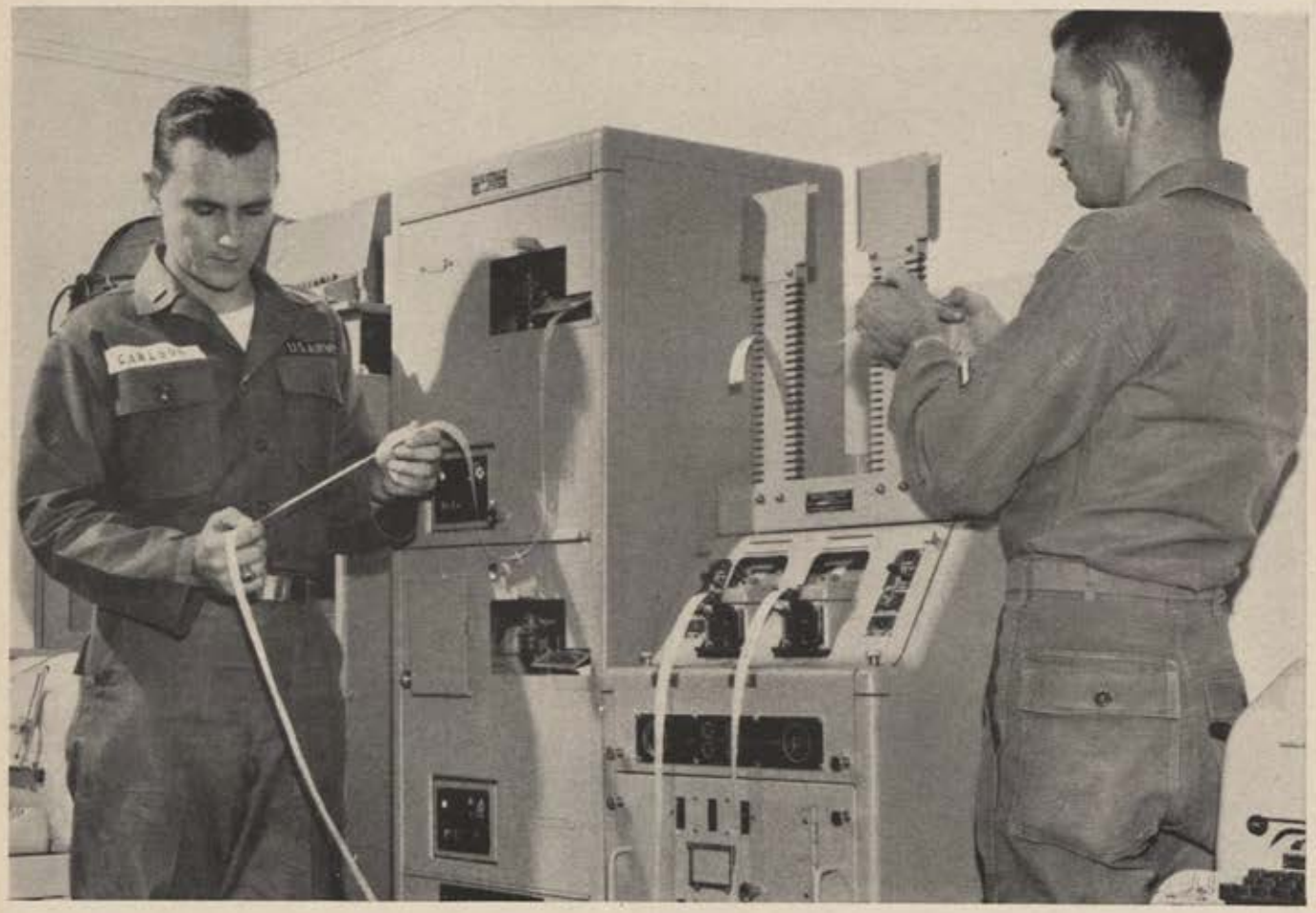
Upon this happy note we will close, assuring you that we do enjoy the magazine tremendously.

Clemence G. Smith, Missionary
Manaus, Amazonas, Brasil, S. A.

● *Perhaps our readers will remember the note from Clemence Smith which appeared in the "Air Mail" column of our February 1958 issue. Mr. Smith is a missionary to the Indians of northwestern Brazil, and we thought this word from our far-away friend would be of interest, too. We'd like to run a picture, but those he enclosed were a bit too fuzzy for satisfactory reproduction. We've asked Mr. Smith to send along another shot, together with the negative, for possible inclusion in the magazine in the near future.*—THE EDITORS

TOP LEVEL TALK

relayed on teleprinted tape



At U.S. Army field communications centers, Kleinschmidt torn tape relay units send, receive, retransmit messages to widely-dispersed commands

"Getting the word" from top command to outlying units in the field can create a communications traffic jam. This compact relay unit solves the problem. It quickly, accurately, automatically numbers and *prints* each message as it simultaneously *relays* another message to one or 100 receivers in the communications network! Developed in cooperation with the U. S. Army Signal Corps, the unit's applications include telemetering, integrated data processing, torn tape communication. In recognition of Kleinschmidt's high standards of performance, equipment produced for the U. S. Army is manufactured under the Reduced Inspection Quality Assurance Plan.

KLEINSCHMIDT

DIVISION OF SMITH-CORONA MARCHANT INC., DEERFIELD, ILLINOIS

Pioneer in teleprinted communications systems and equipment since 1911

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.

Russia's heavy-duty, all-weather fighter, the YAK-25, soon will appear in satellite air forces. The bulb-nose, two-man twin jet, which resembles the French Vautour in many ways, is destined shortly for the Czechoslovakian and Polish Air Forces. NATO code-named Flashlight, the YAK-25 is capable of revving up to 700 miles per hour. In addition to 37-mm. cannons, it carries a tray of air-to-air missiles. The tray is let down beneath the fuselage during firing, and then can be retracted. The missiles are heat-seekers, or infrared guided.

• • •

Russian airline pilots flying jets ordinarily log sixty hours of flight time a month. Pilots of piston-type aircraft log some 120 hours per month.

Soviet aircraft engines aren't allowed to chalk up many hours between overhauls. The 1,900 hp ASh-82T piston engine in the IL-14 twin-engine transport gets overhauled every 800 hours. Similar US engines run up at least twice as many hours between overhauls.

Pratt and Whitney turbojets in the Boeing 707s turn in about 800 hours between overhauls these days. The AM-3 turbojet used in the TU-104 jet transport is overhauled every 400 hours.

• • •

More emphasis is being put on technical training in the Soviet armed forces. At the end of World War II, there was one engineer or technician for every 4.2 officers. Today the ratio is one engineer or technician for every 1.5 officers. Figures are not available for the Red Air Force alone.

• • •

During World War II the USSR produced two top fighter aces whose names became household words across Russia. Interestingly, both have done quite well since—listing among other attainments membership in the Supreme Soviet, Russia's Congress.

Ivan Nikitovich Kozhedub is a Major General of Aviation in the Soviet Air Force and a Deputy Inspector of Fighter Aviation. Born in Sumy province in 1920, he became a pilot while a member of DOSAAF, a Soviet flying organization for youth. He took formal air force flight training in 1941. For a time he was a pilot instructor and later fought on the Belorussian front, where he was credited with shooting down sixty-three enemy aircraft. He came out of the war a full colonel and was sent to the command faculty of the Zhukovsky Air Academy in Moscow. During the Korean War he commanded a MIG-15 fighter division and in 1954 was appointed a Deputy Inspector of Fighter Aviation. He has been elected a deputy to the Supreme Soviet three times, and is a three-time "Hero of the Soviet Union."

Aleksandr Ivanovich Pokryshkin is credited with shooting down fifty-nine enemy aircraft in World War II. He flew a total of 560 missions, of which 156 developed into aerial battles. Pokryshkin was born in 1913 in Novosibirsk. Drafted into the Red Army in 1932, he attended the Aviation Technologist's School at Perm (formerly called Molotov). He remained in the Air Force and in 1942 became head of a fighter squadron with the Fourth Air Army at Stalingrad. Near the end of the war he took over a fighter division. Pokryshkin was the man who introduced the lead-man-wingman concept to the Red Air Force. Following the war he went to the Frunze Military Academy, then he was appointed an Inspector of Fighter Aviation. After that, he was elected to the Supreme Soviet.

• • •

Russia now has three Chief Marshals of Aviation. Latest to receive the distinction is the Commander of the Soviet Air Force, Konstantin Andreevich Vershinin—whose new title was announced recently in Moscow. The others are Pavel Fedorovich Zhigarev, now the head of the civil airline Aeroflot, and Aleksandr Alesandrovich Novikov, who is more or less retired following eight years in the Vorkuta concentration camp for past differences with the powers that be. He was released in 1954. Zhigarev and Novikov are both former Red Air Force commanders.

• • •

Recent claims by Soviet spokesmen that Aeroflot has "more civil (airline) airplanes in service than any other three nations in the world" may not be an exaggeration.

Aeroflot does many things with airplanes, such as crop-dusting, fish-searching, and ambulance work, besides hauling passengers and freight. Its backwoods operations are extensive through much of Siberia. Therefore, it may well have the giant air fleet claimed. Further, much of the Soviet civil air fleet appears to be on the ground most of the time simply because Aeroflot's aircraft utilization is very low.

In terms of passenger hauling it still ranks far behind the airlines of the US, which carried thirty-eight million passengers last year. Aeroflot gives out no figures on this score, but counts of aircraft taking off and landing at Moscow and elsewhere make it appear that the Russian airline carries only about ten million people a year. In the US American, Eastern, and United each carry about seven million passengers per year.

• • •

Russians have been giving much attention to improving their aircraft production techniques by the increased use of extrusions, pressure shaping at high temperatures. They have on hand at least two different kinds of extrusion presses. These turn out flat-ribbed structures or circular forms that can be cut lengthways, flatted out, and used for structural purposes.

• • •

East Germany's aviation industry appears to be coming along by leaps and bounds. It may soon offer a stiff challenge to Russia's own. The new East German BB-152 jet transport has looked extremely impressive in early flights, according to information from behind the Iron Curtain. The plane can carry seventy-two tourist-class passengers a distance of 1,240 miles at an average cruising speed of 500 miles an hour.

Russia's highly publicized TU-104A, by comparison, hauls seventy passengers 1,500 miles at about the same speed but at a higher operating cost. The TU-104A has much greater airframe weight and consumes considerably more fuel.

The BB-152, it is said, can take off in less than 3,500 feet—remarkable by any standard.—END

The nation's new air-borne missile launcher

The new B-52G, now in operation with the Strategic Air Command, brings a new dimension and unprecedented mobility to the missile field.

Besides its regular load of nuclear weapons, the eight-jet B-52G carries supersonic Hound Dog missiles for in-flight launching toward targets several hundred miles away.

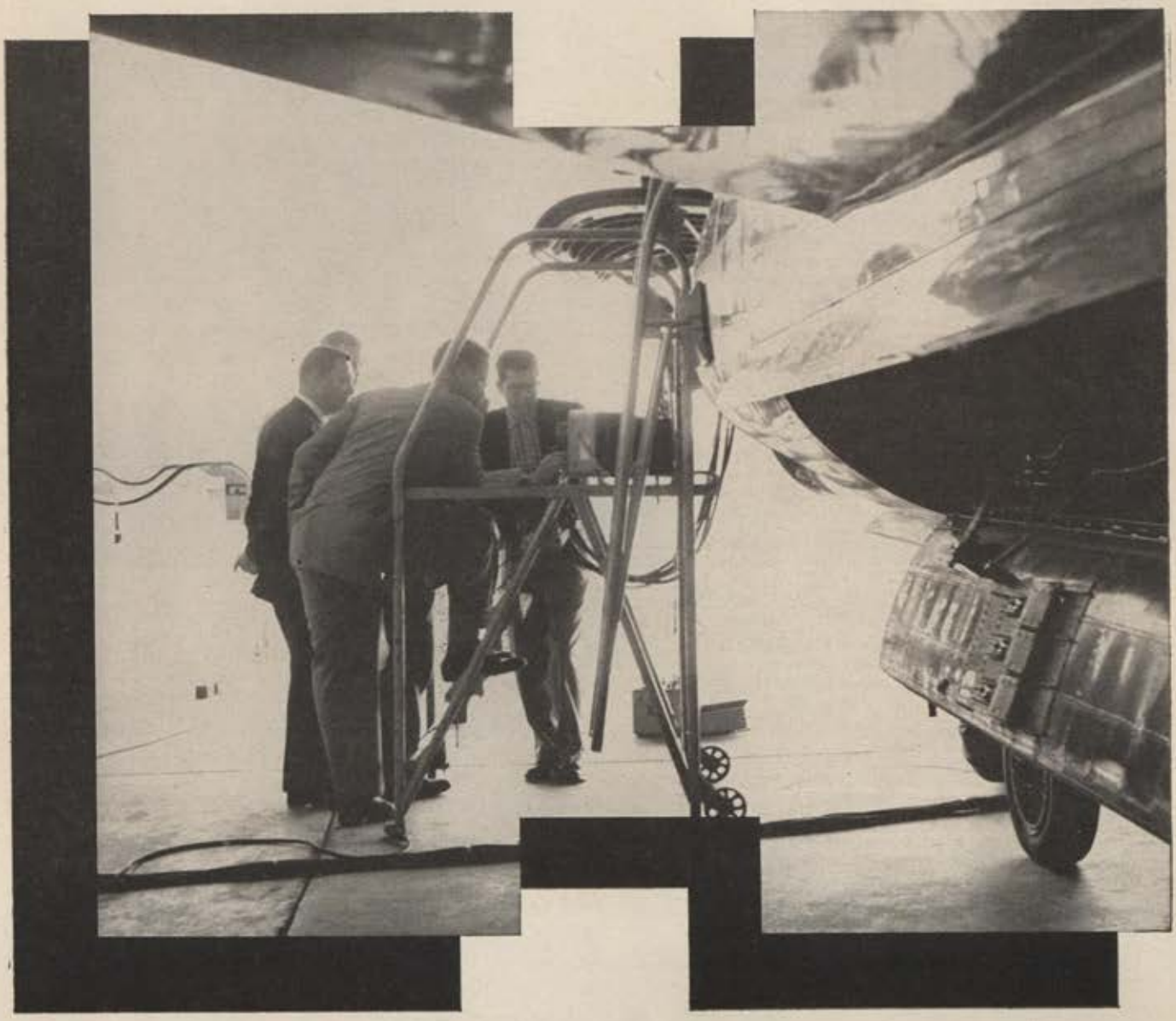
Hound Dog missile in position under B-52G wing.

The B-52G is the most versatile long-range weapon system in the U.S. arsenal. It is now, and for years will continue to be, a proved retaliatory defense weapon not dependent upon foreign bases. It is also a proved weapon system that combines accurate long-range guidance with mission recallability and supersonic weapons delivery.

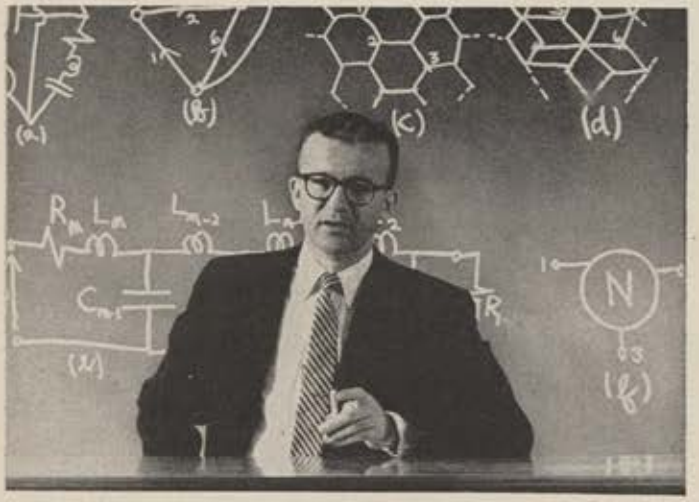
The world's longest range jet, the B-52G can span oceans and return to bases in the U.S. without refueling. On a single retaliatory defense mission each B-52G could strike several targets thousands of miles apart.

BOEING B-52G

Flying brains need



clear heads



NETWORK SYNTHESIS *is one of the many areas of study at Hughes Research and Development Laboratories. This work includes lumped and distributive parameter systems, both passive and active.*

TESTING THE TESTERS—*At Hughes Advanced Electronics Manufacturing Division, test equipment designed and built for Hughes Weapons Systems is often as sophisticated as the systems themselves!*

...and keeping them "thinking" clearly is the job of the Hughes Field Engineer. Invariably you'll find him in the company of top armed services and aircraft manufacturer's personnel. As in the photo at far left, his laboratory is in the field, evaluating a highly advanced Hughes Electronic Weapons System.

Drawing on a firm base of training in the total system, he judges and evaluates its performance. One of his key jobs is suggesting basic modifications. Simultaneously, he maintains close liaison with Hughes manufacturing groups to insure the highest standards of reliability.

The Hughes Field Engineer is typical of engineers and scientists throughout the Hughes organization. With them all, *reliability* is a touchstone to judge the value of every project.

It's so at Hughes Ground Systems Division, for example, where engineers and scientists are now exploiting a major breakthrough—3-D radar...a new development that is probably one of the most significant progress steps since radar itself was discovered.

And it's so at Hughes Products, where advanced work is being done on a variety of automatic control systems, microwave tubes and new semiconductor devices.

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. Their reliable performance is a prime reason for Hughes' status as one of the world's largest producers of advanced electronics.

The West's leader in advanced ELECTRONICS

HUGHES

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

COUNT DOWN

for the conquest of space

"MISSION ACCOMPLISHED: DEPARTING LUNA 2205 ZEBRA"

This message, flashed across a quarter-million miles to Washington, D.C., will be awaited anxiously by millions.

But even then our first expedition to the moon will still face its most crucial test—the journey home to earth.

The success of that trip will depend in large part on rocket propellants—fuels and oxidizers that will have been stored for days in the tanks of the expeditionary vehicle and yet will respond instantly when needed.

Storable liquid propellants is one of the fields in which Rocketdyne has anticipated the future. For more than ten years, its propellant chemists have been studying, engineering, and testing combinations of storable fuels and oxidizers for greater storability and higher energy.

Storability PLUS high energy

Rocketdyne has tested these combinations in all production and experimental engines. The results prove that today's storable fuels and oxidizers have these important capabilities:

(1) High performance, even after months or years of storage; (2) Stability over a wide temperature range, permitting storage in missile tanks without rigid environmental controls; (3) Dependable performance, predictable even at extremes of heat and cold; (4) Instant readiness for firing at any time during the storage period; (5) Energy yields equal to or higher than those of conventional propellant combinations.

Second-generation missiles

The tests also prove that engines developed for conventional propellants can be converted to storable combinations rapidly and inexpensively—a significant consideration in the development of second and third generation strategic, tactical, and air defense missiles.

Significant, too, is the *potential* performance of storable combinations. Research points to energy yields as high as 400 seconds of altitude specific impulse—performance 20 percent higher than that of today's combinations. These high-energy yields will offer new capabilities and greater flexibility for America's scientific and military programs.

Stepping stones to Space

Rocketdyne has designed and built much of today's operating hardware in the high-thrust rocket field. Engines by Rocketdyne power most of the military and scientific projects sponsored by Air Force, Army, and NASA. This experience now becomes the point-of-departure for tomorrow's journeys into the unknown.

POWER FOR AMERICA'S MISSILES

Thrust chamber production line for Thor and Jupiter at Rocketdyne's Neosho, Mo., facility moves smoothly.

FIRST WITH POWER FOR OUTER SPACE

ROCKETDYNE

A DIVISION OF NORTH AMERICAN AVIATION, INC.

AIRPOWER in the news

Claude Witze
SENIOR EDITOR

Watches and Weapon Systems

WASHINGTON, D. C.

This may be hard to believe, but it is a fact that one of the menaces to the defense program today is an *unsigned* letter received by a congressman. The letter complains about the brands of watches sold at the Fort Myer (Va.) Post Exchange.

The representative, who is Alfred E. Santangelo of New York, also has read a book called *USA, Second Class Power?* and studied a few lists of retired military officers who now work for defense industries. On the basis of this assorted literature he offered an amendment to the fiscal 1960 Defense Department Appropriation Bill that would have forced contractors to fire retired military officers of general or flag rank who have been out of uniform for less than five years.

Appearing as a witness before the Subcommittee for Special Investigations of the House Armed Services Committee, Mr. Santangelo faced some incisive queries from John J. Courtney, the committee's able counsel. Under Mr. Courtney's intelligent pressure, the record now shows that the amendment was a reckless proposal. Consider the matter of the watches:

Mr. Courtney: . . . what is your conclusion . . . as to whether or not anyone is being favored in the purchasing of watches for PX resale?

Mr. Santangelo: All I can state is the fact that there are three types of watches which are being sold, to the exclusion of others.

Mr. Courtney: Well, do you have any conclusions as to whether or not there is improper influence or any coercion of any kind leading to the facts which you have found, and which you accept as correct?

Mr. Santangelo: I wouldn't make that statement, except the statement that there are three watches which are being sold in preference to any other watches.

There went the case in a puff of smoke. The congressman had no evidence that the watches sold by the PX were put there, as he was told by "anonymous people," by military persons who were obtaining special consideration for "certain companies."

Mr. Santangelo's interest in watches at the PX would be a little funny if it were not for the fact that his apprehension led him to offer the Appropriation Bill amendment, which failed by only a single vote. Had it passed and stayed in the law, it would have created untold havoc in much of our defense industry where experienced military men are making valuable contributions to the development of weapon systems. Because of Mr. Courtney's skill, Representative Santangelo turned out to be an excellent witness for the defense. The only lament that is left is the pathetic coverage given in the press, which had screaming headlines to announce the Santangelo effort in the House but ignored almost entirely his appearance before the committee, where the real weakness of his position was exposed.

Another New Yorker, Rep. Samuel S. Stratton, also helped keep matters within the bounds of reason. The Santangelo proposal, he told the subcommittee headed by Rep. F. Edward Hébert, was "unwise and unsound." Mr. Stratton submitted that the amendment was based on a false assumption, that the employment of former officers by defense industries is necessarily evil, a "detriment of the government, the taxpayers, and the defense program as a whole."

This matter of the assumption of evil is one that deserves increasing attention. There is a disturbing tendency both in Congress and the press to ignore the fact that today's defense industry is a partner in the defense effort. Also ignored is the truth that officers of general and flag rank are approved by the Senate before they are given positions of trust in the armed forces. That their integrity should be challenged after they shed the uniform is almost incredible. And the "facts" are wrong.

One example of this is the insistence of Mr. Hébert that retired pay of the military is what he calls "federal money" that comes out of the taxpayer's pocket, just like his committee's expense account. This simply is not true, and it took another member of the Armed Services Committee, Rep. Paul J. Kilday, to make it clear that retired pay belongs to the officer. It is his money and is considered part of his *earned income*. This factor is given weight in the determination of military salaries.

Here is another example. In the Washington *Daily News*, Ed Koterba, a columnist, recently went into a frenzy over what he called "lavish parties" that are "financed by the taxpayers." He said the tabs usually are picked up by retired generals on the payroll of defense contractors. Then, according to this reporter, the company "tacks the expenses of the lush party to the cost of its defense contract."

This, too, is not true, as the comptroller of any defense plant can testify. Entertainment is *not an allowable cost* on a defense contract and never has been. What is spent on entertainment comes out of money that otherwise would go into the stockholder's melon. And, if Koterba and Mr. Hébert will continue the research, they will find that defense industries have melons that are far smaller in proportion to sales than those of nondefense industries.

And while we are on the subject of what defense contractors do with their legitimate profits, it is fitting to point a finger at the new $10 million John Jay Hopkins Laboratory for Pure and Applied Science, just dedicated at San Diego, Calif., by General Dynamics Corporation. The $10 million is *not* taxpayer's money, despite the fact that General Dynamics is predominantly a defense industry. The laboratory will be used for research work on atomic projects that are aimed at improving the American economy. It represents American capitalism in action. It is an important weapon in the cold war.

There are several bills already before Congress that seek to curb, to one degree or another, employment of former military officers by defense industries. The Hébert hearings presumably will help Congress decide what to do about them. The chairman has declared that he has no preconceived ideas of what the facts may be regarding the ethics

(Continued on page 27)

AN ACHIEVEMENT IN DEFENSE ELECTRONICS

NEW AMPLIFIER CUTS NOISE TO BOOST RADAR RANGE 40%

This new solid-state parametric amplifier made possible the reception of Pioneer IV signals through more than 407,000 miles of space. Because the easily tuned amplifier cut receiver noise to a mere whisper, General Electric's tracking station accomplished the feat using a standard 18-foot dish antenna. This was four days after blast-off, with the satellite transmitting a signal of less than two tenths of a watt.

Since that time, G-E parametric amplifiers have been applied to existing radars and have reduced input noise 6 db—equivalent to a 400% transmitter power increase or a 40% addition to effective range. Achievements such as this continue to prove General Electric's outstanding technical competence in defense electronics. 227-1

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GENERAL ELECTRIC

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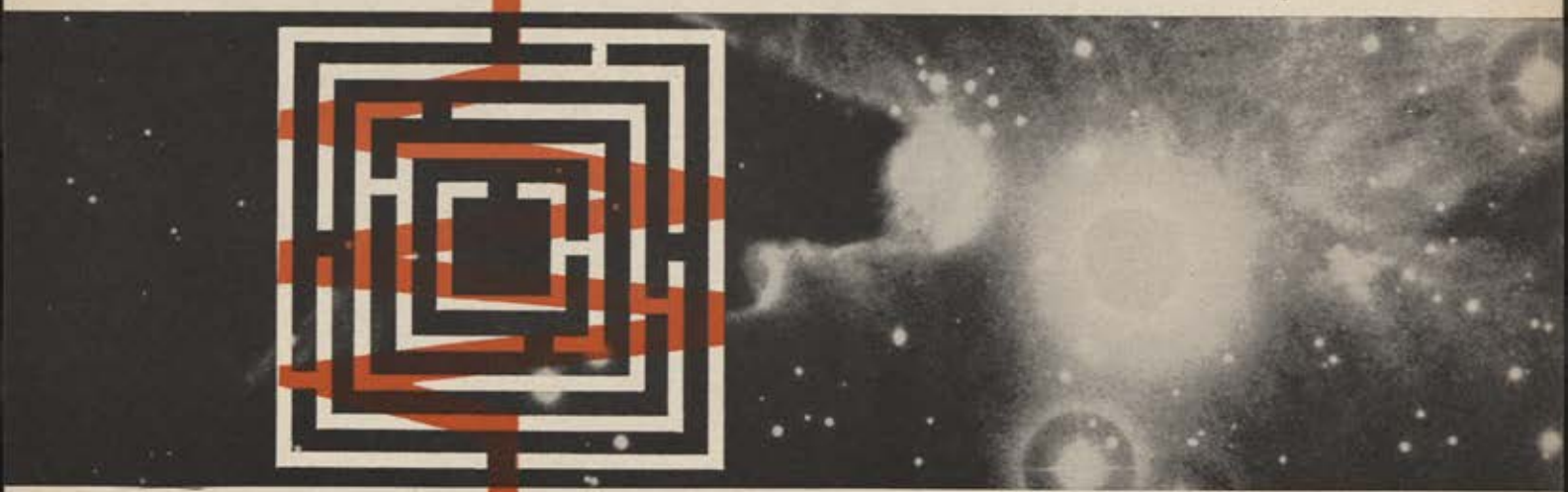

COMPUTATION FOR THE SPACE AGE

EXPEDITIONS INTO SPACE FOLLOW TRAILS BLAZED BY COMPUTATION SPECIALISTS. IN THIS HIGHLY SOPHISTICATED TECHNOLOGY, BURROUGHS CORPORATION'S DEMONSTRATED COMPETENCE RANGES FROM BASIC RESEARCH THROUGH PRODUCTION TO FIELD SERVICE AS PROVED BY PROJECTS SUCH AS THE AIR FORCE ATLAS. BURROUGHS CORPORATION IS EQUIPPED BY ABILITY AND ATTITUDE TO FUNCTION AS A TEAM MEMBER—A CLEARCUT RECOGNITION THAT EVEN IN THE REACHES OF OUTER SPACE, THE SHORTEST DISTANCE BETWEEN TWO POINTS IS SINGLENESS OF PURPOSE APPLIED TO MUTUAL OBJECTIVES.

Burroughs

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"NEW DIMENSIONS / in computation for military systems"

ELECTRONIC LIFE PRESERVERS FOR THE MISSILE AGE

They're known as countermeasures.

To you, they could represent the difference between life and death.

Their job: to make missiles miss.

Active countermeasures may jam the radar which guides a missile. Or blind its electronic eyes. Or deflect it from its course. Or help seek it out and destroy it—miles from its target.

They Cannot Wait

If an attack ever comes, there are only minutes in which to act.

ITT is one of the companies holding the stop watch.

More than 15 years ago, in fact, the Department of Defense anticipated missile warfare and assigned the ITT System to the development of countermeasures.

Since then, many have been perfected. Others are now being tested. Still others are being rushed to completion. Some are active countermeasures. Others are passive countermeasures, which record hostile electronic activities.

Hundreds of ITT scientists and technicians, specialists in fields such as physics, astronautics, electronics, chemistry and metallurgy, are devoting their energies to the job.

At their disposal are the facilities of 101 growing research and manufacturing plants.

Many Other Big Jobs

Countermeasure development is one of the many areas in which ITT is engaged for the defense of the United States.

Guiding, controlling and testing missiles—to defend, to retaliate—is another vital area of activity. Still another is the creation of a split-second global communications system for the Strategic Air Command. And the development of earth satellites is another.

The all-important job of operating and maintaining the DEW Line, our Distant Early Warning radar network in the Arctic, is also an ITT assignment.

Countermeasures Come First

The potentiality of missile warfare is a fact we must face squarely, realistically and *quickly*. Countermeasures must be on call. ITT will help to get them there in time.

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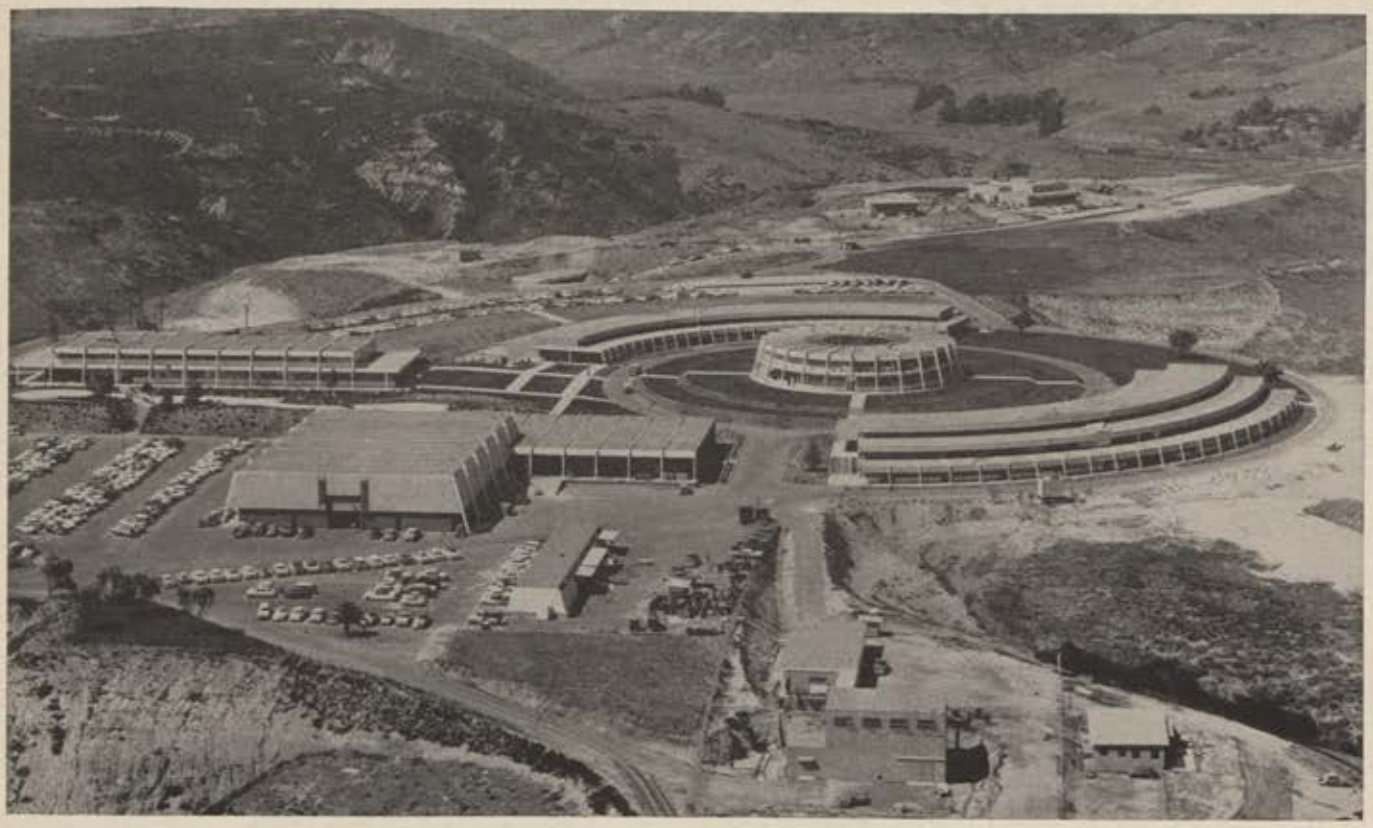

This is General Dynamics Corporation's John Jay Hopkins Laboratory for Pure and Applied Science in San Diego, Calif. It was built at a cost of $10 million. The money came out of corporate profits; it is an investment by the stockholders.

of ex-officers in these positions. He says he is looking for the facts and that he wants to start "pulling back the shroud to get a look at the truth." This indicates that the truth may be dead, which is a distinct possibility unless the contributions of former military men, and their corporations, are made clear on the record.

One of the best early witnesses in this regard was the more-or-less unpopular Vice Adm. Hyman Rickover, who refused to give out a list of names of persons, once of the military services, with whom he had discussed atomic power projects. To do so, he told the committee, could result in injustices.

The Admiral won support for this thesis from Rep. Melvin Price, who believes that if an applicable idea is generated in some facility such as the new General Dynamics laboratory in San Diego the snappy sailor who built the atomic submarine should know about it. And, if he is told by an ex-military man now on the General Dynamics payroll, that is not an evil thing. It may be the best thing and it does not constitute "pressure," if anyone in his right mind possibly can conceive of swaying the mind of Hyman Rickover.

It appears that the entire idea that legislation is needed has grown out of false assumptions, spiced by misinformation, some of it out of anonymous letters. There is a genuine danger that in passing new laws we will burn down the house in order to eliminate a couple of termites. Testimony presented in the first week of hearings indicates that Defense Department officials, represented by Deputy Secretary Thomas S. Gates, Jr., and men now in uniform believe the existing regulations are sufficient. Adm. Arthur W. Radford said he could not recall a single instance in which a retired officer tried to influence his decisions improperly. This means he has not seen any violations of the law or the military code of ethics which applies to retired officers as well as to those in uniform.

Speculation at this writing is that there will be a minimum of restrictive legislation recommended by the committee, although it may be accompanied by an "Hébert Code of Ethics" that will define some of the gray areas. If this is the result, it will be recognition of the contribution being made to the defense effort by retired military officers on industry payrolls. This has been emphasized by no less a person than Defense Secretary Neil H. McElroy, who put it on the record that "retired officers of our military services have done very good work in behalf of defense production." He called for protection of their right to fill these jobs, which is the same as the right of every other citizen.

It is interesting that Mr. Hébert, on at least one occasion, has traced the genesis of his inquiry back to the White House. There, President Dwight Eisenhower, who once was President of Columbia University while on retired military status, made his famous remark about a "munitions lobby" operating in Washington. According to Mr. Hébert, it was that unkind remark that made the Santangelo amendment such a lusty young threat when it was born on the House floor.

This illustrates the importance of using carefully chosen words in this town and making sure, at every opportunity, that the facts are straight. The formula for the present situation included a dirty label, reckless charges out of a popular book, and anonymous letters and a general low state of intelligence on the whole subject of weapon systems and how they are sold.

That the outcome could result in vast injustices and major damage to the defense effort, so far is the only proven fact. The Fort Myer PX still sells only three types of watches.—END

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Industry Briefing Speaker
Friday, September 4

LT. GEN. BERNARD A. SCHRIEVER
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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:

12:00 N Finish of Ricks Flight
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:

12:00 N Panorama Open to Public

*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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AFA's 1959 Convention program offers something special for everyone attending. There will be a classified briefing for industry, a seminar for Reservists and Guardsmen, business sessions for AFA leaders, a symposium for everyone, and a series of luncheons, banquets, and receptions.

The biggest, most colorful Air Force Reunion ever held will climax the Convention Saturday night, September 5, at the world-famous Fontainebleau Hotel. For the thousands who received their World War II training in Miami Beach, this will be a "homecoming"; to others, it will be an opportunity to renew thousands of service friendships in one of the best vacation spots anywhere in the country.

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( ) Aerospace Banquet @ $10 — $ .....
( ) Awards Luncheon @ $ 6 — $ .....
( ) Air Force Reunion @ $ 7 — $ .....

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P-107
AIR LAUNCHED

P-106
GROUND LAUNCHED

AERONCA TARGET MISSILES PERFORM A VARIETY OF MISSION PROFILES... WITH SUBSTANTIAL ECONOMY

The adage "practice makes perfect" keynotes today's concept of missile warfare. Against supersonic targets, there isn't time for "the second barrel". Therefore, extensive operational testing of air defence systems . . . and training programs for personnel who operate them . . . must be conducted to assure national preparedness.

To accomplish this requirement at minimum cost, Aeronca has developed two expendable, lightweight, high-performance target systems under the Design-Tool-Produce envelope concept. These proprietary missile programs, the P-106 and P-107, are designed for supersonic performance and accurate scoring at all required altitudes, speeds and ranges. *And their production cost is projected to be substantially less than any current target missile system!*

Another Aeronca-produced missile project is *Pogo-Hi II E3c.* Ground launched to high altitudes, this target utilizes a radar reflective parachute and an infrared emitter package. It is used as "bait" for such current projects as *Nike, Talos, Sidewinder* and *Falcon.*

With integrated Design, Tooling and Production capabilities, Aeronca can produce weapon systems envelopes at either prime or subcontractor levels.

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Operational expansion has created openings for additional senior engineers. Write to W. W. Gordinier, Personnel Manager.

FLIGHT LINES

The Mach 2 **Republic F-105 fighter bomber** took a giant step toward joining the operational Air Force on June 16. Four of the new aircraft, which have been under development since 1953, flew in to **Seymour Johnson AFB,** Goldsboro, N. C., where they are the nucleus of the 334th Tactical Fighter Squadron.

The four Thunderchiefs, led by **Brig. Gen. Joseph Moore,** Commander of the 4th Tactical Fighter Wing, flew up from Eglin AFB and performed for a crowd of several thousand at Seymour Johnson before landing at the field.

Maj. Gen. D. W. Hutchison, Commander of Ninth Air Force, Shaw AFB, S. C., delivered a short address welcoming the F-105s to Seymour Johnson.

The 334th will be the **second squadron** to fly the multipurpose Thunderchief. The **335th Tactical Fighter Squadron** has been conducting a high-priority operational test program on the F-105. Some 750 pilots and ground crewmen are taking part in F-105 transition training at Seymour Johnson.

World Wide Photos, Inc.

Capitol Hill conversation: Chairman Richard Russell of Senate Armed Services Committee, AF Secretary James Douglas, Lt. Gen. "Rosie" O'Donnell. Senators approved fourth star for PACAF commander O'Donnell.

The June 16 flyin marked the last leg in preoperational testing for the F-105. It is expected to be a fully operational airplane by the end of the year.

Maj. Andre Edouard Turcat, chief test pilot for **Nord Aviation,** won the **1959 Harmon International Aviation Trophy** for the world's outstanding flyer. Major Turcat, a veteran of the Berlin Airlift, became the first pilot to **exceed Mach 2 in a ramjet-powered experimental plane,** the **Griffon O2,** in a flight from Istres AFB, France, last October 29. The 1958 Harmon Trophy was presented to USAF **Gen. Curtis E. LeMay** for his record-breaking nonrefueled KC-135 trip from Westover AFB, Mass., to Buenos Aires in November 1957. A Frenchman, **Lt. Col. Georges Pelletier-Doisy,** was the first winner of the Harmon award in 1926. Among other winners have been **Charles A. Lindbergh** in 1927, **Wiley Post** in 1933, and **Lt. Gen. James H. Doolittle,** in 1949.

The **Civil Air Patrol** is on the move. After thirteen years at **Bolling AFB,** Washington, D. C., CAP headquarters is shifting to **Ellington AFB,** southeast of Houston, Tex., a move contemplated since administrative responsibility for CAP was transferred from USAF Headquarters to CONAC last January. About eighty-five Air Force people and some thirty civilians will be involved in the relocation.

The largest passenger plane in the world, the **Russian TU-114,** made the first nonstop flight from Moscow to New York on June 28, covering 5,092 miles in eleven hours and six minutes at an average speed of 460 mph. On board were thirty-one crew members, thirty passengers, including **Soviet First Deputy Premier Frol R. Kozlov,** the plane's designer, **Andrei N. Tupolev,** and three USAF flyers who helped with navigation and communications. The four-

Paris ceremony: Lt. Col. James Jabara, right, 1st Lt. Chris Jensen present F-104 model to widow of French aviator Louis Bleriot on fiftieth anniversary of his historic first flight across English Channel on July 25, 1909.

engine turboprop plane took off from Moscow with a weight of 370,000 pounds. Its wing span is **167 feet,** length **177 feet,** height **fifty-two feet.** At the request of the State Department, the Port of New York Authority waived its noise-test regulation to permit landing.

The **Federal Aviation Agency** reports that air traffic at airports and along airways hit an **all-time high in 1958.** At the 213 control towers operated by the FAA there were **26,599,719 landings and takeoffs,** a **six percent gain** over 1957 traffic. The busiest airport in the world is still **Chicago's Midway,** with 397,765 itinerant operations in addition to local traffic. Second most active was **Los Angeles,** with 296,730 operations, and **Dallas, Tex.,** was third with 280,753. **A complete report of 1958 operations,** "FAA Air

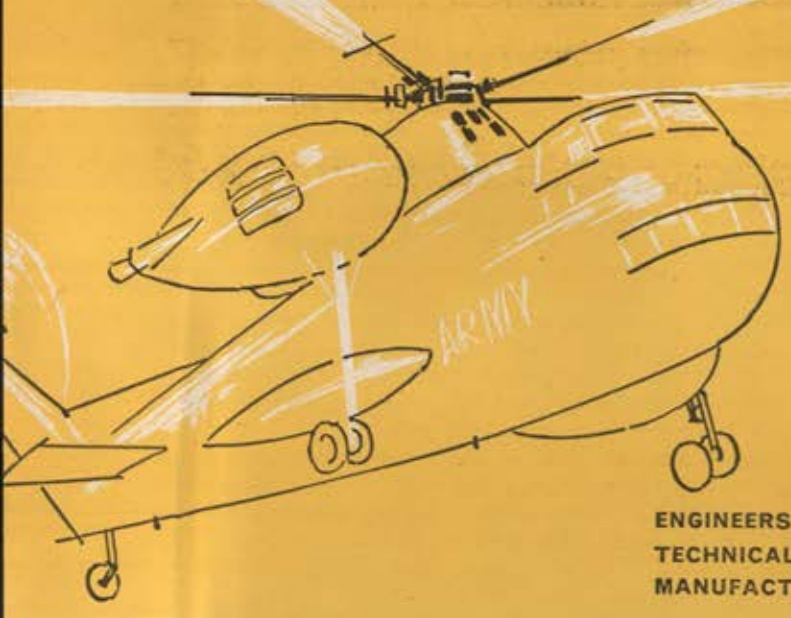
(Continued on page 33)

USAAC . . . Symbol of teamwork with American Industry

The UNITED STATES ARMY AVIATION CENTER at Fort Rucker, Alabama is the focal point of most Army aviation activities. Here at the Army Aviation School, aviators advance in aeronautical skills essential to providing organic aviation to the battlefield commander. The Aviation School develops doctrines, procedures, tactics and techniques relating to the operation and employment of organic Army aviation—including Army transport aviation in joint operations, up to and including the group level; medical evacuation, unilateral Army airborne and amphibious operations and operations involving logistics support by Army transport aviation.

Tenant activities at Fort Rucker include the Army Aviation Board, the Army Transportation Aircraft Test and Support Activity, and the Army Signal Aviation Test and Support Activity—combining to provide the U.S. Army Commander with the most effective organic aviation support possible.

To assist in its diversified task, the United States Army Aviation Center contracts with industry to supply the maintenance of the many aircraft required in its vast training programs. For the third successive year, Hayes Aircraft Corporation has been selected for this teamwork.



RESEARCH, DEVELOPMENT, AND TECHNICAL PERSONNEL are needed by Hayes Aircraft Corporation to participate in modern weapons system and component design and manufacture. With more than 10,000 employees, Hayes is currently active in both missile and aircraft production and is conducting research and development in many diverse fields. We welcome your inquiries. For further details, write to Personnel Director, Department 405, P.O. Box 2287, Birmingham, Alabama.

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Traffic Activity," has been compiled by the FAA and is available for 40¢ from the Government Printing Office, Washington 25, D. C. The FAA, with the help of the CAP, will survey 750 airports this summer to obtain air traffic information for its Traffic Forecasting Project.

A well traveled **Northrop SM-62 Snark** was fired over a thousand miles of the Atlantic Ocean on July 2, and then returned to its **Cape Canaveral launching strip** after four and a half hours of guided flight. This particular Snark was a veteran of two tests made earlier this year. The 600-mph Snark, capable of carrying a nuclear warhead, can zigzag and dodge enemy missiles during flight.

Larson AFB, Wash., has been selected as a base for the **Titan ICBM.** Titan bases will also be constructed at **Lowry AFB,** Denver, Colo.; **Ellsworth AFB,** S. D., and **Mountain Home AFB,** Idaho.

Atlas missiles will be based at **Francis E. Warren AFB,** Wyo.; **Vandenberg AFB,** Calif.; **Schilling and Forbes AFBs,** Kans.; **Offutt and Lincoln AFBs,** Neb.; and **Fairchild AFB,** Wash.

SHIFTS: Malcolm A. MacIntyre, Under Secretary of the Air Force since 1957, is resigning to return to his New York law practice, it is widely but unofficially reported. He would be replaced by **Dudley C. Sharp** of Houston, Tex., who was Assistant Secretary of the AF for Materiel from 1955 until last January.

John W. Crowley, Jr., has retired as NASA director of aeronautical and space research. He was succeeded by his deputy, **Ira H. Abbott.**

Maj. Gen. Reuben C. Hood, who retired as Commander of USAF Headquarters Command in June, will enter Duke University this fall. He plans to get an M.S. in mathematics and become a college math teacher.

Canada has begun to convert its **41,000-man militia** into a **civil defense force.** Equipment not needed for survival operations will be gradually withdrawn, and the units will keep **only small arms and transport and communications equipment.** The civil defense groups will be trained in such useful practices as **radiation monitoring, traffic control, demolition, maintenance of law and order during emergencies, and civil aid.** This may be a good answer to the general who said he considers the Reserves good only for answering telephones.

The **Federation Aeronautique Internationale,** at its Moscow meeting, reelected **Jacqueline Cochran** as president and **Jacques Allez** of France as vice president. Miss Cochran presented USSR plane designer **Andrei Nikolaevich Tupolev** with the FAI gold medal for his work in aviation from 1901. Mr. Tupolev presented Miss Cochran with a medal depicting the TU-104 jet transport and a dove of peace enclosed in a circle of gold.

PROMOTION LIST: Approved by the Senate June 30.

Lieutenant general: Truman H. **Landon,** Emery S. **Wetzel,** Mark E. **Bradley,** Walter C. **Sweeney,** Archie J. **Old,** John P. **McConnell.**

Major general: Wendell W. **Bowman,** Harold H. **Twitchell,** Harry C. **Porter,** Dale O. **Smith,** Robert M. **Stillman,** Daniel E. **Hooks,** Benjamin O. **Davis,** Jr., Albert P. **Clark,** Von R. **Shores,** Conrad F. **Necrason,** J. Stanley **Holtoner,** Lewis L. **Mundell,** Robert **Taylor,** III, Robert J. **Friedman,** Waymond A. **Davis,** Marcus F. **Cooper,** Sam **Maddux,** Jr., Frank E. **Rouse,** Osmond J. **Ritland,** Beverly H. **Warren,**

Far left: Maj. Gen. Don R. Ostrander, new ARPA Deputy Director, replacing Navy Rear Adm. John R. Clark, effective October 1. Left: Gen. Frank F. Everest, former CinC, USAFE, the new Commander of TAC.

Keith K. **Compton,** Horace M. **Wade,** David A. **Burchinal,** James F. **Whisenand,** Glen W. **Martin,** William M. **Momyer.**

Brigadier general: Norman L. **Callish,** Clair L. **Wood,** James R. **McNitt,** Robert S. **Brua,** Charles H. **Morhouse,** Theodore C. **Bedwell,** Frederick **Bell,** William G. **Lee,** John N. **Ewbank,** Harold K. **Kelley,** Henry C. **Huglin,** Robert F. **Burnham,** Clyde **Box,** Irving L. **Branch,** John S. **Samuel,** Henry C. **Newcomer,** Frederic C. **Gray,** John A. **Pechuls,** Horace D. **Aynesworth,** William E. **Elder,** John A. **Rouse,** Theron **Coulter,** Gladwyn E. **Pinkston,** James B. **Tipton,** John A. **Dunning,** Milton H. **Ashkins,** Harvard W. **Powell,** Gilbert L. **Pritchard,** Reginald J. **Clizbe,** Joseph A. **Cunningham,** Dorr R. **Newton,** Thomas R. **Ford,** Walter R. **Graelman,** Charles H. **Terhune,** Harold E. **Humfeld,** Selmon W. **Wells,** William T. **Seawall,** George S. **Brown,** Grover C. **Brown,** Seth J. **McKee,** Loran D. **Briggs,** John C. **Meyer,** Jack J. **Catton.**

STAFF CHANGES. . . . Maj. Gen. William S. Stone, former Commander of the Eastern Air Force of MATS, at McGuire AFB, N. J., has succeeded **Maj. Gen. James E. Briggs** as Superintendent of the Air Force Academy, Colorado Springs, Colo. . . . **Brig. Gen. Joseph R. Holzapple** has been reassigned from duty as Deputy Director for Operational Forces, DSC/Operations, Hq. USAF, Washington, D. C., to become Assistant Deputy Commander for Weapon Systems, ARDC, at Wright-Patterson AFB, Ohio, with additional duty as Commander, Detachment 1, Wright-Patterson AFB and Director of Systems Management.

Lt. Gen. Robert M. Lee, who was Chief of Staff, UN Command, and Chief of Staff, US Forces, Korea, was assigned as Vice Commander of ADC at ADC Hq., Ent AFB, Colorado Springs, Colo. . . . **Brig. Gen. Chester W. Cecil** has been relieved as Director of Management Analysis in the Office of the AF Comptroller, Hq. USAF, Washington, D. C., to become Assistant Chief of Staff, Comptroller (A-6), Hq. PACAF, APO 953, San Francisco, Calif.

Maj. Gen. Robert F. Tate, who was Vice Commander of Air University at Maxwell AFB, Ala., is now Vice Commander, 5th AF, PACAF, APO 925, San Francisco, Calif. . . . **Maj. Gen. Daniel S. Campbell,** who has been in Ankara, Turkey, as Deputy Director, Combined Planning Organization of the Baghdad Pact, and Chief, US Element Baghdad Pact, has been assigned duty with the Central Control Group of the JCS as Special Assistant to the JCS for National Security Council Affairs, in Washington, D. C.

Maj. Gen. Harold C. Donnelly, who is Assistant DCS/Plans and Programs, Hq. USAF, Washington, D. C., has been assigned additional duty as Chairman of the US Section, Canada-US MCC (Military Coordinating Committee). . . . **Brig. Gen. William T. Large, Jr.,** former Commander of the 706th Strategic Missile Wing (ICBM-Atlas), SAC, at Francis E. Warren AFB, Wyo., has been assigned as Assistant Deputy Commander, Weapon Systems, Aircraft, at Hq. ARDC, Andrews AFB, Md. . . . **Brig. Gen. Perry M. Haisington, II,** has been relieved as Commander of the 57th Air Division, SAC, to be Commander of SAC's 820th Air Division, Plattsburgh AFB. —MICHAEL B. MILLER

VIEWS & COMMENTS

Russian Imperialism — Marxist Style

The following incisive analysis of present-day Russian imperialism, as contrasted with the so-called altruistic aims of early Marxist apostles, is excerpted from an article in the New York Times Sunday Magazine, *June 28, 1959, by Prof. Louis J. Halle of the University of Virginia. It appears here with permission.*

MORE THAN A century ago Karl Marx published a prophetic vision of the future that was not borne out by the subsequent course of history. The failure of his vision to come true confronted his principal intellectual heirs, the men who had captured Russia, with some severe practical problems. They found themselves obliged to keep up the pretense of honoring their Marxist ideological heritage while making shift, at the same time, to deal with the world as it really was.

The world revolution that Marx predicted was to be an uprising of industrial workers everywhere, under Communist leadership, against their capitalist masters. Instead, the workers, having acquired the power to bargain on terms of equality, have generally reached an accommodation with capital that gives them a vested interest in the existing social order. The great majority have consequently become antirevolutionary and anti-Communist. The only way the Communist movement could capture them today would be by force.

Another of Marx's fundamental misconceptions was that nation-states were bourgeois devices, that "working men," as he put it, "have no country." He assumed a degree of international class-loyalty that does not exist, and he discounted the fierce national loyalties that do exist in the hearts of working men. . . .

Can we say that Moscow still has as a working objective that world revolution that was the objective of Communist intellectuals in another age? It may be that Marx's vision of Utopia is still entertained as a day dream by some Russian Communists. But the men who run things in Moscow are tough, practical operators, gang leaders more than they are intellectuals. However profitable they may find it for their own purposes still to intone in public the old Marxist incantations, they may privately be as cynical as politicians anywhere; and in any case their working objectives are surely of quite a different order. They are the familiar objectives of a great power, to realize its interests and ambitions as one state in a world of rival states.

For ten centuries Russia has been obsessed by military insecurity and the fear of encirclement, as she is still today. This has impelled her to push the danger away by constantly expanding the area under her control. In doing so she has threatened the security of her neighbors, who have repeatedly acted to contain her or to force her retraction.

In a large sense, then, the present "cold war" is simply a continuation of that long struggle in which the Crimean War, a century ago, was one incident. The struggle has become more dangerous to us today on two counts. For one, the development of atomic weapons has made its possible consequences more terrible. For another, the relative power of Russia, greater today than ever before, has been tending to exceed the power that we have been willing to muster, on our side, to balance and contain it. We have depended, hitherto, on our exclusive possession of nuclear weapons to offset the Soviet superiority in other forms of armament. Now Russia's acquisition of a full nuclear capability tends to neutralize our own capability, inhibiting its use, leaving her with a net superiority in military power that she did not have before. . . .

If this is a realistic picture of what we confront today, then the objectives of Soviet policy are not hard to understand. They are the classical objectives of an autocratically governed empire that has constituted itself the challenger in an old-fashioned power contest. They are the objectives of achieving security by first increasing the relative power of the state, then forcing changes in the international *status quo* that reflect the increase.

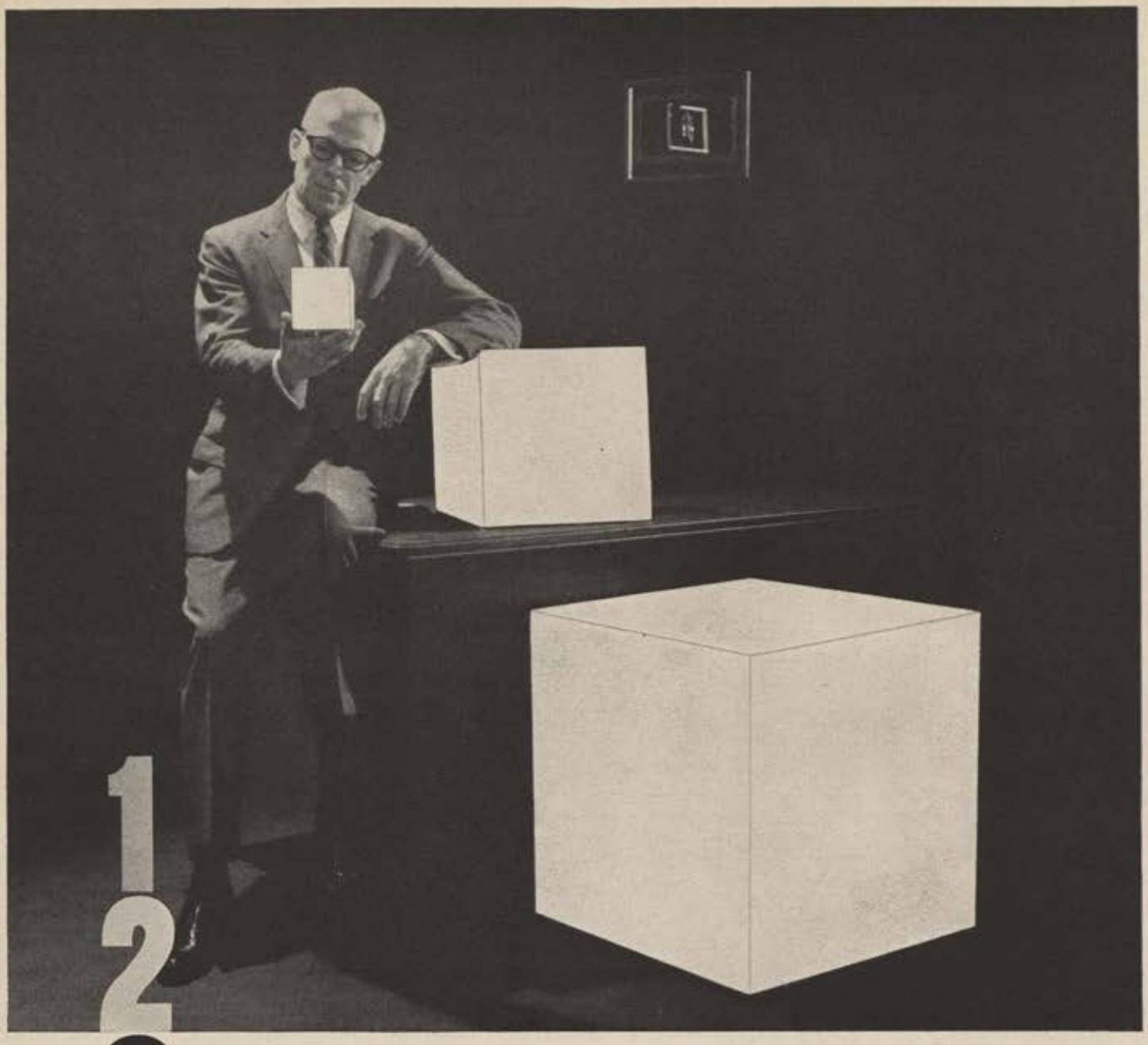
In the politics of power, an international arrangement is legitimate only as long as it accurately reflects the relative power of the participants. When the power relationships change, then the arrangement itself must be correspondingly changed.

Our continued presence in Berlin is no longer legitimate and acceptable to Moscow because it no longer reflects the realities of power as Moscow estimates them. Legal agreements have nothing to do with the matter. In Moscow's eyes we should now acknowledge the power realities by getting out of Berlin. For us not to do so is, in Mr. Khrushchev's language, "unrealistic." From the Soviet point of view, the proper purpose of diplomatic negotiation at this stage is to bring about the change smoothly.

But the present Berlin crisis is only one incident in the course taken by the Soviet foreign policy that it represents. If we continue to allow our power to decline, in relation to the Soviet power, we shall find ourselves faced with a succession of such crises, deliberately created and timed by Moscow, coming upon us like successive combers in a heavy surf. We shall not find it easy to keep our feet, and if we allow our relative power to decline too far we shall, at last, not find it possible.

The answer to this prospect is simple, if not easy. Moscow will presumably refrain from repeatedly challenging our strategic positions in the world whenever it has reason to believe that we have built and are maintaining the power to support them. This power must be more than military power. It must include political and economic power, and what we might call cultural strength. It must have a moral basis.

But we should not deceive ourselves with the belief that, as an alternative to military power, we can rely on some putative spiritual power that does not call for material sacrifices by us or interfere with our desire to balance the budget. The military power to back our diplomacy is only one element among others, but it is indispensable. It is indispensable to the achievement of that international stability from which a peaceful world order might at last grow.—END



1 2 3 generations of airborne digital computers (but we can't show you their configurations)

In the photo above, the three ARMA computers have been intentionally deleted. But the cut-outs accurately represent the relative size of the three generations of ARMA airborne digital computers.

The larger size has been *in production* since 1957. The middle-sized one (a quarter the size of today's) will be in production in 1960. And the micro-miniaturized version in the engineer's hand will be operational in 1962—only .3 cubic feet in volume.

A production line unit of ARMA's current model has operated in excess of 4000 hours without a component replacement. And the 1960 and 1962 versions will have reliability factors at least equal to this.

With this program of miniaturization, ARMA has made the digital computer truly airborne. ARMA . . . Garden City, New York. A division of American Bosch Arma Corporation.

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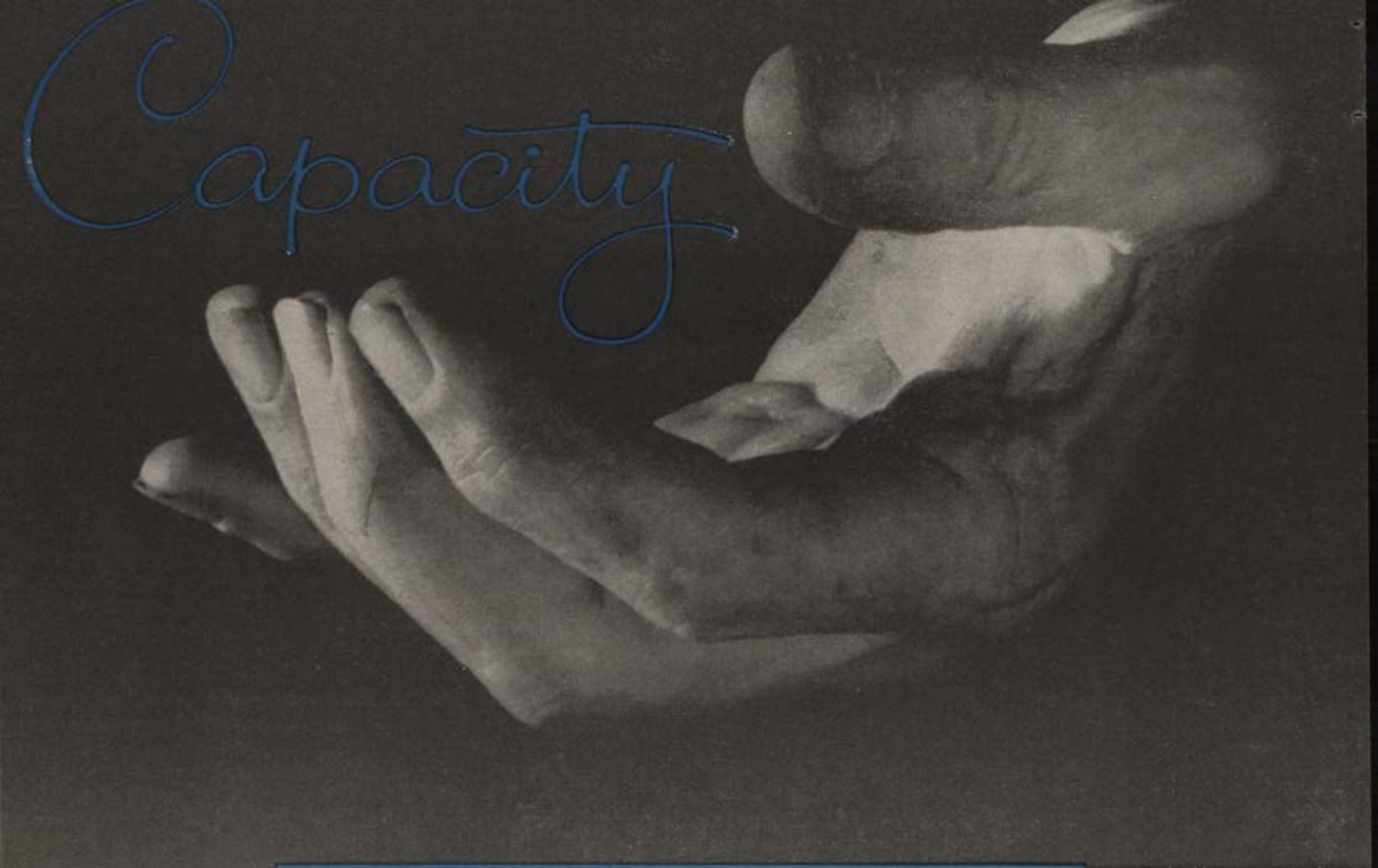
AMERICAN BOSCH ARMA CORPORATION



It takes more than "know how" to solve major defense production problems: it takes plenty of production capacity, too. We have it: in equipment alone we count over 1500 *major* items in one plant. A full staff of engineers work here in research, design, development and production. And there are hundreds of machinists, heat treaters, welders, forgers, assemblers, riveters, foundrymen. Clearly, we have the capacity to handle major projects in whole or in part, at any stage from original conception to operational assemblies. Contact any American Car and Foundry sales office or Director of Defense Products, American Car and Foundry, Division of ACF Industries, Incorporated, 750 Third Avenue, New York 17, N. Y. *Sales Offices:* New York — Chicago — Cleveland — Washington, D. C. — Philadelphia — San Francisco — St. Louis.

Numerous hydraulic presses up to 4000-ton capacity make fast work of intricate draws, stampings and other hot and cold forming operations.

AMERICAN CAR AND FOUNDRY

DIVISION OF ACF INDUSTRIES, INCORPORATED

Products for Defense

For example: Rocket Engine Cases • Missile Ground Support and Installation Equipment
Artillery Shells • Radar Structural Members • Armor Plate • Armored Vehicles

AMERICAN CAR AND FOUNDRY CAN DO ANYTHING WITH METAL

SHOOTING THE BREEZE

WITH THE EDITORS OF AIR FORCE MAGAZINE

Two poems, two introductions, and a new "flat-on-my-back" story sit atop our desk spike this month.

In case your own kids have let up recently in the production of grade school art of one kind or another, and as a result you have a few free moments, here's something Sheldon Bermont, the eight-year-old son of a friend, penned for us recently:

The moon is a calm and quiet place
And so the man in the moon has a smiling face.
Our earth would really be more fun
If people would not scream or run.

Which set of sage observations seemed to suggest, amid this humid Washington summer, that it might be well to catch the first spaceship moonward—to become, in this case, a looney astronaut. Then a semiregular contributor of verse, Everett Scrogin, brought us back to earth rather abruptly with this four-line R&D report:

Grandfather said, "If you'd go far,
You'll hitch your wagon to a star."
Ambition's flights are now by rocket—
The problem: Where and how to dock it!

The introductions come next:

☆

Stephen A. Rynas recently has assumed the position of Director of Industrial Relations for the Air Force Association. In this capacity he will direct the Air Force Association's Industrial Associate Program and will coordinate the Association's relations with its Industrial Associate companies.

Robert C. Strobell, formerly Director of Industrial Relations, has been named Exhibit Manager of the Association. He will direct the rapidly expanding industrial exhibitions that are held in conjunction with the Air Force Association's annual Conventions and other conferences and symposia.

Mr. Rynas was formerly associated with American Aviation Publications. In this capacity, he was working with twelve different publications, including *Missiles and Rockets*, *American Aviation*, the *World Aviation Directory*, and *Armed Forces Management*. Before coming to Washington, D. C., Mr. Rynas was with Allied Chemical Corp., and McGraw-Hill Publishing Co., both in New York City.

A graduate of the City College of New York, he served in the Army Air Forces during World War II, and saw combat in the Southwest Pacific with the Thirteenth Air Force, flying in B-24s.

In another staff addition, Morley L. Piper has been appointed New England Advertising Manager with offices at 428 Essex St., Hamilton, Mass. Mr. Piper's position will enable AIR FORCE/SPACE DIGEST representatives to serve an increasing number of advertisers more effectively.

During the first six months of 1959, incidentally, advertising sales showed a twenty-two percent gain over the same period in 1958.

Mr. Piper brings eleven years of advertising sales experience to AIR FORCE/SPACE DIGEST. For the past seven years, he has been on the sales staff of the *Boston Globe*, covering national accounts. From 1948 to 1952, Mr. Piper was general manager of the Chronicle Publishing Company, Ipswich, Mass., which published two weekly newspapers. Mr. Morley's aviation experience includes service as civilian personnel officer at Orly Air Field, Paris, France, and civilian personnel officer at Rhein-Main Air Field, Frankfurt, Germany.

Mr. Piper is a graduate of Illinois College, Jacksonville, Ill., and also studied at the University of Oregon and Boston University. He served for three years in the United States Army, two of which were spent in the European Theater.

☆

And here's a novel variation on the old "40,000 feet, flat on my back" routine. An Air Guardsman we know recently tuned in a Grand Junction, Colo., disc jockey while tooling along high over the Rockies. Finding he had a yen to hear his current song favorite, he called the FAA station at Grand Junction, asked it to relay for him to station KRAX there.

Minutes later, the disc jockey introduced "The Girl on Page Forty-four," a special request from Guard jet number so-and-so, the pilot of which was then at 40,000 feet hearing his record.

☆

If you plunged into the blue Mediterranean, B-26 and all, in November 1944, and a French Navy vessel pulled

(Continued on following page)

"What do you mean—it was only a *little* sonic boom!"

you out, you may be the object of a search now being conducted by a French Navy skipper. The Frenchman, Capitaine A. C. Pedez, was commanding officer of a French patrol boat which picked up two Americans off Corsica one day in November 1944, after their B-26 went in. Capitaine Pedez, now living in Normandy, France, would like to make contact with the two he helped save. Send any word to us and we'll pass it along.

☆

From closer home comes the report that the 22d Bomb Group holds its tenth annual reunion at the Hotel New Yorker, New York City, on Saturday, August 8. The man to contact for further information is Milton Weiner, 635 Madison Avenue, New York 22, N. Y., phone PLaza 9-6622.

The 91st Bomb Group, with similar intent, is presently engaged in contacting members across the country. Persons interested are requested to write to Bassingbourne Rally-Round, c/o Maj. Gen. Stanley T. Wray, P.O. Box 7657, Wright Air Development Center, Wright-Patterson AFB, Ohio. General Wray, now Commander, WADC, formed the Group and headed it in its early days at Bassingbourne Royal Air Force Station, England.

☆

Art and photography exhibits on the Air Force and allied subjects have been busting out all over. Our "MIG Alley to Missiles" photo report in this issue provides one example. Another was the Air Force art show at the Society of Illustrators in New York earlier this year. The paintings on display were the latest of more than 400 done by prominent civilian artists under the four-year-old Air Force Historical Art Project.

Members of the Society of Illustrators have traveled millions of miles to paint airmen at their duties.

☆

Along these lines, it might be noted that Air Force Chief of Staff Gen. Thomas D. White, an enthusiastic supporter of Air Force art, some while back showed no small mettle as a cartoonist in his own right. One of eight officials invited to draw cartoons expressing their view of editorial cartoonists, General White came up with a rather angular squirrel sitting on a tree stump and thumbing his nose.

The caption, penned in below the general's signature, read, "I'd rather hunt nuts—and I know where to look for them!"—END

Higher

faster

training

in Cessna's

T-37

Cadets in the U. S. Air Force now get a faster introduction to jet flying. Sitting side by side with their instructors, they're quickly learning to handle Cessna's T-37—a new, high-flying trainer with the characteristics of a combat jet. As a result, cadets are trained faster and easier (at substantial savings) to assure America's future in the air. Cessna Aircraft Company, Wichita, Kansas.

Cessna *Inquire today about the rewarding future your Air Force offers you.*

BELL
HU-1A
MOST ADVANCED HELICOPTER IN THE AIR

A Product of Army-Air Force Teamwork

The Army's all-new HU-1A is the first turbine-powered helicopter to be adopted as standard U.S. military equipment. No other helicopter in the world has been so thoroughly tested before being placed in service. The Air Force conducted Phases II, IV and V of the program, augmenting the Army's User Test, Desert Test, and 1000-hour Logistical Support Service Test.

The HU-1A has been praised by airmen everywhere for its simple design and ease of maintenance. In terms of flyability, loadability and over-all performance, it is truly a military man's helicopter.

This already-service-proven helicopter offers outstanding capability in the areas of rescue, utility, missile system supply, and liaison. It is now in production . . it is available.

Icing Test, Ottawa, Canada

Desert Test, Yuma, Arizona

Low temperature test, Eglin Field

Performance and controllability tests, Edwards Air Force Base

BELL

HELICOPTER CORP.

FORT WORTH, TEXAS SUBSIDIARY OF BELL AIRCRAFT CORPORATION

RB-66s high over Europe on photo reconnaissance mission, one of thousands of such hops flown since the last war.

FROM MIG ALLEY TO MISSILES

A Photo Report on the US Air Force, on Guard Across a Troubled World

THE SUN never sets on the US Air Force. Through tortured years of cold war, USAF has stood guard, as it does this minute, around the world. When the need arose, in Korea, USAF fought with devastating effectiveness. But, for the most part, the Air Force's patient task has been to train, and train—and then train some more—and keep its powder—or H-bombs—dry.

Some years ago, an imaginative, highly mobile photographic team of three brothers from Schenectady, N. Y.—George, Jim, and John Burns—set itself the task of capturing on film the global drama of America's mid-twentieth-century Air Force. The result: a collection of pictures stretching back to the end of World War II, photos depicting the Air Force family—men and machines—pursuing their duties from the Arctic snows to the North African desert, from Korea to Cape Canaveral, from Saipan to the edge of space. The entire collection, entitled "Saipan to Space," selections from which appear on the following pages, was on display at the Overseas Press Club in New York City last spring. These photographs were taken on assignment on five continents for a variety of clients by the much-traveled Burns brothers, who in line of duty last year, for example, flew 150,000 miles and went another 90,000 by car and 35,000 more by train.

The shots on the front cover, clockwise behind the B-58 Hustler, show a stack of F-104 Starfighters; an Arctic-based F-89; the Vulcan aerial cannon being ground fired; a New York ANG jet as it prepares to take off; F-94s on a training hop; and an airman celebrating the end of the Korean War.

Next month, AIR FORCE/SPACE DIGEST will take a much longer look at the global Air Force in our annual Almanac Issue.—THE EDITORS

FROM MIG ALLEY TO MISSILES

Scratch one MIG-15. A youthful pilot reports kill on top-performance Russian-built jet in Korean War debriefing. MIGs sharply challenged US air dominance over Korea, particularly in the MIG Alley sector, but Sabrejets overcame them.

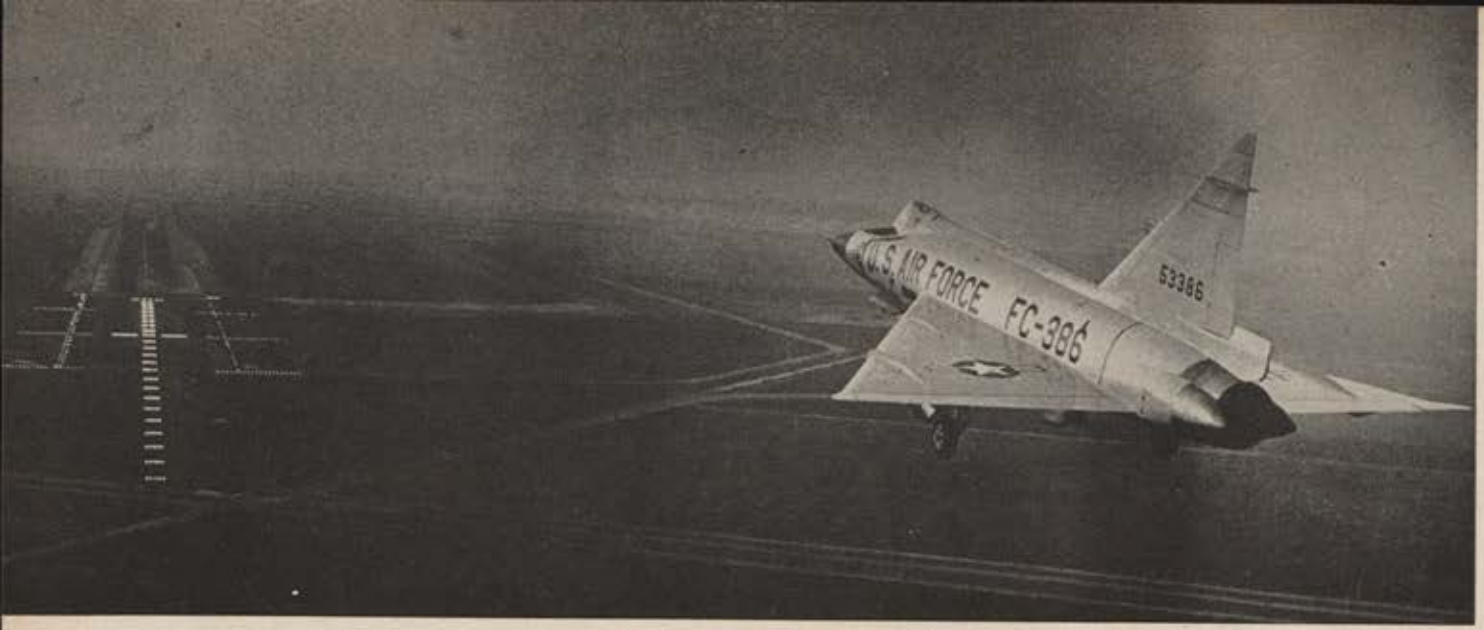
Another time, another place, but the same cold war. The pair of camels pays scant heed to the flight of F-86 Sabrejets overhead. The scene is at a North African airstrip, one of the important links in USAF's worldwide chain of bases.

New life for a wounded man during the Korean War. Whole blood was a priority item in the Pacific Airlift, which flew in food, ammunition, and supplies. The same planes, on return flights, evacuated thousands of UN casualties.

Go, go, go! Pilots man their aircraft on the double after scramble horn sounds. Fortunately, this one's for practice. Scene is familiar at US air bases around the globe. A major USAF aim is to maintain a high state of combat readiness.

Day and night, radar stations keep their electronic eyes peeled against surprise attack on the US. Above, view from helicopter (past pilot's head) of Texas Tower offshore radar.

◀ Canine guardian for a nuclear weapon system. SAC sentry dog strains at leash during base patrol. B-52 stands on runway.



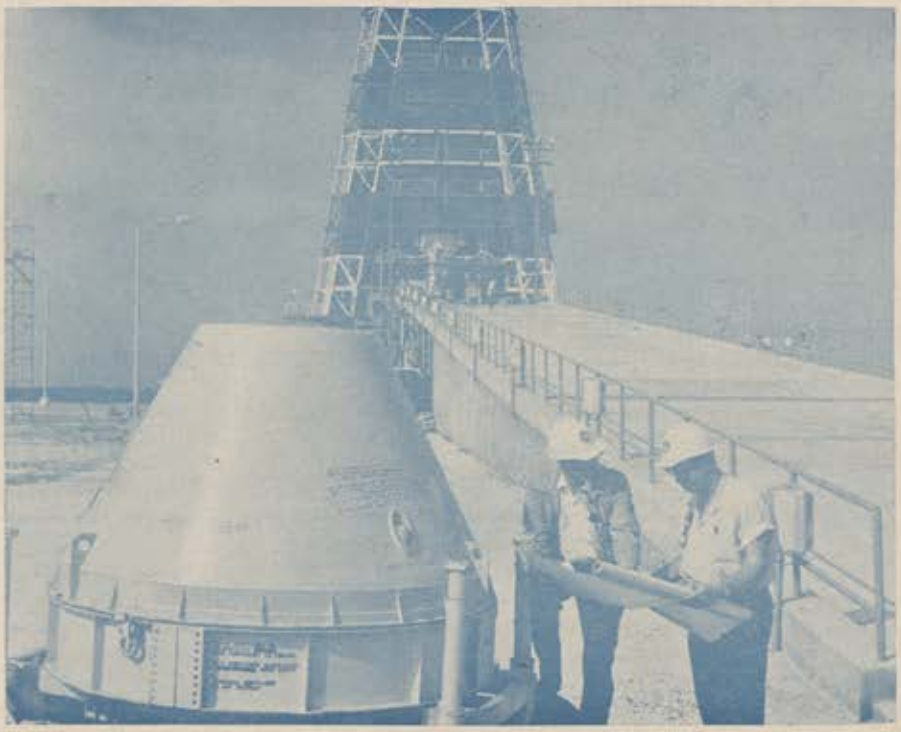
F-102 jet intereceptor, one of world's hottest aircraft, goes into final leg of landing approach at March AFB, Calif. Supersonic Delta Dagger was first delta-winged plane to come into USAF inventory. Developmental F-106 will eventually succeed F-102.

FROM MIG ALLEY TO MISSILES

Air Force Academy Cadet receives navigational aid from gendarme while on summer visit to Paris. Visits abroad supplement Academy program, provide military, cultural, general background.

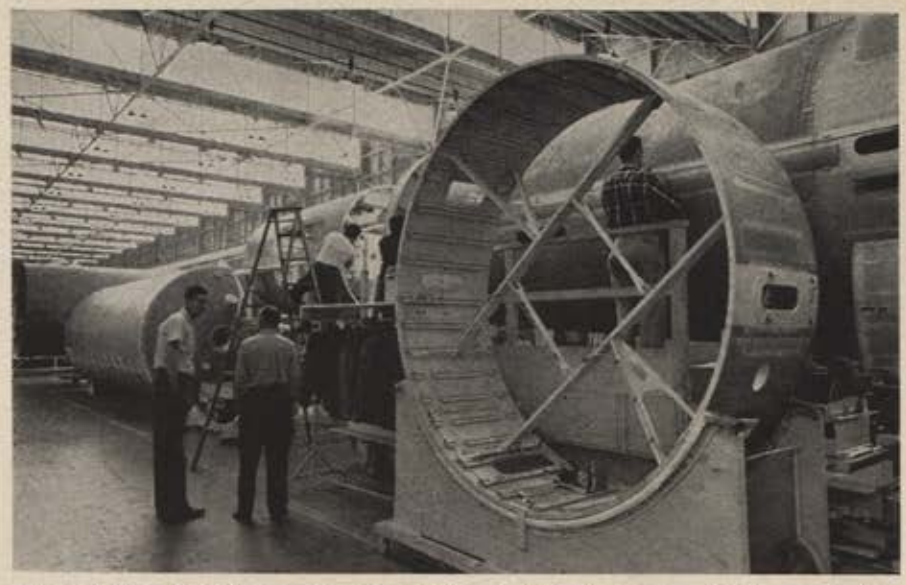
An element of Lockheed F-104 Starfighters flies high over the countryside of southern California. This interceptor, now operational, holds the world's records for speed (1,404.19 mph) and for altitude (91,249 feet).

On the threshold of tomorrow: Scott Crossfield, North American test pilot who will be at the controls of the X-15 aerospace vehicle when it makes its first powered flights late this year in a USAF-backed project. Inevitably, airpower past and present will give way to a future of aerospace weaponry. Crossfield, wearing MC-2 suit, pauses at the door of test chamber.



Technicians work at launching site for Atlas intercontinental ballistic missile at Cape Canaveral, Fla. Air Force family of missiles has come a long way in past year—although many believe budgetary restrictions hold the vital program back unnecessarily. Other major USAF missiles include Thor intermediate-range ballistic missile, developmental Titan and Minuteman ICBMs. But manned aircraft still pack the major deterrent punch of USAF.

A top Air Force procurement officer calls for "continuing realignment of policy" amidst . . .



View of Thor IRBM assembly line at Douglas' Santa Monica, Calif., plant. The author predicts missiles will increase their claim on annual budget dollar.

AVIATION'S INDUSTRIAL

THE PAST few years have brought spectacular technical achievements to public attention—satellites, ballistic missiles, supersonic bombers, and much else. At the same time, less dramatic and less publicized, there has been a behind-the-scenes industrial evolution equally important to the nation and the Air Force.

This evolution, both in Air Force-industry relations and within industry itself, must be accelerated today to meet the needs of the times.

One of its main products has been the weapon system concept, now at the heart of Air Force procurement programming. The Air Force has also instituted specialized management techniques to expedite decisions, control expenditures, and assist and supervise contractors selected to develop and produce weapons. The weapon system concept is a master plan, rather than a rigid set of rules and procedures, for the management of major programs. Within its broad framework, changes are being instituted and planned.

These extremely significant premises form the skeletal structure for current Air Force thinking in this whole area:

- Missiles will substantially increase their claim on the annual budget dollar.
- Manned space vehicles must in time play an important role in our total military airpower effort.
- Manned aircraft will be required for the foreseeable future as an essential part of our operational strength.
- Aircraft production will remain an important, although no longer paramount, factor in procurement.
- The weapons complex must be governed by the necessity for "readiness." We must both deter war and, if necessary, fight aggression with the weapons at hand.
- The mobilization base and "post-crisis buildup" concepts which have preceded our full-scale operations in previous wars must be replaced by force in being.
- Improvement in nuclear weapons has provided a tremendous increase in existing and future destructive capabilities. Consequently, long production runs and duplicative airborne delivery systems have no place in today's planning.

Our operational doctrines and procurement patterns are largely functions of these and closely related factors. The Air Force and industry must comprehend their full meaning if we are to meet our mission objectives. The feeling at present is that further and continuing realignment of policy and effort, of attitude and practices by and in connection with industry, is required.

The pattern of bit-by-bit progress that has typified industrial and governmental actions should be set aside. Organizational changes for the Air Force and industry are mandatory; cost concepts must be critically reviewed; scientific progress must be accelerated; and new production techniques, equipment, and skills must be developed.

Air Force procurement is governed by stringent ground rules. Decisions on what to buy and when to buy are dominated by the dollars available to Air Force planners. Every article purchased is at the expense of some lower-priority item—not necessarily an item that is determined to be nonessential, but one that we can best delay in purchasing, or that is not absolutely essential. Each program is selected after determination that it can offer the greatest return in national defense for the dollars involved. The enthusiasm of the Air Force to buy a given weapon is determined by the predictable time span that the weapon can satisfy in meeting military requirements, by military urgency, and by costs. The number to be produced is determined by the ability of the weapon to satisfy the mission during the time period.

At the same time, this procurement is the largest single business in the free world. The annual procurement

Another look at a Thor in the works. ". . . Aircraft prime producers have added other products such as missiles."

EVOLUTION

Brig. Gen. Harvard W. Powell

program involves approximately 4,000 prime contractor facilities, excluding the innumerable local suppliers of commercial-type consumable products. The subcontractors supporting the 4,000 primes would bring the total to about one-fourth of the total manufacturing facilities in the country. Thus, Air Force procurement problems are national in scope, international in consequence. A change in the procurement pattern has a widespread immediate impact throughout the national economy.

These problems obviously are many sided. They concern varied segments of the vast industrial complex that contributes to modern weapon systems.

In 1944, 95,272 military aircraft were produced. In 1953, this number was decreased to 10,626, and in 1957 to 5,500. In 1953, 779,000 persons were employed in the aircraft and parts industry; this employment peaked at 878,000 in 1957 and was reduced to 765,000 in 1958.

With an increase of thirteen percent in employment from 1953 to 1957, there was a forty-four percent increase in salaried personnel and six percent in the production or wage category. In 1957, there were 141.5 million square feet of over-all space available for the manufacture of aircraft and missiles; this was more than double the 1950 availability and eleven times the 1940 space.

The past two years have seen the Air Force declare as surplus plants that had been built during the period since 1950 to support its industrial complex. Maintaining idle plant capacity is an expensive problem that must be handled aggressively. The Air Force and industry must continue to eliminate such nonprofitable capacity as may exist.

The requirements for missile production will not absorb the total capacity made vacant by decline in aircraft production; nor is it always feasible to establish missile production in facilities being vacated. The only alternative for the Air Force is to remove them from its inventory.

The last five years, it is observed, have seen the number of military aircraft procured decline substantially. This trend will definitely continue. In order to maintain the level of operations and to ensure continuity of employment, there has been a decided move on the part of the major aircraft companies to diversify their activities.

Companies which formerly were essentially aircraft prime producers have added other products such as missiles, electronics, and propulsion systems, and have substantially participated as subcontractors. Likewise, the change in the weapon systems procured has brought to the prime contractor the responsibility to secure increased support from other segments of the industry. There is now heavy subcontracting of major parts of weapons.

For example, North American Aviation, with Air Force approval, has programmed approximately seventy-five percent of the dollars on the B-70 and F-108 for subcontracting. We are currently seeing "teams" of major prime contractors formed to bid as a unit on major weapon programs.

The fact is that the complexity of present weapons is such that one company can hardly assume the total task. The Air Force "make-or-buy" policy, recognizing this fact, requires subcontracting under these conditions. This is the best method to ensure time compression and yet produce the weapon at a lower cost.

Production in the recent past has been costly. It has often been accelerated under conditions of urgency to deliver articles before design has been proven. Major changes and modifications, delays in delivery to the Air Force, and heavy increases in costs often result before contract objectives are achieved. In one typical case, aircraft performance, delivery schedule, and negotiated costs were all completely missed, and yet the contractor showed a nice profit for the years involved.

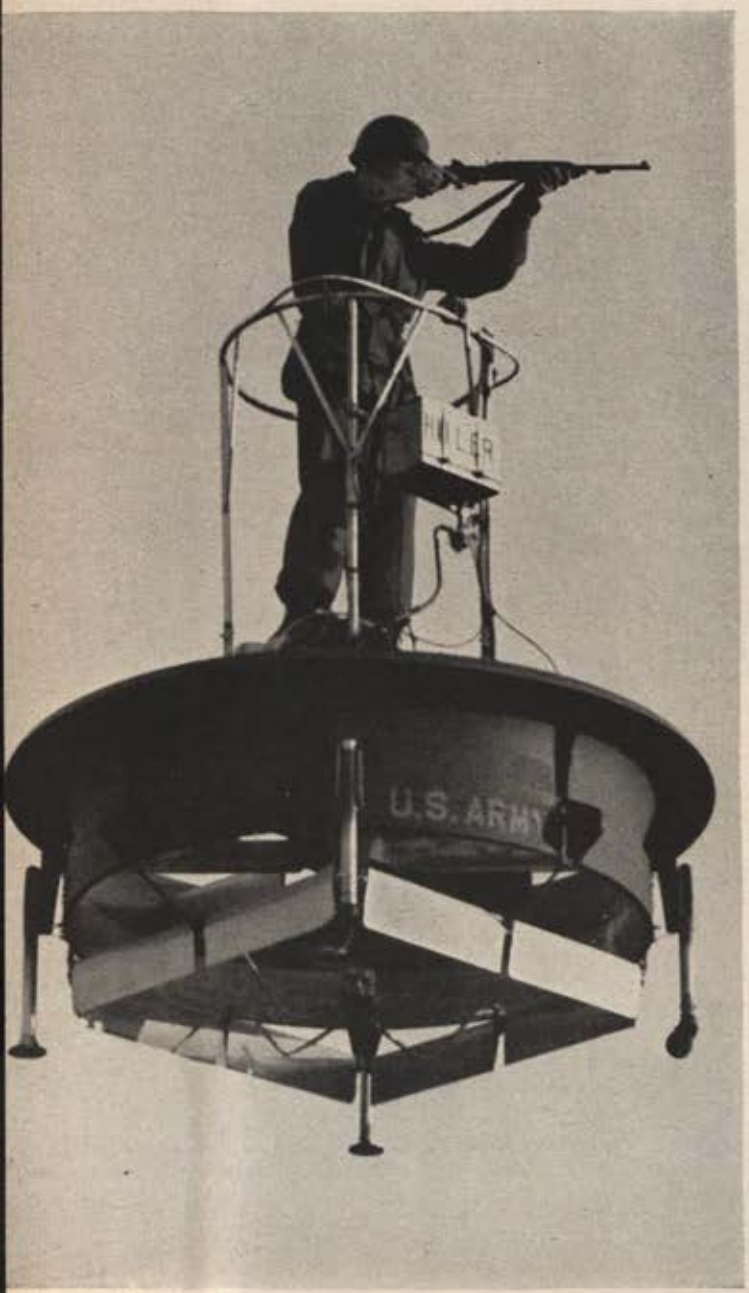
These conditions have been experienced in the past on some weapons since unit costs permitted procurement of duplicative types and large numbers. In the future, the industry will have to stand on its own feet and survive through technical and management competence. In fact, the future promises to be dismal for the marginal producer, or for the producer who sees his performance unsatisfactory, his schedules slipping, his costs soaring, and his reliability unproved.

The relationship between limited production runs, nonproductive labor, high employment, and idle plant capacity is one of the most serious problems facing the aircraft industry. The cost of complex weapons is very high even when reduced to the minimum. However, to tolerate high overhead created by a lack of aggressive management, "gold

(Continued on page 50)

First vertical takeoff-landing transport, Air Force's 16½-ton Hiller X-18 tilt-wing, now in test at Edwards AFB. Power: Two Allison T-40 turboprops totaling 11,070 hp plus 3,400-lb. thrust Westinghouse turbojet for transition and hover control; approved with Champion Jet Igniters. (Champion pioneered jet igniter development with experimental engines in '42, remains in forefront today.) Hiller Pres. Stan Hiller predicts "inevitable conversion of entire transport system to VTOL."

Project Engineer M. F. Gates uses smoke filament "to check entrainment of ambient air by downward deflected jet flow" in VTOL lift project. Basic research contract in external jet mixing was awarded Hiller's Advanced Research Division. (New high-temperature adhesives subsidiary puts Hiller into space race.)



"Look, man! No hands!" Without hands on controls, pilot demonstrates hovering stability of Hiller ducted-fan "Flying Platform." Nelson H-53 engine manufacturer worked with Champion, mating plugs to engines during development stages. Now underway are three separate military ducted-fan projects—outgrowth of unconventional flight concepts proved by Flying Platform. One is development of experimental vehicle in higher speed range for Bureau of Aeronautics.

"...feet planted square in mid-air..."

A behind-scenes report on Hiller Aircraft Corporation... one in a series on why helicopters and VTOL aircraft, like the world's airlines and business fleets, use Champion Spark Plugs

Hiller XROE-1 Rotorcycle, world's smallest collapsible 'copter, can be unfolded by one man and flown in less than five minutes! Pilot models of the Champion-fired Rotorcycle are scheduled for delivery to Marines shortly. Test engineers found Champions mandatory to ensure dependability of 45-hp, 290-lb. Rotorcycle.

Perched on a mountain top doing a commercial job is the new Hiller 12E. The Champion-equipped, 305-hp 12E is the most powerful production 'copter in the 3- to 4-place class, Hiller reports. First deliveries of the lightweight commercial 12E are in progress. Hiller is aiming for 50-50 commercial and military sales. (Nearly 80% of total Hiller business in 1958 was military.)

Turbojet blade-tip propulsion model takes shape from drawing boards . . . possible solution to large helicopter flight problems. Hiller experts on Army-Navy project are (l/r) C. W. Messinger, "Tip-Turbo" Project Engineer; J. B. Nichols, Manager-Advanced Planning. Hiller tip-propulsion experience includes thousands of flight hours with ramjet rotorcraft.

by **HERB FISHER**

International aviation authority, veteran test pilot, author

Mr. Fisher

"You just strap it on like skis, give it some throttle—and you've got your feet planted square in mid-air!"

That simple, says the test pilot who first "walked on air" with the unconventional ducted-fan Flying Platform strapped to his feet. You wonder how some of Hiller's research craft can fly . . . but then, aerodynamics is still puzzling the flight of the all-wrong bumble bee. He flies. And so does Hiller—with phenomenal success!

Founded in 1940 by 17-year-old mechanical genius Stanley Hiller, Jr., Hiller Aircraft Corporation is rightly famed for two things: Volume-supplying a vast military and civilian market with light helicopters noted for efficiency as well as operating and maintenance economy. And pioneering "years-ahead" flight concepts to *reality*.

Visionary Stan Hiller and his lab and design team sent aloft the world's first co-axial aircraft four years after the company's founding.

Next came this country's first jet torque-compensating 'copter.

Soon afterward, the unconventional Flying Platform. First of its kind. Completely revolutionary! Forerunner of a whole new era of ducted-fan flight (wait and see!) . . .

Then the 290-lb., collapsible, one-man XROE Rotorcycle. A virtual flying motorcyle! The Marines snapping up first test models . . .

And—the nation's first vertical takeoff transport, the VTOL/STOL X-18, a turbine-powered 33,000-lb. research giant currently under test at Edwards Air Force Base.

In the works at Hiller are more research craft destined to lift the eyebrows of old-time fixed-wing test pilots like myself (until we remember the bumble bee and Hiller's knack for taking the bugs out of "bumble bees").

Production-wise, backbone of the 61-acre Hiller operation at Palo Alto, Calif., is the Army H-23D "Raven" helicopter with its Lycoming VO-435 engine and the higher powered civilian version, the new 12E, with its 305-hp Lycoming. First deliveries on the lightweight, heavy-load-lifting commercial and business 12E began this Spring.

One of the many missions of the military-version Raven is primary trainer for all Army helicopter pilots. At Camp Wolters, Tex., world's largest helicopter operation, normal helicopter maintenance time has been slashed in half with a fleet of 200 Ravens!

Throughout these dramatic years at Hiller—from first light 'copters to as yet unannounced giants with turbojet blade-tip propulsion and second-generation jet-lift VTOL's—Hiller and Champion Spark Plug Company have worked together. Closely. Developing technology in the vital area of ignition—heart and lifebeat of any machine that flies.

With Hiller, the military, and the engine manufacturer, Champion developed and tested new plugs for new flight requirements. Hiller further subjected these—and competitive plugs—to torture seldom experienced by a plug in actual use . . . even though normal 'copter cruise conditions approximate continuously those of regular aircraft at full-power takeoff. The result of this torture-testing is one reason Champion today remains 'way out front in spark plug and jet igniter development—and preferred by the world's major airlines and business fleets.

I haven't got space to detail Hiller tests. But I'll tell you about one, the brutal "tie-down": Hiller straps 'copters and VTOL's to test pads and runs engines—day and night, without letup—at continuous full-throttle, then 85% power! I'm telling you! If everything isn't up to missile-age par—especially those vital plugs—you can imagine the results!

Any wonder, then, that Powerplant Design Specialist Bob David directs Senior Buyer Gene Sparks to *specify Champions* when ordering the various engines Hiller uses?

Hiller has had a personal hand in tailoring the *dependability* of those plugs to torturous requirements — as Hiller tailors its research craft to fly *right!*

CHAMPION SPARK PLUG COMPANY • TOLEDO 1, OHIO

Whisking heavy loads anywhere is duck's soup for the powerful new lightweight commercial 12E helicopter with its Champion-fired 305-hp Lycoming VO-540 engine. Compared with its predecessor, the three-place commercial-executive 12E will transport 65% more payload, 50 miles farther, and hover in ground-effect four times higher.

plating," and other practices that do not contribute to weapon performance is unpardonable.

Contractor management must face such problems realistically. The Air Force needs simplification of design and increased maintainability by the tactical organizations. The very complexity of the weapons in their simplest configuration is posing equally serious problems in producing, transporting, using, maintaining, and supporting the weapon. Ground-support equipment has become as costly and complex as the weapon itself. The specialized skills required to maintain the weapon have far exceeded the skills required to operate it.

The contractor is being asked to renew his efforts to reduce the cost of weapons through the elimination of nonessential and nonproductive workers, by reducing costs in all areas of overhead, stressing maximum simplicity in design of the weapon and its associated equipment, and ensuring that the most effective management procedures are employed on all phases of the weapon development and production.

The basic materials industry has not solved its problems. We find, relatively speaking, that materials such as titanium, molybdenum, beryllium, columbium, tantalium, and some stainless steels are still laboratory curiosities in regard to their adaptability to meet aerospace program requirements. In too many instances, the techniques of producing the required alloys with proper tolerances, the ability to fabricate to required configuration, and, certainly, cost are limiting application to current Air Force programs.

Yet, these materials and improved supporting fabrication techniques are needed to meet the conditions to be imposed on future Air Force weapons. This is typical of the problems facing the industry and Air Force.

The electronics industry faces a dominating challenge. The necessary guidance, communications, radar, control, and propulsion systems demand increased performance capabilities. Today's complex weapons inherently depend upon electronics equipment which must be made reliable. There is no way to salvage an intercontinental missile once it has left the launching pad; there is no way to direct it to a target if a malfunction occurs in the guidance system. No longer do we have the judgment or skills of a crew aboard to overcome mechanical and electronic failures.

The best that can be expected in case of malfunction is that the missile can be destroyed, fail safe, and land in isolated friendly territory, or if over the enemy territory will luckily hit an area that might be militarily advantageous. I do not mean to deprecate the progress that has been achieved; this has been substantial and significant. However, the military mission of the Air Force from sea level to outer space poses problems never dreamed of during the premissile era.

Increased systems and/or components testing will be mandatory in the future prior to incorporation in the weapon system. Time compression alone will not justify a deviation from adequate assurance that all parts are reliable prior to incorporation in the weapon. During the past history of military aircraft, a component or system failure normally did not produce an insurmountable problem; however, with the advent of the supersonic aircraft the problems became serious, and with missiles a component failure could be disastrous. With the increasing dependence upon mechanical or electronics equipment and operating under the stresses of hypersonic speeds and space conditions, a weapon must be proven as reliable.

To minimize the impact of this increasing demand for reliability and to reduce the development time of weapons, the Air Force is beginning development of such basic components as guidance systems, communication systems, and rocket motors under the "building block concept." This permits the Air Force to contract for the system without regard to the ultimate specific weapon it will support. With selected key systems already in existence, the problem of integration into the weapon is minimized and lead-time compression in development will result.

The transition from the normal production contract, under which the prime is furnished systems and components developed and produced under prime Air Force contracts, to weapon systems contracting has presented a challenge to the industry that is unique. The prime contractor and his subcontractors participate in a relationship that did not exist in the past.

Their mutual dependence upon the technical and management ability, as well as the integrity, of each other is perhaps the greatest single development in the evolution of Air Force procurement. A mutual responsibility for costs, schedule, reliability, and performance of the weapon exists. If any of the elements fail to meet the requirements of the prime Air Force contract, the entire industrial complex supporting the development and production suffers.

The Air Force is encouraging a maximum participation in capital investment on the part of its contractors. It is our desire that industry own the facilities and equipment used for performance on Air Force contracts to the maximum extent feasible. The historical concept of "normal business risks" must be broadened to require greater participation of industry capital.

Changes in Air Force management are pacing its demands. Recently, the Air Research and Development Command and the Air Materiel Command strengthened the weapon systems project offices to provide increased capability to manage the programs at the lowest practical echelon in the Air Force. Technical capability has been added to detect mistakes early, to provide decisions promptly, and to evaluate progress concurrently with the contractor. From this base, the total Air Force team will be geared to react to support the weapon.

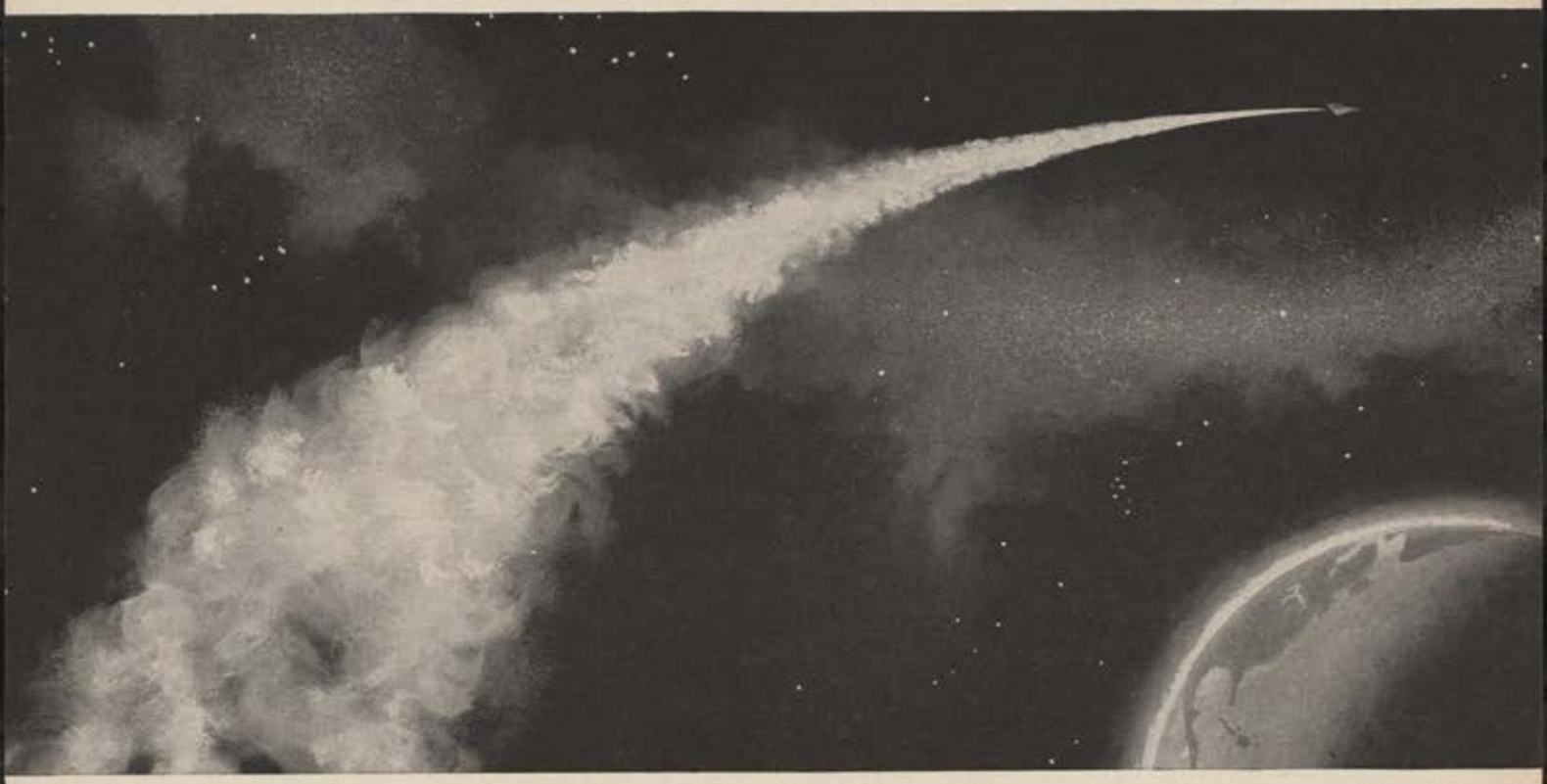
Air Force policy has been changing recently to recognize shifting circumstances. Increased fees based on superior performance, termination of duplicative and marginally effective programs, the "force-in-being" concept, requirement on primes for subcontracting enforced by the "make or buy" policy, and the building-block concept are positive examples of the trend in weapon procurement.

Industry is expected to evaluate these requirements in terms of its capability to produce. Strong management will be required from the inception of an idea to the ultimate delivery of the weapon. Industry can do the job required; it has proven its capability in the past.

However, outmoded ideas and concepts must be abandoned, and a philosophy of careful attention to details will be required to produce the weapon of the future and to permit the Air Force budget to encompass the total mission assigned it in the aerospace age. Industry is a partner in Air Force procurement and production. It is imperative that we make this partnership successful.—END

The author, Brig. Gen. Harvard W. Powell, is Director of Procurement and Production, Office of the DCS/Materiel, Hq. USAF. General Powell, who served in China during the war, has been in the materiel field since 1951 when he was assigned to the Procurement Division of the Air Materiel Command.

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.

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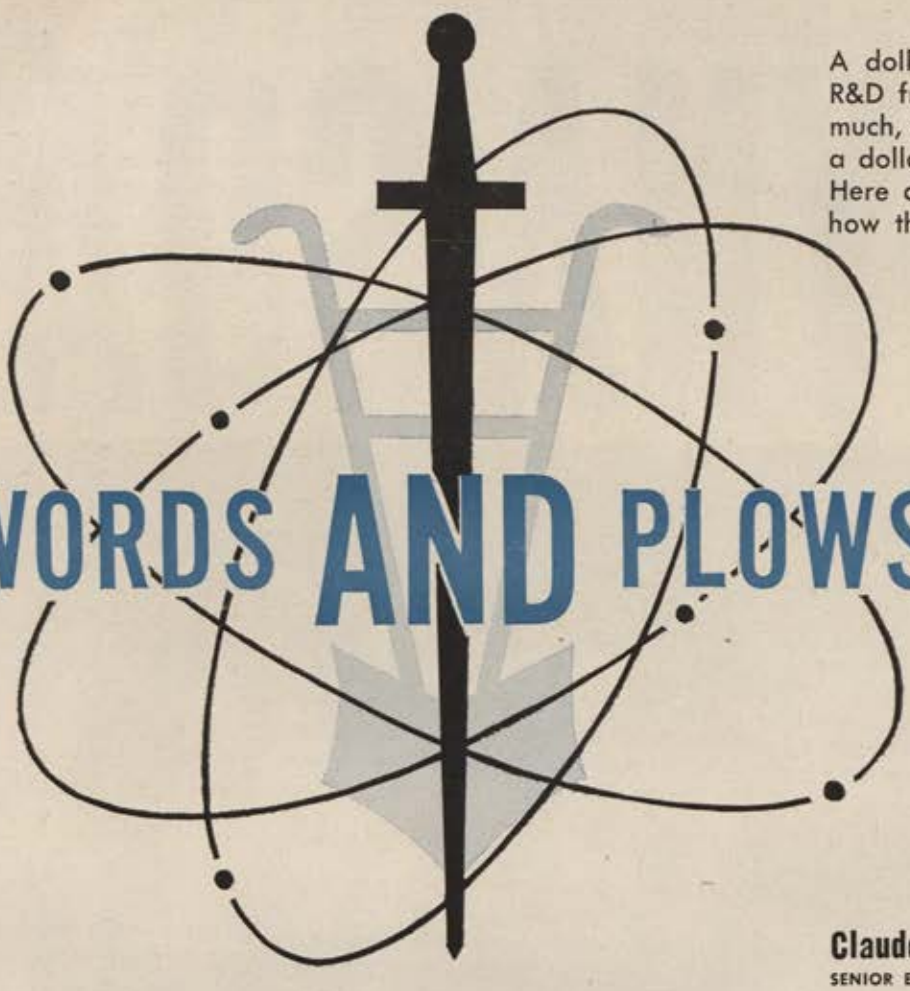


A dollar spent on military R&D frequently produces just as much, or more, civilian benefit as a dollar spent for civilian R&D. Here are some examples of how this investment produces...

SWORDS AND PLOWSHARES

Claude Witze
SENIOR EDITOR

YOU wouldn't know it to watch a housewife picking canned goods off the shelf in a supermarket, but she is buying the results of a military research and development program. It was a program set up by Napoleon, a general usually credited with the observation that an army travels on its stomach.

The man who made it possible to fill army stomachs out of cans was a Frenchman named François (Nicolas) Appert, winner of a 12,000-franc prize offered by Napoleon for perfection of a method of preserving food in containers for use in the field.

There is no record to show how the 12,000 francs appeared on Napoleon's budget, but it is a fair guess that some eagle-eyed critic tried to cross it off on the assumption that any franc saved from the defense effort was a true and worthwhile economy. Canning of food a military requirement? Don't be silly. Military expenditures must be confined to expendable goods—boots, bullets, and dried beans. Within the military budget there must be provided only items of existing military value, because we all know there will be no benefit to the civilian economy. That could have been the reasoning of Napoleon's Budget Bureau.

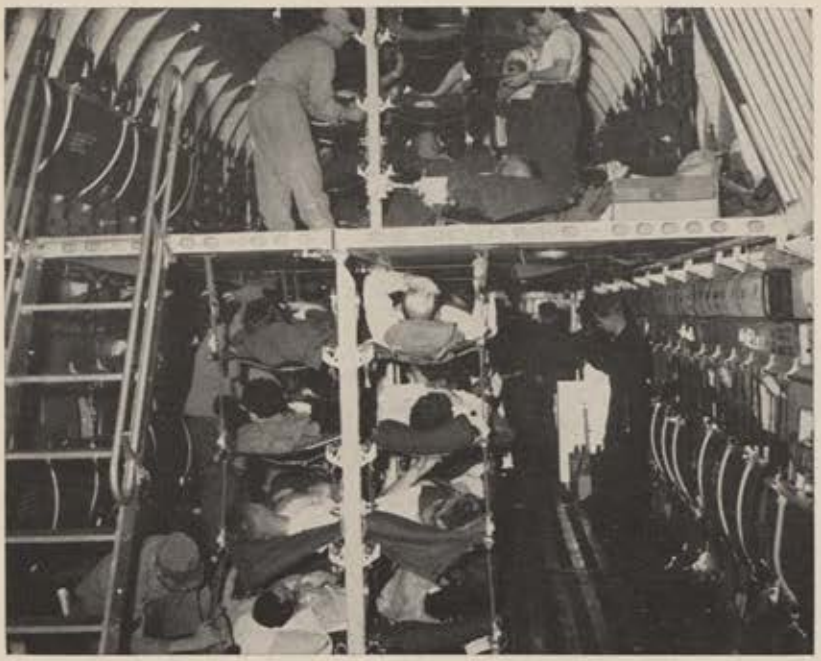
Well, the canned food business grew out of that 12,000-franc military development project, and the civilian economy has been profiting from the idea ever since. Also in the supermarket there are frozen TV dinners, first developed by the Air Force to feed B-36 bomber crews on their long missions. And outside the food department there is a household deodorant, developed for the USAF to combat the "hospital smells" that overpowered patients and crew during air evacuations from Korean War field hospitals. The aerosol bomb, used to package the deodorant, was developed as an Army Chemical Corps project during World War II. Today there are more than 300 commercial products sold in these spray cans. The packing alone is a multimillion-dollar business.

There is no need, actually, to stay in the grocery store to find examples of how money spent on military research and development, in this era of speeding technology, produces both swords *and* plowshares. Visit the local airport. Look overhead at America's booming commercial airline business. Consider grandma's tiny new hearing aid. The economic "fallout" from military research and development expenditures is felt in almost every aspect of our daily life, at home and in business.

The point is that *all* research contributes to the nation's general welfare and that USAF and the other military departments play a big role in the nation's research program.

"Research directed at military ends," says one USAF report, "although it may be concentrated in defense-interest areas, is indistinguishable from scientific research in general. Research progress provides the basis for all technology and is, therefore, essential to new products and better living conditions."

Some of the best examples of this kind of benefit are found in the field of medicine. In 1957 an Asian flu epidemic swept the country from coast to coast. The fact that there was an ample supply of "shots" to protect the



"Glade" is a household deodorant that is credited with neutralizing odor by a chemical reaction. It is not a perfume. The product was developed for the Air Research and Development Command during the Korean War, when crowded hospital planes ferried the wounded across the Pacific *(left)*. Another military product that has found a spot in the domestic market is the popular aerosol spray bomb, used to package "Glade" for convenient use in the home *(below)*.

majority of our people was due to an Army research program carried out to protect soldiers overseas.

During World War II and in the years since, military medical research has made major contributions to surgery. It has introduced new and better ways to treat burns, has improved antibiotics, and has brought them down in price. Currently, a major military medical hunt is on for a new and better substitute for blood plasma. Natural plasma, widely used during the Korean War, is blamed for the prevalence of hepatitis, an affliction that is a common cause of hospitalization. One plasma expander, Dextran, already has resulted from the Army's research effort, and it is being used by civilian doctors in the treatment of shock, burns, and hemorrhage. The search for a better material is being continued and, as in the missile race, there is competition with the Russians, who have an elaborate program of their own in this area.

In sharp contrast to household and hospital progress are the massive and almost immeasurable strides in atomic energy and electronic computers.

The electronic computer industry is the direct product of an Army-sponsored research project in the early days of World War II. The initial problem was the calculation of trajectory and firing tables at the Ballistic Research Laboratories of the Ordnance Department. By 1946 the laboratory had the first modern electronic computer, built at a cost of $400,000.

Application of these machines to the everyday problems of industry, universities, and government agencies is practically unlimited. Certainly it is impossible to measure the possibilities. From that first $400,000 investment, which appeared on the federal budget as a development item just as Napoleon's 12,000 francs, the value of computers sold or rented in a single year now approaches a half billion dollars. And the curves can go in only one direction—up.

Programs involving the commercial application of atomic energy are a subject of continued exploration, debate, and industrial concern. Pilot power-generating plants already are under way, and their future, like that of the electronic computer, appears unlimited. The most crass optimists say atomic energy can and will free man from most of his labor and wipe out the age-old hunt for new sources of fuel. Both the Department of Defense and the Atomic Energy Commission are involved.

Frank Pace, Jr., a former Secretary of the Army and Director of the Bureau of the Budget, later President of General Dynamics Corporation, has speculated that the fusion process would have been developed without mili-

(Continued on following page)

There is a growing number of commercial products that were developed with government funds and first were seen on the military market. Prominent are the miniature electronic parts essential to modern weapon systems. Today 700,000 can be fitted into same space formerly filled by 7,000. They have made it possible to build tiny radios, hearing aids, and flat TV sets.

tary funding, but that it would have taken fifty years to reach the point already achieved in ten. As a result of this military requirement, Mr. Pace has pointed out, "We have today the possibility of producing by nuclear fusion of the atoms in sea water limitless power for a million millenia."

He added:

"In a world soon to be short of conventional power sources, we shall have the guarantee of power in plenty.

"For the two-thirds of the world's people who have not the strength nor the knowledge nor the interest nor the opportunity to overcome famine, disease, and poverty, nuclear energy promises such individual and national cultural and economic development as never before dreamed of."

The amount invested in the nuclear power program runs, of course, into millions of dollars, but the investment will not be big in terms of what this kind of spending for defense will mean to two-thirds of the world's population. Much of the military program is concerned with power units for remote and inaccessible locations. The application for use in remote areas to meet civilian needs in mining and isolated industries is obvious.

Many of the most important contributions of military research and development are in the wide field of materials, their perfection, and the frequently painful process of learning how to fabricate them. An outstanding example is in the jet engine, where the temperatures forced an elaborate program to find out which alloy could be used for the manufacture of dependable turbine blades and how the blades could be manufactured. USAF's Air Materiel Command today has a Manufacturing Methods Branch working with a small budget and looking ahead to 1965 and 1970. It is concerned with machine tools, basic industry, methods engineering, and electronics. The Aerospace Industries Association issues an annual "Forecast of Trends and Requirements" which summarizes the outlook for the future in terms of what will be needed in materials and their working in the factory.

The advent of ballistic and guided missiles has resulted in new advances in the use of beryllium, six times stronger than steel and capable of withstanding temperatures up to 1,200 degrees Fahrenheit. The Martin Company of Baltimore recently announced that its engineers have found a way to fabricate beryllium sheet metal under a USAF contract that is about two years old. Until now, according to Martin, all beryllium has lacked uniformity and has been as brittle as glass. Because the metal is scarce it will be years before commercial uses are developed, but the pioneering is being done with defense dollars.

More recently, the Defense Department's Advanced Research Projects Agency announced that it is launching a modest program, entirely in university laboratories, pointing to the development of new materials. In announcing the project Defense Secretary Neil H. McElroy said, "It seems quite obvious that the civilian components of our economy will get a great deal out of whatever is turned up by these programs."

One of the oft-told stories in the electronic field is that of the requirement for miniaturization of components. The most common example is the old-fashioned tube, now replaced by the tiny transistor, and the printed circuit, which has abolished wiring in many subsystems. This area, says one expert, "has seen a quantum jump in the last ten years and can be expected to surge beyond the boundaries of our imagination in the next ten years." For military purposes, electronic parts have been reduced in size to the point where, instead of 7,000 parts in each cubic foot, we now can put 700,000 parts in the same space. The civilian application, again, is obvious to anyone who has seen a pocket radio, a modern hearing aid, or a television set so thin it fits in a picture frame.

There are myriad other examples, all of them demonstrating that in an age of technological complexity the defense development dollar pays fantastic dividends to the civilian economy. Anyone can scan the list. It includes new and better clothing, fabrics, packaging, communications, paint, propulsion, weather predictions, and industrial machinery. The effects are felt in photography, synthetic rubber, plastics, lubrication, quality control, and shipping, among others.

Nevertheless, nobody can find a justification or a necessity to argue for more defense spending on purely economic grounds. But it is clear that a big defense budget is with us for a long time to come. For this reason it is essential that we evaluate the defense picture not in terms of how many dollars it will cost in this fiscal year or the next fiscal year, but in terms of that expenditure *minus* the economic benefits that come from it.

Mr. Pace has made the point in clear language:

"There seems to be on the part of most people a distressing tendency to regard defense spending as contributing only to military survival purposes, as an uneconomic cost endured only to turn back immediate military aggression.

"It is this concept of defense spending, I believe, that makes us so vulnerable to the stock themes of Russian propaganda. . . . At the slightest hint that the enemy's policy of military aggression may be diminished or diverted, many of us are all too willing to drop the burden of our arms. I am dismayed that so many of our people can be repeatedly faked out. . . ."

He continued:

"As a former Director of the Budget, I am quite aware of the fact that ceilings must be set. . . . On the other hand, for an economy which is constantly expanding, I feel that the imposition of arbitrary and final limitations, either in our national or in our defense setup, would be unwise."

Back of this opinion is the truth that the *net worth* and *net cost* of today's armament program calls for an assessment of all the benefits as well as of the liabilities.

In a study on "Defense Spending and the US Economy," prepared last year by the Operations Research Office of Johns Hopkins University, the authors said:

"Support or criticism of a defense budget should be made upon the basis of a judgment supported by the maximum amount of information pertaining to the benefits and liabilities, explicit and implicit, of the proposed budgeted activities."

The report said that our historical approach is one of severely limiting defense expenditures in time of peace. This is on the assumption that a dollar for the military is a dollar down the drain and is not put to productive use. The facts, in an age when wars, cold and hot, are fought in laboratories, prove this assumption is false.

"A dollar spent on military research and development," the ORO report declares, "frequently produces just as much, or more, civilian benefit as a dollar spent for civilian research and development."

This is something that Napoleon did not know when he paid 12,000 francs for the first canned food and thought it was a military requirement. He got a bargain, and there are bigger bargains ahead for those who will invest in them.—END

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Radioplane drones shown left to right: XQ-4B; RP-76; RP-77D; OQ-19; SD-1

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PLUGGING THE GAPS IN OUR FIRST LINE OF DEFENSE

Maj. Gen. Clyde H. Mitchell

THE DATE was May 17, 1958, the time between 10 and 11 a.m., the place Rome Air Force Depot (now Rome Air Materiel Area), Rome, N. Y. An analysis of teletype messages requesting maintenance which was beyond the capability of the operating organization showed the following:

Teletypes out of order at Torrejon, Spain; Sembach, Germany; Philippine Islands; Hawaii; and Alaska. Radars out of order at Boise, Idaho; Irving, Tex.; Tampa, Fla.; and Thule, Greenland. Ground Control Approach (GCA) systems out of order at Andrews AFB, Md.; Guam; Alaska; Mobile, Ala.; Grand Forks, N. D.; and Burtonwood, England. Communications equipment out of order at Patrick AFB, Fla.; Salem, Ore.; Westerly, R. I.; Japan; Alaska; France; and French Morocco. Peaking of equipment or integration of SAGE required at Philadelphia, Pa.; Austin, Tex.; Washington, D. C.; and Charleston, S. C.

These were the types of maintenance problems being wired into Rome Air Force Depot prior to July 1, 1958. Each of them required immediate emergency maintenance assistance, and each of them was identified by a mission priority which demanded the quickest possible reaction time.

The World War II repair concept, "repair by replacement," was no longer possible because of the sharply reduced postwar "buy" program. There were two obvious answers to the problem—buy more replacement items or send highly specialized and skilled Air Force civilian technicians to perform the necessary maintenance on site.

Economy and the long lead time entailed in any buy program of the scope required dictated that on-site maintenance was the only possible solution. But how do you simultaneously send highly skilled technicians with the necessary replacement parts, tools, test equipment, and technical data to cover all the maintenance requirements stated in the teletype analysis above?

A study group at Rome Air Force Depot evolved a plan that would produce the desired results, wrote an implementing publication (TO 00-25-128), and obtained the sanction of Headquarters, Air Materiel Command, and the US Air Force to begin operation on July 1, 1958.

The basic philosophy of the plan recognized that mobile teams for manned aircraft support had proved satisfactory, and that theory was applied to depot-level support for ground communications-electronics equipment. Five mobile facilities—each with the capability of providing complete on-site depot-level support, and each responsible for fulfilling all depot-level requirements in a designated area—were established.

To simplify supply procedure, the plan called for an Air Force supply inventory of approximately 25,000 items to enable each activity to provide its own supply support. The repair and return concept or "maintenance-to-maintenance" principle is the backbone of this supply system. A defective "black box" is replaced with a workable one; the defective one is later

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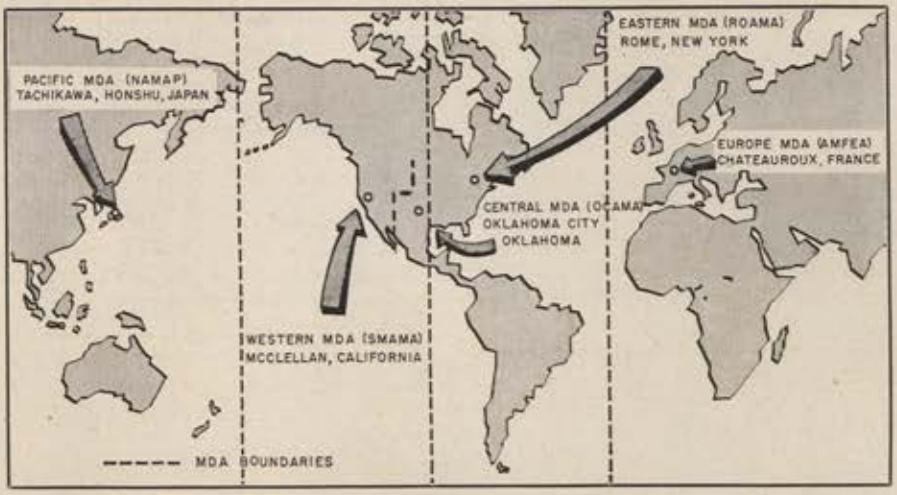
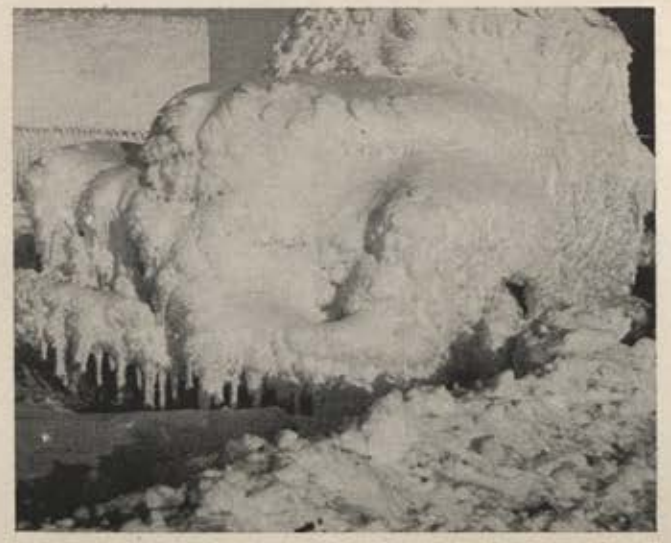


Focal point for Mobile Depot Activities program is Directorate of Maintenance Engineering at Rome, New York. Five MDAs have been set up around the world.

MDA personnel provide communications-electronics support continuously in Far North. Here, in typical Alaskan scene, AC&W site cables snapped by heavy ice.



In the line of duty, MDA man parked his car overnight at AC&W site in Norton Sound region, Alaska. The mercury fell to some 50 degrees below with this result. But the repair job got done.

repaired in the home workshop and returned to the "ready-for-use" stock. This in itself curtails the need for buying more replacement items.

Since these mobile facilities were to perform depot-level maintenance they were appropriately named Mobile Depot Activities, with the focal point for the program located within the Directorate of Maintenance Engineering at Rome Air Materiel Area, Griffiss AFB, Rome, N. Y.

It is the responsibility of this "home office," staffed by nine people, to ensure accomplishment of the Air Force ground communications - electronics maintenance support and to act as the central coordinator and manager of the MDA program.

To accomplish this mission, the world was divided into five geographical areas with an MDA established in each area.

The Eastern MDA is at Rome Air Materiel Area and covers a twenty-four-state area in the eastern portion of the United States, the District of Columbia, the three Texas Towers in the Atlantic Ocean, an area stretching northeast as far as and including Greenland and Iceland, and also southeast to include Puerto Rico, the Canal Zone, and Bermuda. This MDA services 421 installations and employs 336 people. Eastern MDA has detachments located at Wright-Patterson, Westover, Warner-Robins, Brookley, and Keesler Air Force Bases.

The Central MDA is at Oklahoma City Air Materiel Area, Tinker AFB, Okla., and covers a sixteen-state area in the central portion of the country, from the Gulf of Mexico to the Canadian border and the territory east of the Rockies and west of the Mississippi with the exception of Illinois, Wisconsin, and the northern peninsula of Michigan. Central services 297 installations, employs 304 people, and has detachments at Carswell, Barksdale, Offutt, and Chanute Air Force Bases.

Western MDA is at Sacramento Air Materiel Area, McClellan AFB, Calif., and covers an eight-state area in the western portion of the United States, as well as the new states of Alaska and Hawaii. Western services 237 facilities, employs 451 personnel, and has detachments at Mira Loma, Calif., Clearfield, Utah; Vandenberg AFB, Calif.; Elmendorf AFB, Alaska; and Hickam AFB, Hawaii.

Pacific MDA is at Tachikawa Air Force Base in Japan, covers all of the Pacific area, and employs 315 people. Their area includes Okinawa, Guam, Korea, Saipan, Wake Island, and, in

(Continued on page 61)

COMMUNICATIONS...

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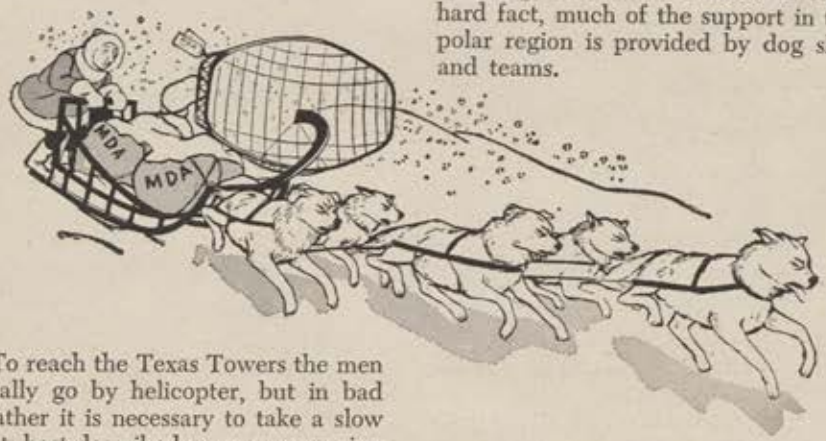
fact, most of the islands in the Pacific except those west of Wake.

European MDA is at Chateauroux, France, and covers Germany, France, Spain, parts of India and Pakistan, parts of Africa, and the Azores. A decision was made by USAF that these areas would be taken care of by contractural support with the work done under MDA policies and principles. The equipment repaired and maintained by these MDA people comprises the first line of defense for the United States against a surprise attack by an enemy. The communications-electronics systems installed throughout the free world are the "eyes, ears, and voice" of the electronic age and are located at Air Force bases, aircraft and warning sites, gap fillers, Airways and Air Communications Service installations, and National Guard facilities.

Anytime the "eyes (radar), ears (radio), or voice (telephone or teletype)" are off the air, there is a gap in our first line of defense which must be repaired within a minimum of time.

Equipped with maintenance parts, replacement components, tools, and test equipment, the MDA people are always on call to respond to any emergency request and use many means of transportation to reach the site.



To reach the Texas Towers the men usually go by helicopter, but in bad weather it is necessary to take a slow boat, best described as an ocean-going tug, which sometimes takes as long as twenty-two hours to make the sixty- to one-hundred-and-twenty-mile trip.

Helicopters are also used to airlift highly sensitive electronic supplies to such high-up sites as the one atop Santiago Peak. Time required for the chopper to deliver the equipment is about forty-five minutes as compared with about a seven-hour trip by truck over a torturous, climbing road, with the gears usually a little the worse for wear.

At a place called Unalakleet on Norton Sound in Alaska, a tramway affords the MDA men and their equipment the only access to an AC&W site. Airborne in their mobile deepfreezers,

the technicians tremblingly join their electronic supplies in a clanking, icy climb over Unalakleet's snow-clad slopes.

While supporting sites in Alaska isn't too troublesome, none of it is easy. During winter months you get the stuff and the men there by airlift (landing on ice-coated runways), by tramway, or you simply go to the dogs—literally speaking, that is. As a matter of cold, hard fact, much of the support in the polar region is provided by dog sled and teams.

But Unalakleet doesn't have a monopoly on ice-clad slopes. Many can also be found stateside. A seven-ton semi-trailer was used last fall on an emergency repair job at an Air Force station in Vermont. By the time the job was completed, the winter snows had already set in and it was impossible to get the van down the mountain. A tractor dispatched for that purpose encountered difficulty descending, even without the van. Some seven or eight weeks later, a temporary thaw enabled a Vermont trucking firm to get the van down the mountain.

On one trip the men may encounter ice and snow, while on their next trip it may be a sandstorm, or fifty- to seventy-five-mph winds, or the sunny climes of Bermuda.

Whether they must battle the whistling, whining williwaws in the Aleutians, the ice and snow in the polar regions, the swamps and insects of the Pacific islands, or the incline of steep mountain sides, the MDA men continue with their support job.

While some of the support is emergency in nature, the men don't sit around waiting for calls. They have a regular schedule of performing pre-depot-level maintenance inspections, coordinating schedules, and performing regularly scheduled overhauls. If they are at "home" for a few days, they can be found doing modification or repair work on ground-electronics equipment.

During any given month, it is estimated that the stateside-based MDA personnel travel about 125,000 miles.

In the nine months the MDA program has been in operation it has developed a planned schedule maintenance which has increased equipment-operating effectiveness, reduced off-air time, made maximum use of organizational and field maintenance personnel, shortened repair cycle time, and reduced the number of components required. At the same time it has made available serviceable replacement components on specified equipment, provided around-the-clock, on-call technical assistance and emergency maintenance support, increased support of "first-line" equipment by Air Force capability, and accomplished all this with but a minimum of maintenance facilities and a maximum of satisfied customers.

The trademark of the MDA man is dedication to his job of serving his customer, wherever he may be.—END

Maj. Gen. Clyde H. Mitchell is Commander of Rome Air Materiel Area, Griffiss AFB, N. Y. Part of Air Materiel Command, ROAMA is responsible for the procurement, supply, installation, and maintenance of ground communications-electronics equipment for the entire US Air Force. Before his present assignment, General Mitchell served in various procurement and production assignments at Hq. AMC, Wright-Patterson AFB. Born in 1905, he was commissioned and won his wings in 1929, is now a Command Pilot.

The four-ton H-16, first in Vertol's series of turbine-powered helicopters, flown in 1955.

The H-21D research aircraft equipped with two GE T-58 turbo-shaft engines, flown in 1957.

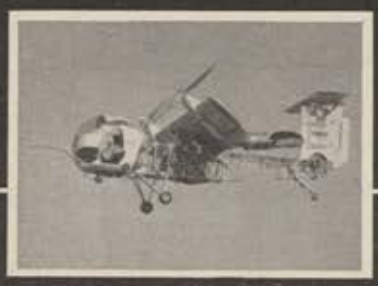
The Vertol 105 with two Lycoming T-53 engines used in the test programs, flown in 1957.

Why Vertol leads in turbine helicopter design and development

Steady progress in helicopter technology has advanced this versatile air vehicle to the threshold of a new era of usefulness. It is the era of the turbine-powered transport helicopter designed for improved battlefield mobility and logistical support of combat elements and missile systems, and for all-weather, day-night operations.

Vertol has been and is today at the forefront in progress toward this new achievement. Among the first to recognize that turbine power would vastly improve performance, capacity and versatility, Vertol also is a leader in research and development on new designs incorporating these powerplants.

The result of many years of work in this field is the Vertol 107, first member of an entirely new generation of multi-turbine helicopters destined to play vital roles in short-range transportation throughout the world. It is now being produced for the U.S. Army as the YHC-1. The 107 can be adapted to an almost limitless variety of functions without altering basic design. Its growth potentialities are built in, assuring a steady progression of helicopters with even greater performance, load-carrying ability and versatility. Detailed engineering on growth versions of the 107, which will incorporate more advanced engines now in development, is under way.



In 1958 the Vertol 76, powered by the Lycoming T-53 was the world's first successful tilt-wing VTOL.

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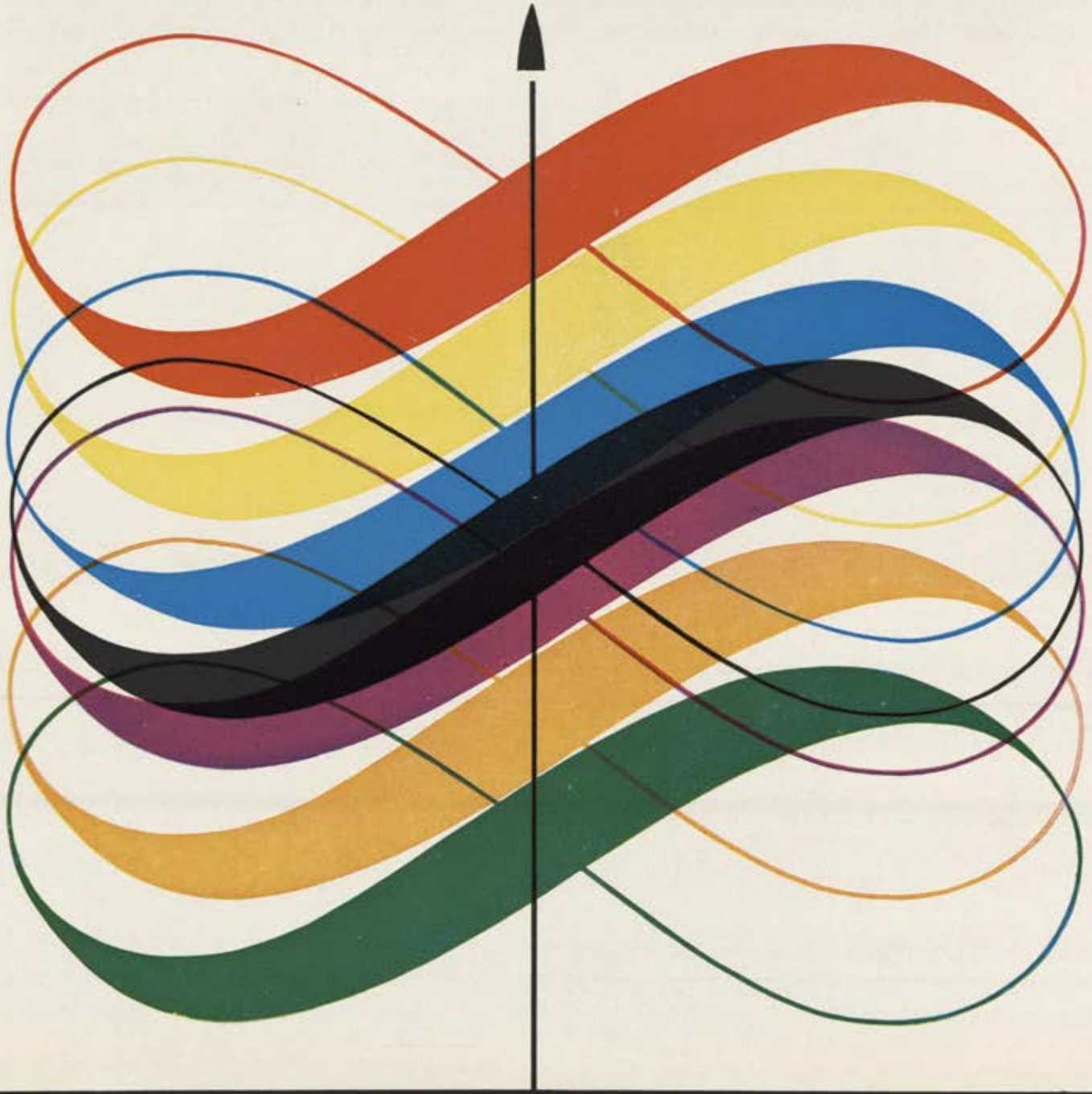
SPACE DIGEST

THE SPACE AGE IN PERSPECTIVE



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VOLUME 2, NUMBER 8 • AUGUST 1959

SPACE DIGEST

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From the Editors...

MONKEYS, dogs, pigs, and now a rabbit. Early in July, the Russians announced their recovery from space-equivalent altitude of a rocket-borne capsule carrying two dogs and a rabbit. The Russian announcement, couched in the usual vague but chauvinistic Communist terminology, shouted of "another triumph for Soviet science" and claimed that the rocket used was the most powerful single-stage device ever launched. Of course, not a mention of the recent US Able-Baker monkey shot or the much earlier series of American launches and recoveries of animals in the early nineteen fifties. In many ways, we may know less about the Soviet Union than anywhere else in the world, but it is a good bet that the Russian man in the street knows even less about *Amerika*.

Another good bet is that precious few letters, if any, are received by the Kremlin from irate animal lovers attacking the use of animals in space and other scientific research, despite the fact that the Russians undoubtedly are as fond of animals as most Americans.

Which brings to mind a wonderful, although possibly apocryphal story. The Air Force's Col. John Paul Stapp, who has repeatedly risked his life by subjecting himself to enormous G forces on rocket sleds, is reported to have received a letter from an annoyed lady chiding him for using bears in such tests.

The letter is supposed to have ended with this question: ". . . and how would you like to have that sort of thing done to you?"

PROJECT MERCURY...

THE UPS AND DOWNS

WILLIAM LEAVITT
Associate Editor

SPACE technology has its administrative, political, and public-relations ups and downs, of course, and the latest project to face the slings and arrows of at least mildly outrageous fortune is the National Aeronautics and Space Administration's Project Mercury program to train seven military test pilots for orbital flight.

In July, the press was invited to attend a quiet tour of NASA's Space Task Group's headquarters at Langley AFB, in Hampton, Va. There they got engineering briefings and another opportunity to talk with the seven spacemen who had been under wraps since this past spring when they were introduced to the world.

Most of the newsmen reported that the spacemen seemed as happy and enthusiastic about their formidable assignment as they had been when they started out.

But one account, which set off a House space committee investigation, suggested that the Astronauts were unhappy about the possibility of losing their flying pay, because of what appeared to be a mixup over the supplying of planes to NASA by the services. Also there seemed to be some irritation among the Astronauts over what were described as delays in paying the per diem due the spacemen as they traveled about the country for their training.

The upshot of the news story was a stir in Congress over denying hot jet craft to the Astronauts and a statement from NASA Deputy Administrator Hugh L. Dryden that arrangements were being made for the Air Force to supply two TF-102s to the Astronaut program. The per diem pay delay, it was also promised, would be cleared up by having NASA rather than the military services act as paymaster.

All this is mentioned only to point up that what on the surface had been a smoothly running program has its problems indeed. Whether, for the specific purposes of the orbital flight program itself, continuous flight training is necessary is a question for the experts. That the Astronauts are thinking of their post-Mercury futures is evident (and only human). That, whether they fly or not, hazard pay should be awarded seems unquestionable. That economy cuts in proficiency flying have made it tough for the services to keep even their *regular* programs going is an old and unhappy story. Who'll figure it all out is anybody's guess. —END

THE US NAVY

TO THE Navy, space is a place, not a program. By this phrase, which crops up in official statements and unofficial conversations, the sea-going service defines its interest in space as a medium through which it believes it may be able to perform its traditional seapower mission more effectively.

The Navy space effort, encompassing strategic aerospace warfare and enhanced control of the sea lanes through improved navigation and maneuverability, is twofold.

Its strategic effort is most dramatically represented by its ballistic weapon program—notably the solid-fueled Polaris missile, designed to be launched from submarines as part of the over-all US retaliatory capability. With top priority, the Polaris project is almost a thing unto itself in the Navy. Its task force of some 4,000 people and contracting agencies, with Lockheed Aircraft Corporation as the prime contractor, is under the aegis of Rear Adm. William F. Raborn and his Special Projects Office. His shop gets its logistical and administrative support from the Bureau of Ordnance, but Admiral Raborn reports directly to the Secretary of the Navy in the Secretary's capacity as Chairman of the Fleet Ballistic Missile Committee, and to the Chief of Naval Operations. Polaris, a 1,500-mile, intermediate-range missile, will have the singular advantage of being launched from a difficult-to-strike-back-at site—underwater. Symbolically, Polaris represents tomorrow's naval airpower, as do hardened-base or air-launched intercontinental missiles in the Air Force. Combined with the nuclear submarine, the Polaris is expected to be a formidable weapon system, when it becomes operational.

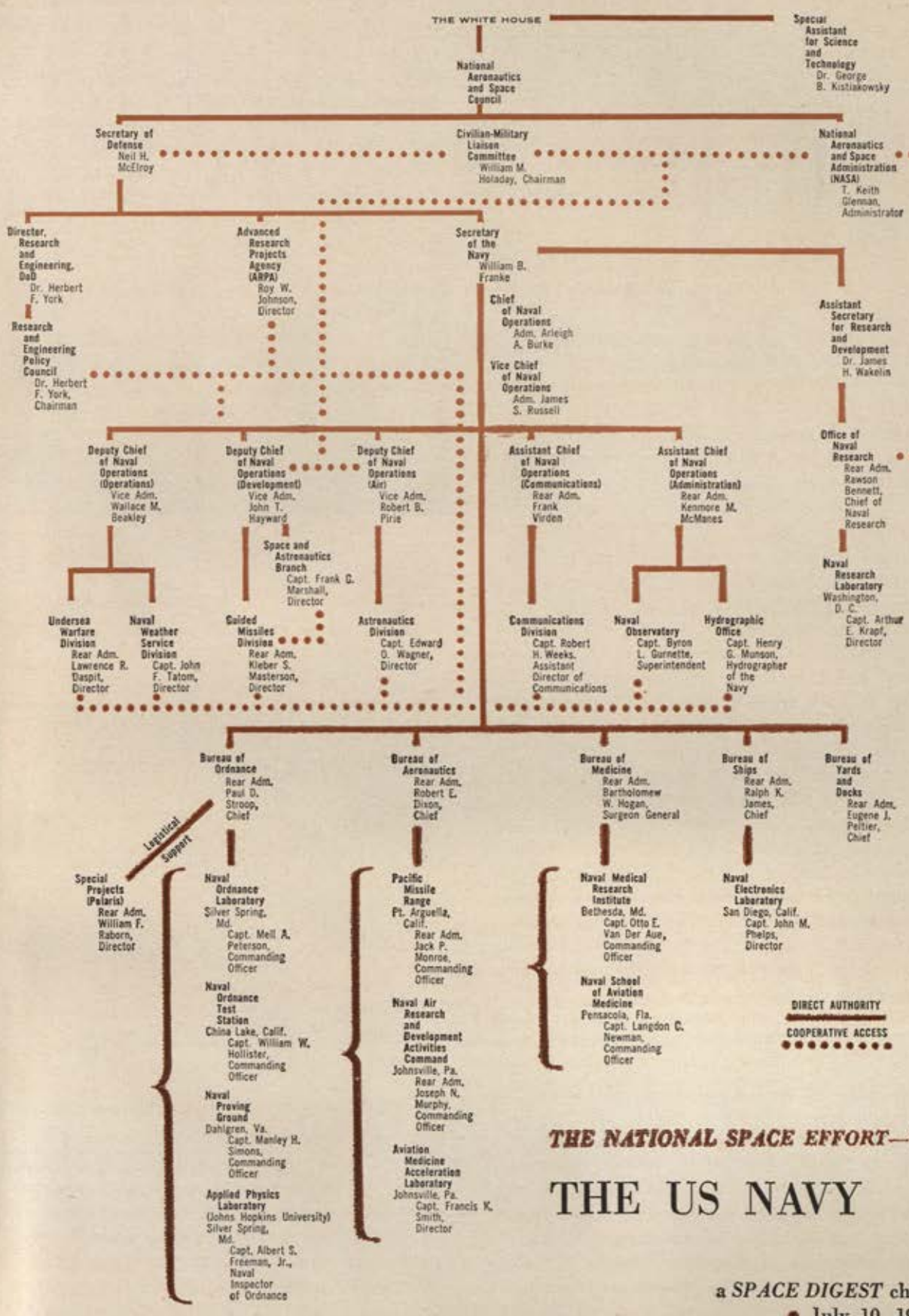
In the broader area of improved fleet operations, the Navy has a strong interest in and desire to contribute to the development of space vehicles which it believes will, in the words of former Secretary of the Navy Thomas S. Gates (now Deputy Secretary of Defense), "use space to accomplish naval objectives and to prevent space from being used to the detriment of those objectives."

Navy spacemen. At left: Vice Adm. John T. Hayward, Deputy Chief of Naval Operations, Development. At the right: Rear Adm. William F. Raborn, who runs the Polaris solid-fuel IRBM program.

Such vehicles include a navigation satellite—Project Transit—currently under study and development by the Bureau of Ordnance for the Department of Defense's Advanced Research Projects Agency, with the Air Force working on propulsion. Such a satellite, the Navy believes, holds great promise for precise all-weather navigation.

Also for ARPA, the Navy is contributing to development of an advanced communications satellite, a project divided among the Army, Navy, and Air Force. The Navy is providing ground environmental data. Also, the Navy's research facilities are contributing to ARPA's solid propellant and detection studies. The Navy has also expressed strong interest in naval utility for reconnaissance satellites, with the aim of providing a boon to

This is the sixth in SPACE DIGEST'S *series on the National Space Effort. Next month, the role of the US Air Force will be examined. See the next page for a chart of the naval organization for space.*



THE NATIONAL SPACE EFFORT—VI

THE US NAVY

a *SPACE DIGEST* chart
• July 10, 1959

At the test stand, Navy Polaris test vehicle towers over work crews. Polaris, mated to nuclear submarine, is expected to be formidable weapon.

worldwide surveillance of seagoing commerce. Highly significant also in the space effort is the Navy-run Pacific Missile Range at Point Arguella, Calif.

In addition, the Navy, through its technical bureaus, the in-house research facilities of its laboratories, and through contracts for research and development placed with industry and universities for Navy, ARPA, and NASA projects, is pursuing study, technical development, program management, and procurement in such areas as worldwide mapping and surveying, worldwide weather reporting, upper atmosphere data collection, and satellite tracking. Also, a major contribution is being made by Navy medical facilities in the man-in-space program. Part of the training of the seven NASA Mercury Astronauts for orbital flight is scheduled for the Navy's Aviation Medicine Acceleration Laboratory at Johnsville, Pa., site of the largest American human centrifuge. And, of course, three of the Astronauts are Navy pilots. Baker, of the recent Able-Baker monkey ride into space, was Navy trained. The Navy, too, has a long record of high-altitude ballooning, and its submarine medicine program has garnered much data at least partially applicable to spaceship environments.

It is also important to mention the recently announced Navy plans for building the world's largest radio telescope at Sugar Grove, W. Va.

In addition, the much-abused Vanguard program, now transferred to NASA under the direction of Dr. John Hagen, was originally a Navy project dating back to the pre-Sputnik days when the ballistic missile capability and the scientific effort associated with the International Geophysical Year were essentially separated.

How is the Navy organized for its space research and development effort? It must be pointed out that for the Navy, as for the Air Force and Army, "pure" space projects are okayed and, in many cases, funded by either ARPA or NASA.

Under the Navy's latest organization, space projects in the idea or development stage are funneled through Vice Adm. John T. Hayward, Deputy Chief of Naval Operations, Development. Serving as his space staff is the Space and Astronautics Branch, headed by Capt. Frank G. Marshall. As the Navy's development man, Admiral Hayward has access to ARPA, NASA, and to the DoD's Director of Research and Engineering, Dr. Herbert F. York, on whose Research and Engineering Council Admiral Hayward sits, along with the Air Force's Lt. Gen. Roscoe Wilson and the Army's Lt. Gen. Arthur G. Trudeau. Admiral Hayward, a naval person with a distinguished record of scientific training, is a strong advocate of a single agency for centralized control of the space effort.

The Navy makes a strong separation between the development side and the operational side, and points out that, when missiles or space vehicles become operational, they quickly go over to the jurisdiction of the Deputy Chief of Naval Operations, Air, or other appropriate staffs. Incidentally, as part of its streamlining for the space age, the Bureau of Aeronautics and the Bureau of Ordnance will soon be combined into a new Bureau of Weapons, in keeping with the recommendations of the recent Franke Report, prepared under the chairmanship of the new Secretary of the Navy, William B. Franke. Another phase of the Navy's streamlining is the newly christened Astronautics Division under the Deputy Chief of Naval Operations, Air.

How much is the Navy spending on air and missile weapons for its space age future? Aside from research and development, the Navy for FY 1960 is scheduling some $2 billion, about twenty-two percent of the armed forces' total. This sum is second to the Air Force's more than $7 billion. The greater proportion of the Navy figure is scheduled for aircraft procurement and production.

Space limits a full compilation of the Navy's space efforts and interests.

But, in sum, the Navy sees space as an extension of the seapower medium, is anxious to participate in space weapons development, and—unofficially at least—is champing at the bit for a greater share in and greater credit for its contributions. Among the military services, it is not alone in this view.—END

Where we stand . . .

THE ANTIMISSILE MISSILE

DR. TOM MARGERISON

The successful development of an antimissile missile would have an important effect on the strategy of deterrence. Here a leading British scientific journalist contrasts the theoretical possibilities of developing one with the practical value that it would be likely to have. . . .

Reprinted with permission from The New Scientist, *published in London, England*

THE explosion by United States forces of three small nuclear weapons about three hundred miles above the surface of the South Atlantic last summer . . . was one step in a series of experiments which the Americans are undertaking to see whether it is possible to develop a defense system against ballistic missiles. The basic idea is to set a missile to catch a missile, and at least two different types of antimissile missiles are being developed in the United States. The first, called Nike-Zeus, being developed by Western Electric for the US Army, is in prototype form and for many reasons does not look very promising. The second, Wizard, is a US Air Force project which was canceled at one stage and has recently been revived. It seems likely that at least one other system is also under development.

There is an adage that for every form of offense a means of defense can be found, and history has failed to prove it wrong. But in combination the two most recent comers to the arsenals of the great nations—ballistic rockets and hydrogen bombs—present such a formidable advantage to the offense that defense is at present impossible. Will it ever become possible?

The Americans seem to think that it will, for they are proposing to spend $2,000 million on research into and development of missile defense systems in the next three or four years. So far as is known, the Russians have no antimissile research program—nor has Britain, France, or any other major nation.

The problem of defense against long-range rockets carrying nuclear warheads is not simply a matter of technical feasibility. To intercept and stop a rocket on its way toward you is a difficult and perhaps impossible task, which I shall discuss later, but there is no theoretical reason against it. Success would not involve contravention of any of the physical laws of nature.

But countries do not live by the laws of nature alone. The possibility of carrying out any major program such as draining the North Sea, or irrigating the Sahara, depends on economic as well as technical arguments. The same is true of defense. However enthusiastic defense engineers may be, a defense system is useless if it is so expensive that in building it the country reduces itself to bankruptcy.

The reason why the hydrogen bomb is such a deadly partner to the ballistic missile is that it makes much more efficient defense systems necessary. During the last war, when bombers carried conventional high explosives to drop on London, a defense system which prevented two-thirds of the raiders from reaching their target area would be very effective. The cost of such a raid to the enemy was high and the damage inflicted on the target relatively low. All that has been changed with the coming of nuclear weapons, for a single hydrogen bomb would obliterate the greater part of London. In other words, any defense system worth having nowadays must have a very good chance of destroying every hydrogen bomb before it reaches its target.

It is against this background that engineers are looking for the answer to the ballistic missile. Their problem is hundreds of times more difficult than that of the guided missile designers who are pitting their wits against aircraft. First, the ballistic missile travels much faster—a long-range rocket will travel 5,000 miles in about half an hour and approach its target at about 22,000 feet a second. Secondly, it is much smaller than an aircraft (or at least the warhead is, and that would probably be detached from the rocket body in much the same way that Sputnik I was) and therefore it would be much more difficult to detect by radar.

On the other hand, the rocket defense engineer has certain advantages. Once the ballistic missile has left the atmosphere and its rocket engine has ceased firing, its course is fixed by the laws of geometry, and in theory two determinations of its position are enough to fix its exact path thereafter. Then, he has the advantage that inevitably the rocket must carry its deadly load high up into space, so that even when the missile is several thousand miles away it may still be above the horizon and therefore "visible" to radar. Finally, he has the consolation of knowing that, while his own job of stopping the incoming missile is extremely difficult, it is almost equally difficult to land a long-distance rocket precisely on a target thousands of miles away. With luck he may be able to make use of some of the special weaknesses of the design of the invading rocket to destroy it—for example, its difficulty in reentering the atmosphere.

The problem of defense against rockets can be broken down into four parts: detecting the mis-

radar breakthrough. A new radar system, developed by Bendix Radio, simultaneously searches and tracks . . . provides space-age detection capability . . . has superior operational reliability . . . and is safe from obsolescence. It is called ESAR—Electronically Steerable Array Radar. Employing techniques far superior to any used heretofore, ESAR generates tremendous power, and overcomes the performance limits of ponderous rotating antennas. This unique equipment, developed under the sponsorship of the Air Force Rome Air Development Center and the Advanced Research Projects Agency, also has applications other than radar detection. To learn how ESAR can solve advanced operational problems, consult us.

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sile, calculating its trajectory, intercepting it with another rocket, and destroying it.

Rockets might (in theory) be launched from anywhere in the world—on land, or from under the seas using a submarine. During its first fifty miles or so the path of the rocket is quite easy to detect, since the motor is running and the ionized gases form a good mirror for radar beams. But in order to "see" the rocket at an altitude of about 100 miles, the radar stations have to be within 900 miles or thereabouts of the launching site. . . . This is why so much emphasis is placed by the Department of Defense on forward radar stations in the Arctic, and in Britain, Germany, Turkey, and other countries comparatively close to the Soviet Union. The fact that the United States has friends in the right place to harbor her forward radar stations is a great advantage for the defense of America. Russia is not so fortunate in having friends close to the United States.

Even with advanced radar bases the detection of missiles is none too easy, since they appear above the horizon with rocket motors working for only a minute or two and it is difficult to watch all directions at once. In addition, the signal has to be sent securely back to the remainder of the defense system without interference from the enemy. In some cases it may be possible to build additional forward radar stations in aircraft which, because of their height, get a better view.

The next problem, having established that a rocket has been fired, is to calculate its trajectory and to decide whether it is a peaceful space probe or satellite, or whether it is a war rocket destined to blow up a city. It is here that real difficulties begin. Let us assume that what we have detected is the firing of an intercontinental ballistic missile. In a sense this is the easiest case, since there is a longer time available for the defense to act and the difficulties of the attackers are more acute than for shorter-range rockets.

Once the rocket motor on the ICBM stops firing its trajectory is fixed, but at once it becomes much harder to pick up by radar as it has lost its reflecting tail. A moment later we can expect the warhead to separate from the body of the rocket, which could be fragmented with an explosive charge to form a swarm of radar decoys spreading like a shot from a gun. Soon the swarm of decoys might spread out to cover an area thirty miles square.

How would the tracking radar distinguish between the warhead and the decoys? Two possibilities exist: either to track all the decoys and calculate all the trajectories to see if any one of them was likely to land on a target, or to defer the decision until the swarm started to reenter the atmosphere at the end of its journey, when the decoys would burn up. This latter course would almost certainly leave action until too late.

In any case, we may question whether radar would be able to detect the approaching warhead. The reflecting area could almost certainly be made small—probably not more than a square yard—and, as it seems likely that plastic laminates would be used for the external shell, a very small radar echo would be obtained. The maximum height of an intercontinental ballistic missile is about 700 miles—above most of the satellite orbits—so that even radar sets immediately underneath the trajectory would have difficulty in picking it up. The extent of this tracking problem can be judged from the difficulty which large radio telescopes such as that at Jodrell Bank have had in following rockets and satellites when they knew more or less where to look.

What is more, our defense radar stations must be certain that the echo they have found comes from a weapon of war and not simply a meteorite, part of a space probe returning to earth, or some quirk of the ionosphere or aurorae. Even assuming that all these problems can be overcome, there remains the possibility that the enemy might himself get up to mischief and upset the long-range tracking radar in some way. For example, the explosion of an American nuclear weapon at an altitude of about 100 miles over the Johnston Islands in the Pacific last year produced disturbances in the ionosphere, and an artificial aurora was observed at Apia in the Samoa Islands. Aurorae are known to produce radar disturbances, and an artificial aurora might be expected to have the some effect.

But let us suppose that all these problems have been overcome and that the destination of the missile has been calculated within five minutes of launching. The next problem is to intercept it, and obviously this can be done only with another

rocket. Liquid-fueled rockets are impracticable since there would be no time to load them with liquid oxygen, which cannot be stored indefinitely in the rocket's tanks. Even using solid-fueled rockets burning cordite or some similar explosive, some minutes are needed to get the rocket off the ground. Probably the best that can be done is to have the rocket launched within about five minutes of getting word from the radar operators. The offensive missile is by now getting near to the highest point in its trajectory, so that our defensive rocket will have to catch it on the downward journey during which it is steadily gathering speed.

If the defensive rocket is to intercept the invader, incredible accuracy is needed—such accuracy of timing and control of thrust of the rocket motor that the task is virtually impossible. Fortunately, there is one trick the defenders can use to reduce the accuracy required. They can site the defensive rockets near to the target areas and launch them back along the same path that the invading missile is known to be on. By using this reverse trajectory the timing of the exact moment when the defender takes off becomes less critical, although it does mean that defense missiles have to be ready close to every target area.

With luck the antimissile will pass close to the missile ten minutes after takeoff—or twenty minutes after the missile took off—and perhaps 2,000 miles away from the target. The meeting will take place about 300 miles up, well clear of the atmosphere. How is the antimissile missile to destroy its opponent?

Most of the destructive effect of high explosives (including nuclear ones) let off on the surface of the earth is due to blast, the wave of pressure created in the atmosphere. But where there is no atmosphere, there is no blast—or almost none. Even if we put a hydrogen bomb in the antimissile, we cannot expect it to damage the intruder by blast. It is possible, however, that a nuclear weapon exploded sufficiently close to the offensive missile would damage it in other ways.

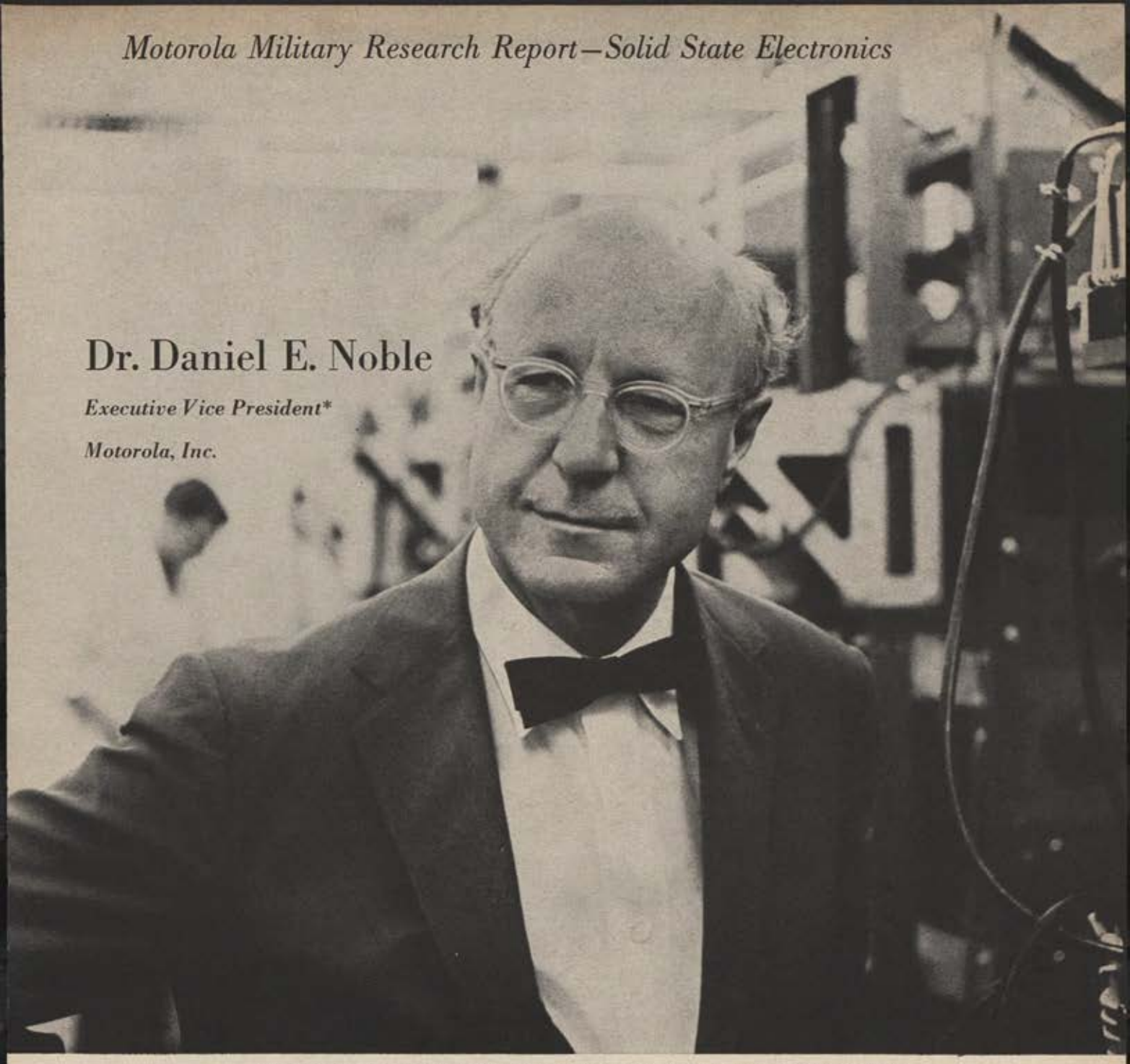
First, if the missile passed through the fireball of the defensive nuclear weapon, it might evaporate. The problem here is that the missile designer has already provided his missile with a jacket which will resist the heat produced on reentering the atmosphere, so it is probably very resistant to heat. On the other hand the missile might survive the first heating by the defensive nuclear weapon, but then be quite unable to guard itself against reentry heating.

Secondly, an exploding nuclear weapon produces a great bubble of neutrons—splinters of the uranium atoms split in the course of the explosion—and these *might* be in sufficient concentration for a moment after the explosion to trigger off the fission detonator of the hydrogen bomb in the offensive missile. Nobody knew how a nuclear explosion would behave in space, how quickly the fireball or the neutron bubble would spread, and it was probably to discover this that last summer's American experiment, Project Argus, was undertaken. The tests should have revealed how near a miss is needed in order to shoot down an intercontinental missile, and they should also show whether this form of sharpshooting blocks radar sets looking for the next attack.

There are many "ifs" attached to any form of defense against long-range missiles; even if Project Argus results show that a kill can be made by a nuclear explosion in space at a range of several hundred yards, the chance that a single defending rocket will succeed is extremely small. To be certain of success many defenders would be needed for each attacker, and the cost would become prohibitively high.

In Britain we would be more likely to be attacked by short- or intermediate-range rockets than long-range ones. The total time such rockets are in trajectory is not more than fifteen minutes. The only chance of interception would be just above the target when the missile was reentering the atmosphere and was particularly susceptible to attack. In this case much smaller defense rockets might be used, designed to spread abrasive particles in the path of the missile and to damage it in that way. Again the chances of success are out of all proportion to the expenditure involved. A much bigger effort would be needed than for the design of guided antiaircraft missiles, which have absorbed a large part of the British electronic industry.

For the time being the antimissile missile is a myth, and it may well remain so. There seems as yet to be no practical alternative to the present childlike approach of defense by deterrent.—END



Dr. Daniel E. Noble

*Executive Vice President**

Motorola, Inc.

*DR. NOBLE IS VICE PRESIDENT IN CHARGE OF THE COMMUNICATIONS AND INDUSTRIAL ELECTRONICS DIVISION, THE SEMICONDUCTOR PRODUCTS DIVISION AND THE MILITARY ELECTRONICS DIVISION OF MOTOROLA, INC.

"In this new era, Solid State Electronics will spread its influence to every form of human endeavor and will contribute substantially to scientific achievement in all fields."

Dan Noble

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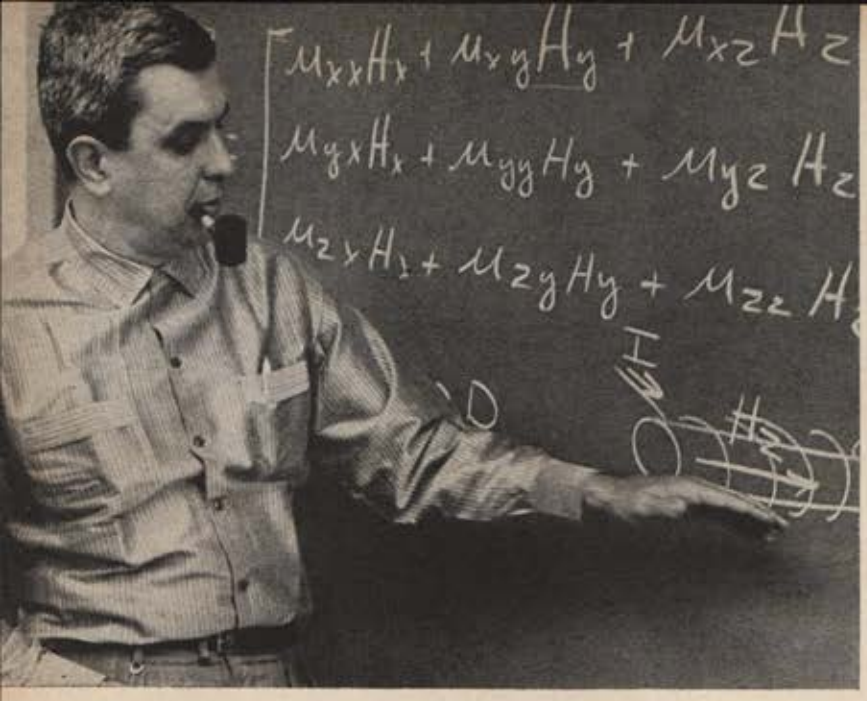
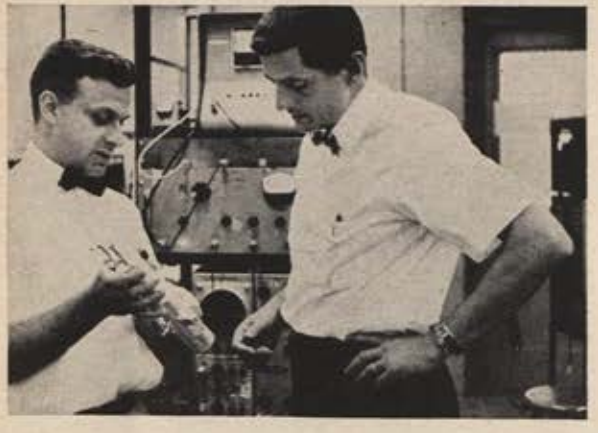


Ferrimagnetic principles are demonstrated by scientist in charge of Motorola's Solid State program, Dr. H. William Welch, Jr., director of research and development, Military Electronics Division. Dr. Welch as a University of Michigan professor established that school's Solid State laboratory and introduced new curricula in Solid State devices and their applications. He holds an I.R.E. Fellow Award for contributions to development of solid state devices and microwave tubes.

Typical of solid state materials now being offered for sale by Motorola are these ferrite rods and bars being examined by Donald L. Fresh, manager of the Solid State Materials Laboratory.

John C. Cacheris, right, manager of the Microwave Applications Laboratory, and a member of his staff inspect a parametric amplifier, one of several devices now being produced by Motorola's Solid State Dept.



Imaginative leadership plus the most modern of laboratory facilities have helped foster a creative environment that is attracting top talent to Motorola. Here, Dr. Arthur L. Aden, associate director of research and development for Motorola's Military Electronics Division, shows a new member of his staff equipment for photographing printed circuits. Dr. Aden welcomes inquiries from qualified engineers and physicists who would like to join his department.

James R. Black, manager of Motorola Microelectronics Laboratory, heads work which leads toward the mass production of economical microelectronic components so small that several would fit on the period that ends this sentence.

How Solid State Electronics is shaping the future

MILITARY ELECTRONICS—industry as well—is being radically changed by rapid advances in solid state technology. Predicted for the near future are computers small enough to fit in the palm of a hand, receivers that will detect the weakest signals from distant satellites.

Motorola's highly experienced Solid State Department, in close cooperation with the Semiconductor Products Division, is advancing the state of the art on several fronts, one of the most promising of which is microelectronics.

By making use of crystalline functional circuit elements created in volume quantities by surface etching or film deposition methods, Motorola researchers anticipate they will soon be able to design equipment with component densities of tens of millions per cubic foot.

This high density will result in a great reduction in systems and computer size coupled with a significant increase in reliability, and it will lead to the development of self organizing computers for such complex tasks as the solution of military logistics problems and space guidance.

In microelectronics and in other areas, Motorola scientists, including those of the Semiconductor Division, are investigating the ferroelectrical, ferrimagnetic, piezoelectrical and pyroelectrical characteristics of monocrystalline and polycrystalline solids. New materials possessing these useful characteristics are created and produced in the Materials Laboratory. Typical applications: newly developed ferroelectrical or piezoelectrical materials to be used in transducers for submarine detection.

At present, the Applications Laboratory is making extensive use of ferrites and semiconductors in the development of broad lines of isolators, circulators and parametric amplifiers. The latter device has already demonstrated its worth in satellite-tracking radars, IGY research receivers, uhf television receivers and radio. In the study and design stage are new and advanced ferrimagnetic devices such as microwave switches, ferrimagnetic limiters and semiconductor switches.

Still another research frontier where striking preliminary results have been achieved is a low-voltage facsimile paper for the transmission of teletype and other information. Applications in the fields of combat surveillance, logistics control and other important military programs are foreseen.

Military Electronics Division's expanding capability in solid state electronics is described in a new booklet entitled: "Solid State Frontiers at Motorola." *Request your copy from Technical Data Service, Motorola, Inc., Military Electronics Division, 8201 East McDowell Road, Scottsdale, Arizona.*

MOTOROLA

Military Electronics Division CHICAGO • PHOENIX • RIVERSIDE

Engineers and Physicists interested in career opportunities are invited to write: Motorola, Inc., Military Electronics Division

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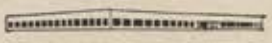
CHICAGO 51, ILLINOIS



8201 EAST McDOWELL ROAD
SCOTTSDALE, ARIZONA

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Speaking of SPACE

Space Telescopes

Out above the earth smog, a fifty-inch telescope could survey the stars and the heavens with a clarity that would make present astronomy obsolete. The National Science Foundation, at the Kitt Peak National Observatory, has begun work to place such a telescope in orbit by 1964. As a preliminary to a satellite telescope, the NSF and the Office of Naval Research plan to launch four balloons that will carry twelve-inch telescopes to an altitude of about 80,000 feet this summer.

Morality and the Atom

Gen. Lauris Norstad, Supreme Allied Commander, Europe, reconciled atomic weapons and morality:

"Let me make explicit my attitude toward the question of the morality of atomic weapons. Its morality derives exclusively from the hand that wields it. Is a simple stone good or evil? We cannot answer until we know whether it is gripped by the hand of Cain or by the young David's as he stands against the tyrant Goliath. A new Goliath now confronts us, threatening our peace, our lands, our lives themselves. Are we not then to defend ourselves to the very best of our ability? Of course. And that we should ever feel guilty, ever feel we have to apologize, for doing so is as fantastic and incredible as it would be for us to do less than our best. Not only need we of NATO never apologize, but we should be proud that we are meeting our obligations as did our forefathers in all countries: to be ready to fight all-out for freedom."

GEORGE "MOON" MEYERS—By Jack Tippit

"Georgie, boy, if you're positive there's no crab grass up there, then I'm signing up to go along with the first rocket load of moon colonists."

Astronautical Autobiographies

The series "Three Astronautical Pioneers," appearing in the April, May, and June issues of *Astronautics,* not only offers insight into the careers of three brilliant scientists, but indicates some of the difficulties encountered by all true pioneers. Robert H. Goddard, 1882-1945, American rocketman, recounts the development of his interest in rockets and propellants from the age of four. His autobiography, as yet unpublished, will appear as a book next year. Konstantin Eduardovich Tsiolkovski, 1857-1935, an introspective Russian dreamer preoccupied with cosmic space, had completed a very practical study of a manned space vehicle powered by lox-hydrogen rockets by 1903. The third pioneer in the technology of astronautics, Hermann Oberth, born in Hungary in 1894 and now living in Germany, was fascinated by the idea of spaceflight from the time he read Jules Verne's stories as a boy of eleven. By 1923 he had published his theory of space travel in a pamphlet that established the framework for much that has become space technology now—"The Rocket into the Interplanetary Space."

Star Story

We have received the good news that a New York film company, Storyboard, Inc., has acquired the rights to Harlow Shapley's superb book, *"Of Stars and Men,"* as source material for a feature-length production. It will be done in color, using animation, straight photography, and "other graphic de-

Have sidearms, will travel

When SAC slings a pair of GAM-77 Hound Dog air-to-ground missiles under the wings of the new B-52G bomber, it has what amounts to a brand-new manned weapon system.

For the Hound Dog's jet engine drives it at supersonic speed to a target hundreds of miles away. Its self-contained inertial autonavigator, set before launch by the B-52's crew, can't be jammed, can't be decoyed.

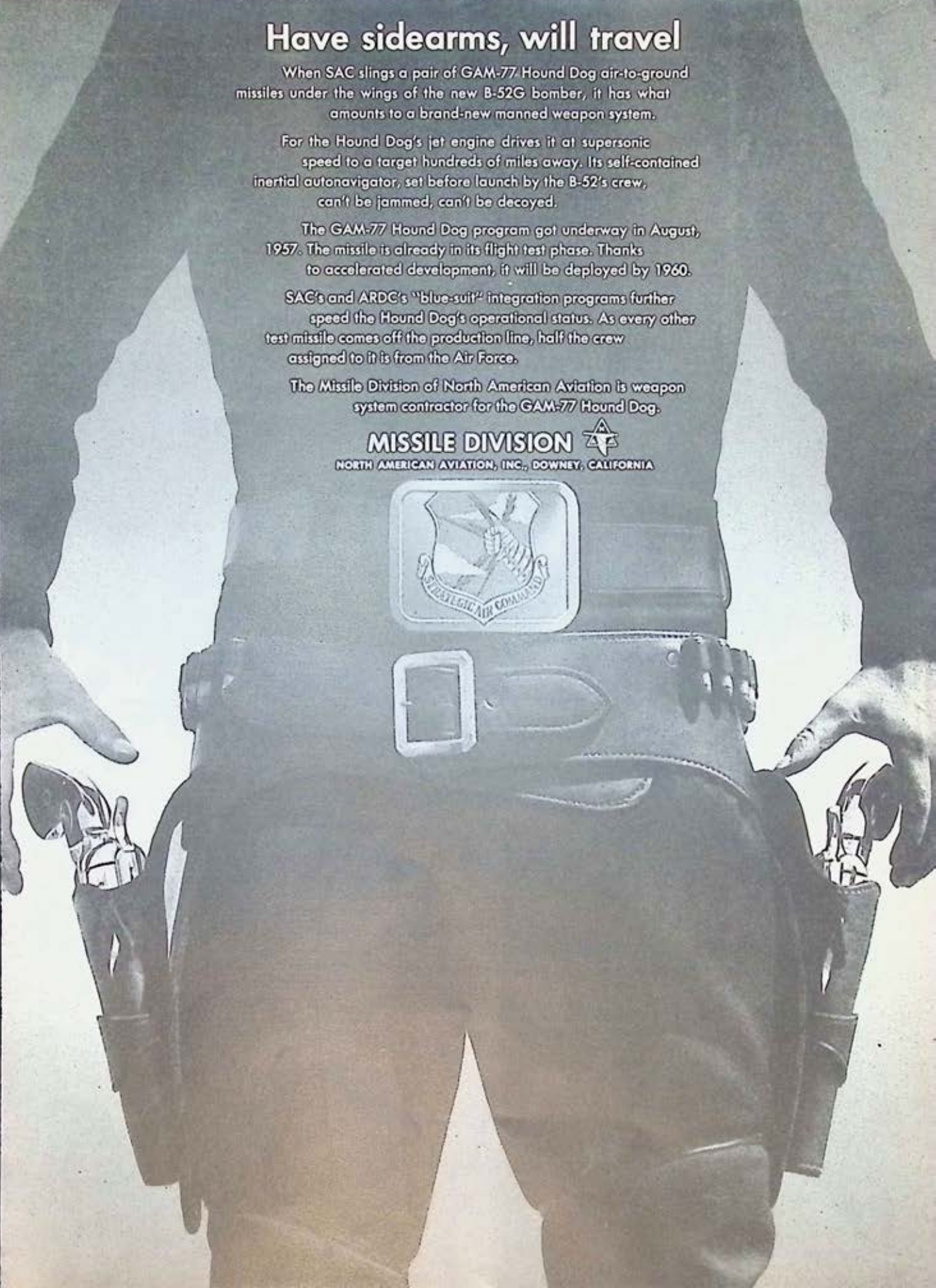
The GAM-77 Hound Dog program got underway in August, 1957. The missile is already in its flight test phase. Thanks to accelerated development, it will be deployed by 1960.

SAC's and ARDC's "blue-suit" integration programs further speed the Hound Dog's operational status. As every other test missile comes off the production line, half the crew assigned to it is from the Air Force.

The Missile Division of North American Aviation is weapon system contractor for the GAM-77 Hound Dog.

MISSILE DIVISION

NORTH AMERICAN AVIATION, INC., DOWNEY, CALIFORNIA



Ability of energy to do work?

A mathematical convenience?

Gibbs' Free Energy?

What does it mean in isothermal electrochemistry?

The concept of energy availability in all its ramifications is becoming ever more important to Allison's energy conversion mission.

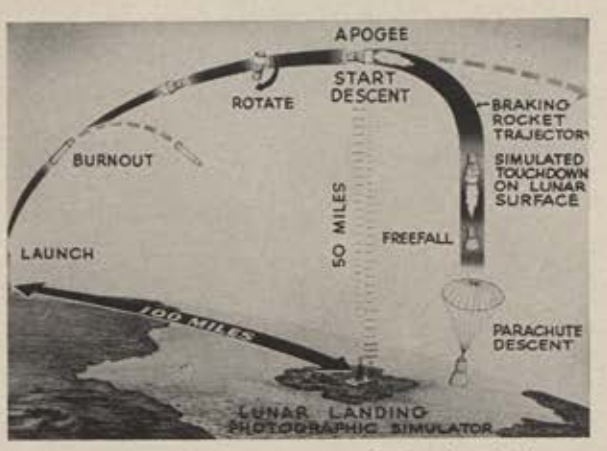
Current projects involving this concept include electrochemical conversion systems (for satellites, space systems, and perhaps even your future automobile), heat regenerator systems and photolysis regenerators.

In our inquiries we rely not only on our own resources but also on the talents of General Motors Corporation, its Divisions, and other organizations and individuals. 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.

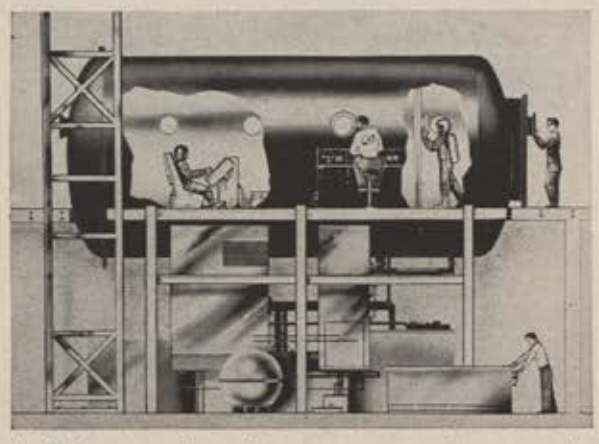
Energy conversion is our business

ALLISON

Division of General Motors, Indianapolis, Indiana



Northrop official has suggested simulated "moon landing" for training purposes. The braking rocket would bring capsule to stop as if it had hit moon.



Artist's conception shows two men in spacesuits undergoing tests in space-simulation chamber to be part of new Republic Aviation astronautics center.

vices." Dr. Shapley is slated to act as technical adviser during production.

Top Banana Eater

William Rockefeller, national president of the American Society for the Prevention of Cruelty to Animals, journeyed to the Navy School of Aviation Medicine at Pensacola, Fla., to present a special award to Baker, survivor of the May Jupiter flight into the wide black yonder. Accepting on behalf of Baker was Dr. Dietrich E. Beischer, director of the Navy project responsible for training the space monkeys. Monkey Able, who died as the result of a post-anesthesia heart arrest, will receive a similar award posthumously.

Recommended Reading

"Pulsating Stars and Cosmic Distances,"—Cepheid variable star pulsations as an astronomical yardstick—by Robert P. Kraft in the July *Scientific American.*

"Which Way Is Heaven?"—as man goes up or out and beyond, where will he look for faith?—by David Greenfield in the July 4 *Saturday Review.*

"Psychological Aspects of Confinement in Fallout Shelters"—confinement for two weeks or more after a thermonuclear attack may have far-reaching effects on the individual—by J. Donaldson, K. Magnuson, *et al,* in the April *Journal of Psychology.*

"How We Established the Lunar Radio Link"—details of the reflection of Morse code and voice messages from the moon—by Dr. J. V. Evans of Jodrell Bank Experimental Station, in the May 28 *New Scientist.*

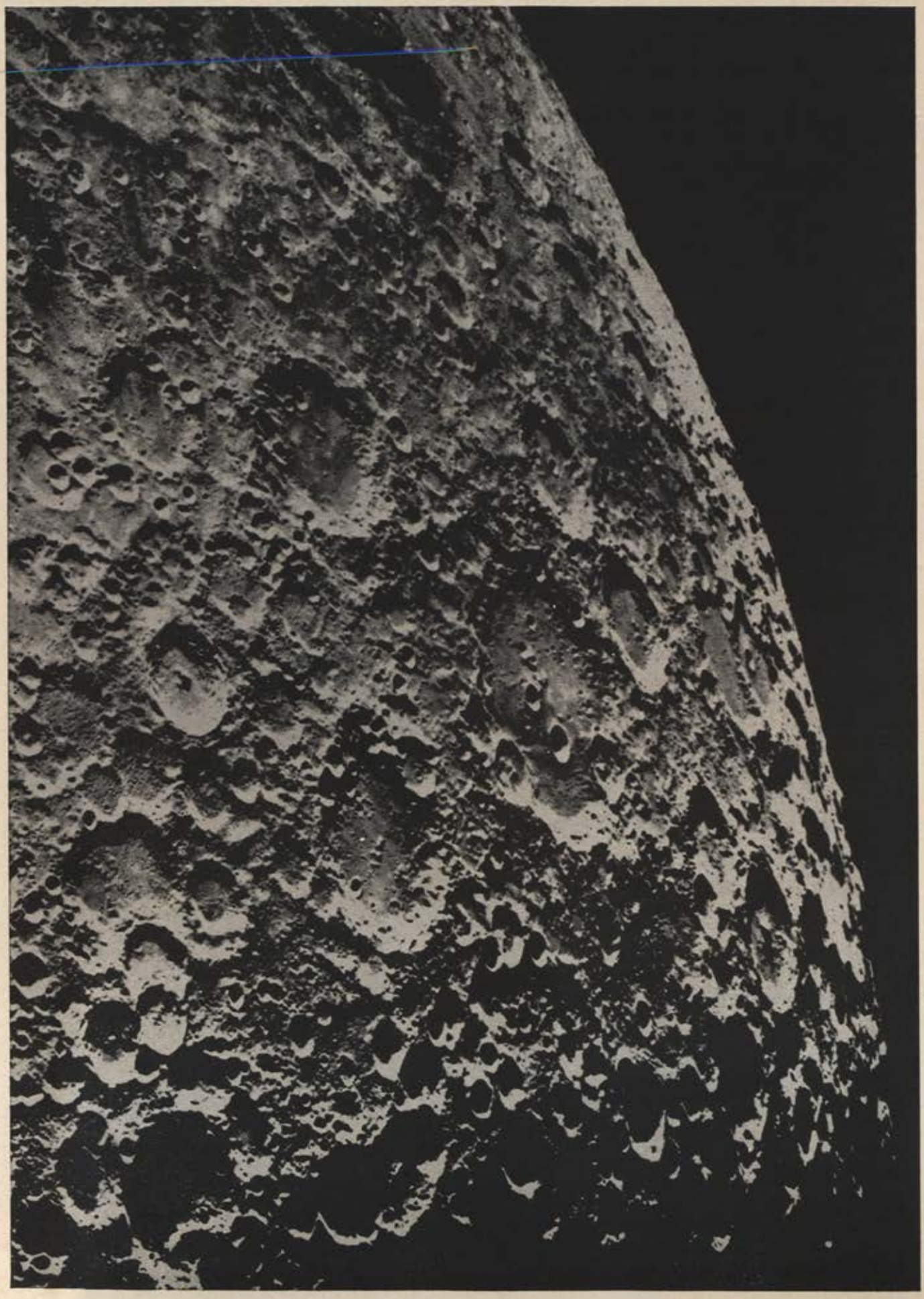
"Vibration and Noise Problems Expected in Manned Spacecraft"—incipient manned spaceflight makes it necessary to consider human tolerance and performance in the dynamic mechanical environment—by H. E. Von Gierke in the May *Noise Control.*

Nuclear Club–How Many Members?

For an interesting and detailed study of the problem of expansion of the international nuclear club, it's well worth picking up a copy of *Daedalus,* the Journal of the American Academy of Arts and Sciences, summer 1959 issue, containing a report by Howard Simons of Science Service on a study of the problem. Write to *Daedalus,* Jefferson Laboratory, Harvard University, Cambridge, Mass.

Mechta Report

From an April issue of *Doklady Akademii Nauk USSR:* "The cosmic rocket launched in the direction of the moon on January 2, 1959, was equipped for recording cosmic rays and terrestrial corpuscular emission. . . . A preliminary processing of data obtained within an altitude range of 8,000 to 150,000 kilometers from the earth's center is presented. . . . The spatial distribution of the high-intensity zone is found to lie at 26,000 km. from the earth's center. At 55,000 km. the terrestrial corpuscular emission is zero. . . . The measured energy does not quite concur with data by Van Allen. . . . The intensity of cosmic radiation appeared constant starting with 66,000 km. altitude, up to 150,000 km. It indicated that at this altitude the terrestrial magnetic field has no more effect."



SPEAKING OF SPACE

Discoverer IV

The fourth satellite in the Discoverer series was launched from Vandenberg AFB, Calif., on June 25 but did not attain orbital velocity. Termed "strictly a hardware test," it carried no medical specimens.

Medicine and Space

The next congress of the Pan American Medical Association to be held in Mexico City from May 2 to May 11, 1960, will include a section on space medicine. Maj. Gen. Otis O. Benson, Jr., Commandant of the School of Aviation Medicine, will be president of the space medicine section, and S. Fred Singer of the University of Maryland will be the section's secretary.

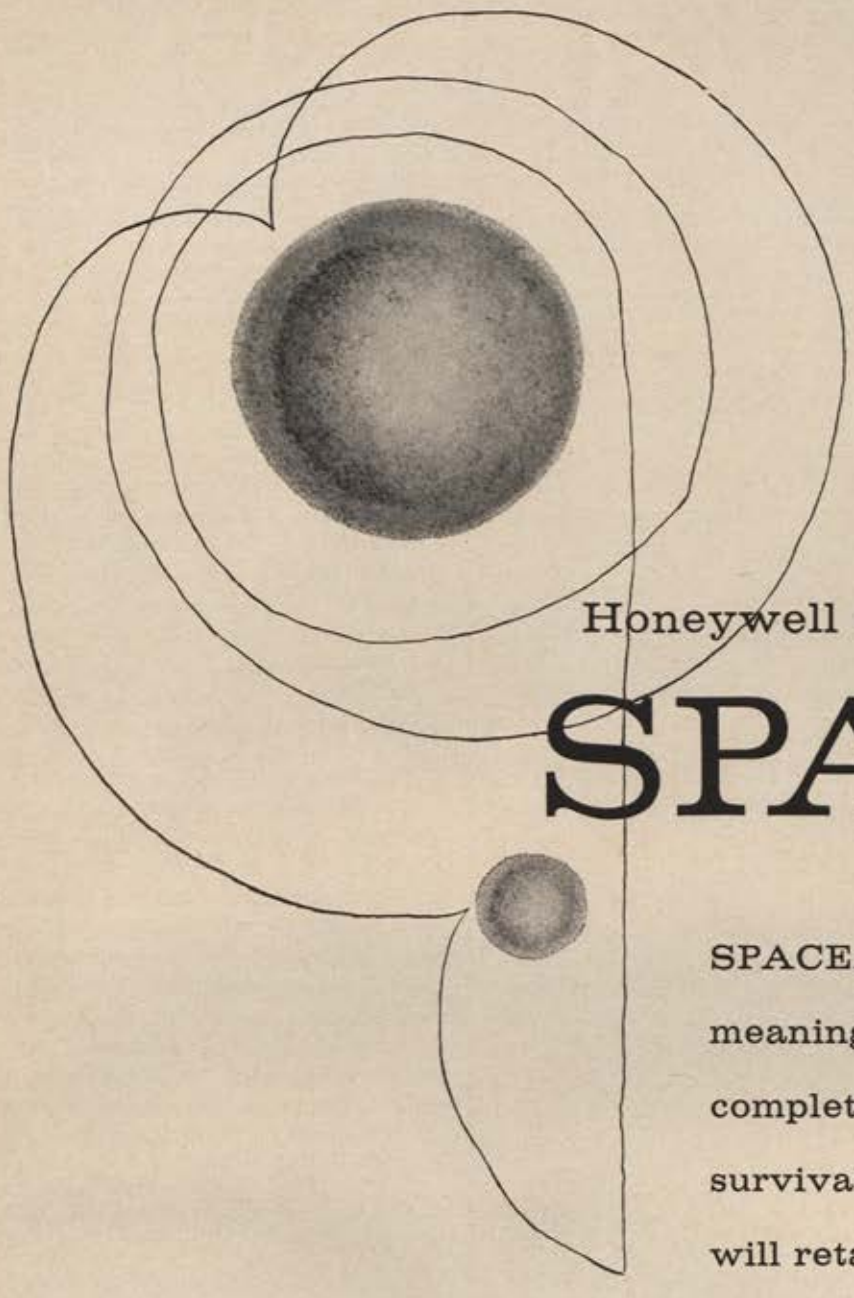
Federal Science

The Senate Government Operations Committee has approved a bill to create a commission to study the need for a federal department of science and technology. The commission would consist of eight members to be appointed by the President from federal agencies and among scientists; four members appointed by the Senate —two senators and two scientists; four members appointed by the House— two representatives and two scientists. At this point, opinion seems pretty well divided as to whether such a department would serve to give science its rightful place in the US or bog down scientists in a morass of government restrictions and administrative procedures.

One very strong argument for a single department was set forth by Lloyd Berkner, distinguished head of Associated Universities Inc., and a chief architect of the International Geophysical Year, who wrote in a recent issue of *Science Magazine:*

"The creation of such a department would centralize governmental responsibility for vital scientific functions that are now performed to an extent . . . most inadequate in the light of current needs. . . . It would bring together closely related scientific responsibilities. . . . It would provide the means of extending . . . leadership."

—Michael B. Miller



Honeywell calls it

SPACEA

SPACEABILITY is a new term meaning the capability to completely equip man for survival in space. While he will retain the ability to exercise his judgment with manual controls, man's welfare in space will depend largely on automatic control of his navigation, flight and power—in fact, his total environment, including food, oxygen and waste disposal.

There are three areas indispensable to space operations: (1) motion control and navigation for vehicles of flight, including inertial systems; (2) environmental control for human activity; and (3) instrumentation and data processing both on the ground and in the air.

Recognition of Honeywell leadership in all three areas is exemplified by the fact that Honeywell controls are going into almost all space vehicles presently planned.

BILITY

This Honeywell capability is benefiting the following projects, some of which have already been completed:

- Providing complete guidance and flight control system for Project Scout, the NASA launching vehicle for orbital and probe flights of instrumentation satellites.
- Developing navigation and guidance system for the proposed Martin version of Dyna-Soar, the Air Force pilot-controlled semi-orbital vehicle.
- Developing and producing an advanced space cabin environment simulator for the Air Force School of Aviation Medicine.
- Supplying orbital injection guidance reference systems for Project Vanguard's launching of satellites into predetermined orbits.
- Developing and producing attitude control for both orbiting and re-entry versions of Project Mercury, the NASA manned satellite program.
- Developing and producing attitude stabilization systems for vehicles used in re-entry test phases of Project Mercury.
- Human engineering studies and instrumentation development for pilot orientation in space flight for Project Mercury.

Corporate capability—With a notable background in missile and space systems management, as well as in the design, development and production of systems and components, Honeywell is fully qualified for work on all phases of prime missile and space systems.

Human engineering in relation to space flight is being studied by an entire project team at the Military Products Group's aeronautical facility in Minneapolis. The group is made up of specialists in anthropology, anthropometry, bio-chemistry, bio-physics, psychology and psycho-servo analysis. Their goal: optimum integration of man into a complex control system, which involves problems such as efficiently dividing labor between manual and automatic computation equipment.

Honeywell organization makes available to space projects unique capabilities and experience. These include Industrial Instrumentation, Computing and Recording complex; the services of environmental experts in the Temperature Controls Group; and associated members of the Military Products Group: Ordnance, Aeronautical, Boston, and Missile Equipment Divisions. The Corporate Research Center works closely with all groups.

Areas of interest and activity at Honeywell for space projects include the following:

Inertial guidance and navigation systems, gyros, stable platforms, accelerometers, computers, air data systems, ballistic trajectory control systems, horizon scanners, fix takers, reaction jets, control valves.

Other areas are flight data sensing and display systems, telemetry and recording systems, data reduction systems, pressure and temperature sensors, analog-digital and digital-analog converters, atmosphere composition control systems, temperature control systems, pressure control systems and recording devices.

If you have a problem that requires outstanding capability in control for space projects, call on Honeywell. For information write Honeywell, Minneapolis 8, Minn.

Honeywell

H Military Products Group

SYLVANIA ELECTRONIC SYSTEMS . . . IN SIMULATION

Creating electronic "realities" in a low-cost manageable package

SIMULATING CONDITIONS of actual operations for flight trainers, radar operators, or space travelers is an experienced and growing facility of Sylvania Electronic Systems.

Good examples are Sylvania's participation in the Navy's Universal Digital Operational Flight Trainer and "ACTER," a new Sylvania development which will add ECM conditions to existing radar training gear.

Undoubtedly the simulation of space travel can be enhanced materially by current simulation projects.

In simulators or trainers, as in every major area of electronic systems, Sylvania can assume full responsibility from system analysis and management through research and engineering, product design, production to field engineering.

Sylvania welcomes the opportunity to outline its special talents and capabilities to you or your organization personally. *Simply address your inquiry to division headquarters, address below.*

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A Division of Sylvania Electric Products Inc.
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SYLVANIA
Subsidiary of
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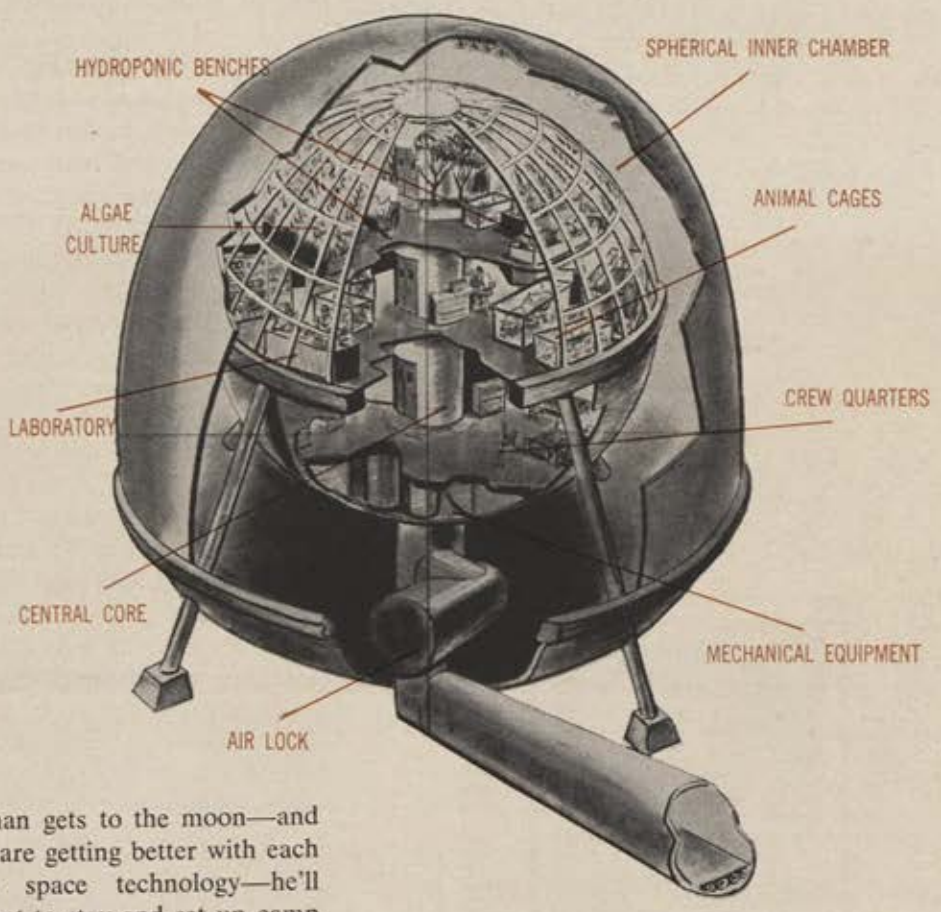
'Lunar Base' Here on Earth



ASSUMING man gets to the moon—and the chances are getting better with each advance in space technology—he'll probably want to stay and set up camp eventually. Such an out-of-this-world housing development will involve an enormous tangle of environmental questions: the provision of adequate atmosphere on our airless celestial neighbor, the provision of food, protection against meteors, and a host of other problems.

Ideally, the moon base will have to be a completely self-sustaining unit, with the capability of providing all essentials.

Human factors scientists at the Martin Company's space medicine section at the Denver, Colo., division believe that a life-size simulator to perfect these sustenance techniques should be built now on our own planet. In such a simulator, they suggest, crews could undergo realistic training for residence on the moon.

Their design, illustrated above, would consist of an outer spherical shell containing an inner spherical chamber. The inner chamber would consist of three levels, with a central core containing a powered elevator for access to all levels. An airlock would connect the inner core on the ground level to the outside. The space between the two chambers would consist of vacuum, an ideal area to test spacesuits or the action of vacuum on materials. This would simulate what crews leaving a real moon shelter would undergo.

The Lunar Housing Simulator, as the Martin scientists have dubbed their idea, would be a closed, self-sustaining ecological system. The upper deck would contain green plants in hydroponic tanks to provide oxygen and food. The median deck would contain a laboratory, animals for food, and additional plants for air regeneration. The lower deck would contain living quarters for a five-man crew, complete with most of the "comforts of home." And the basement level, like an ordinary house, would contain the powerplant—probably a conventional one here on earth, although on the moon it would be necessary to use solar or nuclear power.

Although their full-scale simulator is still a drawing-board item, the idea has been brought to the attention of such agencies as the National Aeronautics and Space Administration. Meanwhile, Martin scientists keep working on space medical problems in their already existing laboratories.—END

DR. LOUIS N. RIDENOUR, JR.

an architect of the space age

ON THE morning of the twenty-first of May a scientist whose name was only barely known to the general public but who had been one of the prime architects of the space age died of a cerebral hemorrhage in Washington, D. C.

The scientific world was shocked to learn of the sudden death of Dr. Louis N. Ridenour, Jr., at the age of only forty-seven, in the midst of his prime as a long-time contributor to the aerospace progress of the country he had served so well.

At the time of his death, Louis Ridenour was a Vice President and General Manager of the Electronics and Avionics Division of the Lockheed Aircraft Company, the last in a series of high and responsible positions he had filled with great distinction during and since World War II.

A nuclear physicist and electronics expert, Dr. Ridenour was a youthful man who looked more like an athletic businessman than the research scientist that he was. One of his most significant public services was his tour as the first Chief Scientist of the US Air Force in 1950-51. As chairman of a special committee that surveyed the then newly independent Air Force, he left a special stamp on the nation's aerospace arm with the famous "Ridenour Report," which led to the establishment of the Air Research and Development Command and the creation of the office of the Deputy Chief of Staff for Development.

During World War II he had served as the assistant director of the still relatively uncelebrated but highly significant Office of Scientific Research and Development's Radiation Laboratory at Massachussets Institute of Technology, which helped transform primitive radar into a reliable defensive and offensive military tool. Even today, the extent of the contribution of the Radiation Laboratory to the Allied victory has not been fully reported, partially because it was obscured by the more dramatic revelation of the atomic bomb project.

Dr. Ridenour, during his all-too-short career, had also taught at Princeton, the University of Pennsylvania, and the University of Illinois, and had written numerous scientific books.

His Lockheed career had begun in 1955 when he joined the company's new Missiles and Space Division as director of research. He had looked forward to working on solutions for the complex problems of the space age.

He will be sorely missed.—END

One of a series of advertisements depicting historic incidents in military communications through the ages

EARLY WARNING—1775 *"One if by Land, Two if by Sea."*

The signal lanterns in Boston's North Church tower winked for only a fleeting moment in the gloom of the night, one . . . two! British troops were to come by sea, hoping to surprise the Colonial Minutemen and seize the military supplies of muskets, cannon and gunpowder prudently stored in Concord, 22 miles away; as well as the provincial leaders Samuel Adams and John Hancock known to be staying in nearby Lexington. So Paul Revere was off, down the lonely moonlit road toward Lexington on his immortal midnight ride to alarm the countryside. Later that day "The embattled farmers . . . fired the shot heard round the world." The war for independence and freedom was at hand.

GRANT WOOD (1892-1942). "The Midnight Ride of Paul Revere." The Metropolitan Museum of Art. George A. Hearn Fund, 1950

Again in today's uneasy world, we must rely on early warning and widespread communication to alert and direct our modern minutemen, in the event of any hostile move to attack this land. In this age of long range aero-space offensive weapons, the most advanced Electronic Communications are pre-requisite in the operation of our continental defenses.

ECI is proud to be supplying major communications equipment to our armed forces...in surface, air-borne and space applications. Systems such as the air-borne communication and data units linking the latest USAF all-weather Century Series Interceptors into the Continental Defense network are ECI products.

☆ A full-color 18 x 25 reproduction of "The Midnight Ride of Paul Revere," suitable for framing, will be sent FREE on request.

ELECTRONIC COMMUNICATIONS INC. *St. Petersburg, Florida*

Specialists in advanced electronic communications, countermeasures, and detection systems

Regional Offices: Washington, D.C., North Hollywood, Calif., Paramus, N.J., Dayton, Ohio, Dallas, Texas

A NEW CHAPTER
IN AIR POWER

"Hound Dog" missiles, launched from far-ranging B-52s, vastly increase the capability of SAC's bomber fleet.

North American's "Hound Dog" missile is powered by the Pratt & Whitney Aircraft J-52 jet engine. The B-52 bomber is also powered by Pratt & Whitney Aircraft engines—eight J-57s.

This is just another example of Pratt & Whitney Aircraft's leadership in flight propulsion, in whatever form it takes.

POWER IS THE KEY!

Flight's historic limitations are being overcome. Today's speeds, distances, and altitudes will soon be extended even beyond the frontiers that research is just now reaching.

The key to this exciting future is power . . . dependable power, to meet any requirement of flight. And dependable power is our business.

In the area of nuclear propulsion, for example, Pratt & Whitney Aircraft has demonstrated important technical achievements which only a year ago were considered impossible or highly improbable. Major accomplishments have also been made in high-energy liquid propellant rocket engines, and other advanced applications of power for flight. These advances are opening the way for ultra-long-range aircraft, as well as for vehicles of space travel.

Flight Propulsion by **PRATT & WHITNEY AIRCRAFT**

East Hartford, Connecticut
A division of United Aircraft Corporation

$trategy Wears a DOLLAR SIGN

The following article is excerpted from one chapter of Strategy in the Missile Age, *a new book by Bernard Brodie, to be published September 21 by Princeton University Press, Princeton, N. J. The book will be the next selection of the Aerospace Book Club.*

Bernard Brodie

THERE is a legend that we Americans have always entered our wars unprepared. It may be true, though it is hard to test the proposition in the absence of a standard that commends itself as logical and objective. It was foolish to enter the War of 1812 against the world's greatest naval power with only a handful of frigates, but it would not have been much wiser to do so with two or three times that force. It is the one war of our history that we did not win, that is, the one war in which our strategic position at the end was clearly worse than at the beginning and in which our avowed war objectives received no explicit gratification from the opponent. Even so, the advance in our national destiny was hardly interrupted by the affair.

It would have been difficult to be better prepared for the Civil War without giving the Confederates a share in the advantages and thus nullifying them. The wars against Mexico in 1846-47 and against Spain in 1898 we won quite handily. Neither did we do at all badly in the two world wars. It is true we never got an American-built airplane to the front in World War I, but we got plenty of other American commodities there as well as men. And if we failed to do as well as we might have in the Korean War, it can hardly be attributed to our deficiencies in preparedness. All we can say is that our military expenditures in the years before each conflict rarely reflected the high expectation of war which our hindsight leads us to consider appropriate.

From the beginning of our national history until the eve of World War II, we paid very little in peacetime for our security, but that is simply because we were not obliged to pay more. With what we spent, however ridiculously low some of the figures now look, we were able to buy well-nigh absolute security from foreign aggression against our continental shores. It did require considerable effort to win the two wars against great powers which we fought in the twentieth century, but who can say what kind of or how much prehostilities preparedness would have made the task much easier? The warships we were building at the time of Pearl Harbor might have been started somewhat earlier, but let us take credit for the fact that we did have a colossal fleet on the building ways! By the time the new ships and all the other new forces began to make themselves felt in the Pacific, the Japanese had hurt our pride and caused us casualties but had actually done us, as a nation, relatively little harm.

As a result of this history we have developed certain national habits, most of them reflecting an ingrained optimism in our approaches to problems of national security. The size of the American peacetime budget today suggests that these habits are not unshakable, that they do tend to adjust to changing circumstances; yet it is hard to visualize how drastically the relevant circumstances have changed. Today we are spending far, far more on defense than we have ever spent before in peacetime, but we are fated to remain far, far less secure. Moreover, insecurity today means something much more terrible and much more nearly absolute than it meant before 1945, even to those countries that thought they knew insecurity.

We do not have and probably never will have enough money to buy all the things we could effectively use for our defense. The choices we have to make would be difficult and painful even if our national defense budget were twice what it is today. The fact that we are dealing with a lesser sum only makes the choices harder. . . .

How much can we afford for defense? Are we spending enough? Or too much? Above all, how do we properly measure these things? If it is true that we cannot hope to buy absolute security and that the best we can hope to do is lessen our insecurity, then the limit on our expenditures has to be determined by considerations other than the fear of running into surplus or redundancy in our over-all military power.

There is obviously a difference between increasing our security substantially and increasing it marginally. But at a time when we have scarcely begun to do anything serious in the field of passive defense, whether for the civil population or even for our retaliatory force, it is sufficiently clear that we are today nowhere near a point of seriously diminishing returns. On the contrary, we are still very much in the area where additional appropriations would bring us important and perhaps critical increases in our security, which is the same as saying that *increasing* returns might well be the result of further investment.

(Continued on following page)

The question of how much is enough is naturally influenced, if not determined, by considerations of how much we can afford. The present Administration has repeatedly expressed anxieties about overspending by the national government. These anxieties have been publicly focused on defense expenditures and have resulted in the imposition of fairly tight and arbitrary budget ceilings. From $53 billion in the last year of the Korean War, the defense budget fell to $42 billion in fiscal years 1955 and 1956. In the summer of 1957 the Defense Department adopted drastic curtailment measures in order to force down military outlays to a level of $38 billion for fiscal year 1958. The shock of the Soviet satellites, however, caused some relaxation during 1958, especially in research and development (R&D) expenditures. The reduction following 1953 was much greater than could be reasonably attributed to a liquidation of the Korean War, and in view of rising prices it involved a greater real contraction than the dollar values indicate. . . .

For a country like the United States, defense spending would have a serious adverse effect on the economy only if it seriously cut into investment for the civilian economy or it caused an inflation rapid enough to have self-intensifying effects. It would, in addition, be a marked *political* (rather than economic) liability if the standard of living were held for a number of years to no increase and perhaps even to some decline. The kind of mobilization we had in World War II, where some forty percent of the Gross National Product was going into the military effort, had marked effects in all these characteristics. But when we are talking of a level of expenditure on the order of ten to fifteen percent of the GNP, we can rule out, except through gross mishandling of the pertinent problems, any markedly adverse effect of a rise in military spending on the usual rate of business reinvestment for the civilian economy. On the contrary, it is quite possible for it to have a stimulating effect, as it did in the Korean War.

The problem of raising defense expenditures has to do mostly with effects on personal consumption and on inflation, and both concern basically the problem of taxation. When people pay taxes they see themselves relinquishing a certain amount of anticipated consumption. This is painful to them even when their scale of consumption is nevertheless continuing to rise; it becomes excruciating when the taxes are large enough to depress the scale of consumption below previously accustomed levels, unless the excitement of a war and the promise of alleviation in the near future beguile a people from their deprivations. Since governments, especially democratic ones, feel they have to be very tender with people's feelings concerning their money incomes and general consumption levels, they are loath to raise taxes. Generally they find themselves competing with their political opponents in promising ultimate reductions in tax rates.

Herein lies the rub. A sharp increase in government spending which is not covered by a rise in taxation levels is likely to mean deficit financing, which, if the margin of deficit is wide enough, tends to foster price inflation. Significant price inflation may bring about the contraction in levels of personal consumption that is needed in order to make more resources available for military purposes, but if it is steep enough it makes people even angrier and more bewildered than a sharp tax increase, and it also results in great inequity and waste. A fast rise in prices also makes people want to buy things in anticipation of further rises, which further aggravates the inflation by increasing demand.

In the United States the GNP has been increasing at a rate which, if considered over eight- or ten-year periods, looks fairly rapid, averaging perhaps three and one-half percent per year at constant prices. Unfortunately, however, this rise is not at all steady. Since the Korean War, the economy has shown a really acceptable advance only in 1955, when the GNP rose by eight percent, but in the three following years the average annual rise, in constant prices, was only about one percent. Naturally, the reasons to which these retardations in growth are attributed vary with the speaker's political philosophy or economic school of thought. They are in the net very costly, because losses in production are often not made up. It is rather easy to show, from normal rates of increase in productivity and in the labor force, that a relatively steady rate of growth of about five percent in the GNP is easily achievable, provided the government follows policies which avoid being deflationary.

It is pleasant to consider how rising rates of defense expenditure could be amply covered by a steadily rising government income roughly proportional to the rise in national income. This could be achieved without raising tax rates and without retarding improvements in other services of government. Unfortunately, as things actually work out, a year of budget surplus brings pressure to reduce taxes, and a shift downward in the level of business activity makes the next year one of deficit. Then the pressure is on again to reduce national government expenditures, of which those for defense now comprise the major portion. Also, an Administration preoccupied by absolute figures and anxious about their size finds it difficult to remind itself that ours is an expanding economy.

The considerable decline in defense expenditures over the years 1953-58, inclusive, probably had something important to do with the relative stagnation of the economy, and certainly it did not reflect the ten to eleven percent rise in the GNP that nevertheless took place. At the end of that time Soviet missile successes forced a speeding up of missile research and enlarged spending for SAC bases, but offsetting these increases was a retardation of the modernization of planes and further curtailment of the forces available for limited war—in other words, a continuing diminution in important segments of our military strength.

However, even if the defense budget were permitted overtime to go up in some degree of correspondence to the real or even the potential rise in the GNP, that might not be enough. We must ask whether there is anything sacred in a proportion of about ten percent of the GNP, which in recent years has marked expenditures on all national security programs, including expenditures on atomic energy, strategic stockpiling, and foreign military aid programs for mutual security. Specifically, since we want to keep inflationary pressures under control, we have to ask whether the tax rates on business and individuals could be appreciably increased without harm to the economy.

There are few professional economists in the country who do not feel they could be. . . . The following estimate by some American economists writing in 1958 under the auspices of the Committee for Economic Development speaks for itself:

> "We see no need to be apprehensive about whether or not the American economy can stand the strain of this [1959] or even a considerably larger budget. The risk that defense spending of from ten to fifteen percent of the Gross National Product, or if necessary even more, will ruin the American way of life is slight

> indeed. It is even less likely that there is some magic number for defense expenditures that, if exceeded, would bring economic disaster; rather, the impairment of growth caused by increasing taxes is a gradually rising one. We have not reached a point at which anxiety over the healthy functioning of the economy demands that defense expenditures be slashed regardless of the dictates of military prudence. We can afford what we have to afford. But we are also convinced that the economic costs of national security can be held down by a system of taxation more conducive to economic growth." . . .

No one can doubt that $45 billion on all defense expenditures is a great deal of money to be spending each year as the decade of the fifties approaches its close. One thinks of all sorts of useful and wonderful things that could be done with that money. On the other hand, there is still about ninety percent of our enormous and growing GNP left to buy most of those things. The usual cliché stresses how many school buildings can be bought for a tithe of what we are spending on defense. The answer is that we can have those, too, if we want them enough. We could raise our defense expenditures by thirty to fifty percent and still provide the best educational system in the world, which we do not have now only because we do not value it enough. Something would have to be sacrificed, but there is an enormous cushion of luxury goods and services to allow for the margin. . . .

There is a final doubt to contend with. Where the recommendation is for increasing a budget which is already so high, may we not be grossly exaggerating the proclivity of the Soviet rival to make war upon us? This brings up the old question: Should we adjust our defenses to the opponent's intentions or to his capabilities? Put in this way, the question implies that Soviet intentions are not necessarily warlike. Actually, the same view is implied in the above recommendations. Any increase in the defense budget which would still leave it under fifteen percent of the GNP must be based on the implicit assumption that the Soviet leaders are not intent upon going to war with the United States.

Foreign intentions provide us cues for our defense efforts only when they are clear-cut and either conspicuously friendly or plainly warlike. The Soviet attitude toward us seems less than warlike, but it clearly inclines more to the hostile than the benign. We also have to acknowledge in ourselves a high degree of distrust and irritation toward them, qualities which are certainly manifested in our policy. On the evidence of mutual attitudes, it seems that war, if not imminent, is also not impossible at any time. Certainly it has not been made impossible by technological conditions; quite the contrary is the case. The margin of possible error is usually greater in reading Soviet intentions than in reading their military capabilities; in any case, their intentions may change quickly and critically. We also know from history that where there is enough tension, war can break out without its being truly willed by either side.

Far outweighing these considerations, however, is the degree to which our defenses are out of joint with Soviet capabilities as we plainly see them, and the magnitude of the disasters that could follow from our vulnerabilities. The intentions-vs.-capabilities question implies that one is in a sufficiently secure position to be able to ponder it. We are not likely to be in such a position in the decade of the sixties. The development of Soviet missile capabilities calls for a countereffort on our part which involves more than merely matching them in missiles. It calls for large defensive measures as well. We are not justified in ignoring the challenge by the fact that the Soviet leaders may be similarly ignoring the growth in our offensive potentialities. They did not do so, incidentally, in the era of the manned bomber, against which they built up much more powerful active defenses than we ever attempted. In any case, we cannot let our foresight be limited by the fact that they may choose, or appear to choose, to limit theirs.

We are in an area of complete uncertainty. The temptation is great to avoid expenditures which in all likelihood will turn out to be unnecessary. There is no way of measuring the risk of general war, or the degree by which we diminish the risk by putting more effort into our defense. But if uncertainty denies us a clear warning, it also denies us reassurance. Basically, we know the following: that we can afford to do much more for our defense without giving up more than a certain rate of growth in our very high standard of living; that a great deal remains to be done; that if it is done the horrors which a general war would bring would be much alleviated; and that the chances of general war occurring would be to some real but unmeasurable extent diminished by our doing it. . . .

From one point of view we are already too accustomed to measuring in dollars the value of almost everything. However, our thoughts about price do not usually go beyond market value. Few among us will spontaneously translate the dollar value of a commodity we buy into what the economist calls "opportunity costs," meaning simply the cost of that commodity measured in terms of any of the other desired goods or services which could have been bought or produced with the same money but which we now have to think of foregoing. The average person may protest that he uses the opportunity-cost concept in his own family budget. It is most unlikely, however, that he does so altogether consciously and rigorously. He finds it much more convenient to let habit and hearsay guide him even in some of his major choices, leaving the suitability of his habits to be tested in a random way in the experience of living. In choosing between weapon systems, on the other hand, the opportunity-cost idea is pursued not only consciously but also conscientiously, which is to say with considerable vigor.

The opportunity cost of a weapon system is any other weapon system that could have been bought for the same money. Where two weapon systems can accomplish more or less the same purpose, they become directly comparable in efficiency on the basis of their money costs. There is almost always more than one way of doing something; at least, if only one way exists there are usually several other ways that are conceivable.

Let us consider, for example, the problem of choosing between two kinds of strategic bombers. Each represents in its design an advanced "state of the art," but each also represents a different concept. In one, which we shall call Bomber A, the designers have sought to maximize range. They have therefore settled for a subsonic maximum speed in a plane of fairly large size. The designers of Bomber B, on the contrary, have been more impressed with the need for a high-dash speed during that part of the sortie which involves penetration of enemy territory, and have built a smaller, shorter-range airplane capable of a Mach 2 dash for a portion of its flight. Let us assume also the smaller plane costs to build about two-thirds as much as the larger.

Perhaps we can take both types into our inventory, but even then we should have to compare them to determine which we should get in the larger numbers. Let us then

(Continued on following page)

pick a certain number of specific targets in enemy territory, perhaps three hundred, and specify the destruction of these targets as the job to be accomplished. Since we know that both types can accomplish this job with complete success if properly supported and handled, our question then becomes: Which type can do it for the least money?

We do not ask at this stage which type can do it more reliably, because within limits we can buy reliability with dollars, usually by providing extra units. Some performance characteristics, to be sure, will not permit themselves to be thus translated into dollars—for example, one type of plane can arrive over target somewhat sooner than the other type, and there is no way of pricing the value of this advantage—but we shall postpone consideration of that and similar factors until later.

Let us assume that Bomber A has a cruising range of 6,000 miles, while Bomber B is capable of only 4,000 miles. This means that Bomber A has to be refueled only on its poststrike return journey, while Bomber B probably has to be refueled once in each direction. This at once tells us something about the number of "compatible" tankers that one has to buy for each type (compatible referring to the performance characteristics which enable it to operate smoothly with a particular type of bomber). Up to this point Bomber B has appeared the cheaper plane, but its greater requirement in tankers actually makes it the more expensive having regard for the whole system. In comparing dollar costs it is pointless to compare merely procurement prices for the two kinds of planes; one has to compare the complete systems, that is to say, the weapons, the vehicles, and the basing, maintenance, and operating costs over a suitably long period, say five years. The last three involve us also in questions of manpower. When we have solved these, we are, in fact, pricing the whole military structure required for each type of bomber.

Now we have the problem of comparing, through a process of "operations analysis," the survival expectancy of each type of plane during penetration, in other words, of finding out how much the greater speed (and perhaps higher altitude) of Bomber B is worth as protection. If the enemy depends mostly on interceptors, the bomber's high speed and altitude may help a great deal; if he is depending mostly on guided missiles, they may help relatively little. Thus a great deal depends on how much we know about his present and projected defenses, including the performance characteristics of his major weapon.

If our Bomber A is relying mostly on a low-altitude approach to target, which its longer range may just make possible (we are, of course, thinking in terms of special high-efficiency fuels for wartime sorties), it may actually have a better survival expectation than its faster competitor. Also, we know that penetration capability is enhanced by increasing the numbers of bombers penetrating (again a matter of money) or by sending decoys in lieu of extra bombers to help confuse the enemy's radar and saturate his defenses. Perhaps we find that the faster plane would outrun the decoys, which again might tend to give it a lower penetration score than one would otherwise expect. But decoys are expensive, too, in acquisition costs, basing, and maintenance, and involve additional operating problems. The faster plane may be less accurate in its bombing than the other, which again would involve a requirement for more aircraft and thus more money....

The kind of problem we have just reviewed takes on new and greater difficulties when we try to compare the relative merits of a given type of manned bomber and a given type of ICBM. It is easy enough to compare them in terms of effects at target if we assume an absence of enemy opposition. The missile is less accurate and probably less reliable than the bomber, and it carries a smaller weapon in its warhead. Knowing this, one can compute for specific targets the ratio of missiles to aircraft necessary for their destruction. One specifies the targets because accuracy and bomb size affect the outcome more in some instances than in others.

However, we are considering not peacetime target shooting but war, and we, therefore, have to assume all kinds of enemy opposition, as well as the possibility of our having to retaliate to an enemy surprise strike against us. We have to consider whether the aircraft or the missile is easier to protect. It almost goes without saying that the missile will have the lesser problem in penetrating enemy defenses in retaliation, but how important this factor is depends on the magnitude of the problem for the airplane. There is a tremendous difference in arrival time at target. We thus begin to find many considerations which are not reducible to comparison in dollar terms....

The truth, unfortunately, is that the profound issues in strategy, those likely to affect most deeply the fates of nations and even of mankind, are precisely those which do not lend themselves to scientific analysis, usually because they are so laden with value judgments. They therefore tend to escape any kind of searching thought altogether. They are the issues on which official judgments usually reflect simply traditional service thinking....

Finally, policy making is a multistoried structure, and the higher we get in it the more we tend to be removed from the area of careful, dispassionate analysis. Let us assume for a moment that in the various systems analyses presented the most magnificent scientific rigor and probity have prevailed, and that the military clients have responded with great wisdom and modesty in making decisions about weapons and strategies. These are considerable assumptions, but not altogether improbable ones. Now we make the heroic assumption that the entire military establishment has been unified in its attitudes about the security needs of the country, and that it represents its conclusions in the form of a proposed budget which is tightly organized and beautifully reasoned throughout. If we want to relate this pleasant fantasy to the present needs of the country, we have to allow, however, for one major defect in the budget: that it calls for an increase of, say, twenty percent for the ensuing year with the warning that the pattern will have to be upward for several years thereafter.

Our awakening comes with an announcement from the President, who, of course, has had no time to acquaint himself with the involved and recondite reasoning for all the stated requirements, that the line will absolutely be held on the defense budget for the next year, and that the citizens can joyfully expect a tax cut for the following year. One ought not to be too distressed by such events, because that is the way government operates. But one should be ready to temper, if not abandon, illusions about the degrees to which wisdom, foresight, and scientific method have improved our security policies.—END

Dr. Brodie, a Senior Staff Member of the RAND Corp., is the author of the widely used A Guide to Naval Strategy *and* Sea Power in the Machine Age. *He has been a member of the faculty of the National War College, a consultant and lecturer at the Air War and Army War Colleges, and professor of international relations at Yale.*

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Students at NATO's Defense College build a stronger alliance around their

PARIS ROUND TABLE

Maj. Robert E. Fuerst

Away from classroom, NATO Defense College students closely examine a Matador surface-to-surface missile.

CAN a Belgian sit down with a German and unemotionally talk about equipping Germany with missiles and late-model jets? Can a Turk, Greek, and Englishman discuss what happened in Cyprus and reach a harmonious conclusion about the situation? Can a Frenchman answer questions about Tunis and Algeria objectively?

Such conversations are not unusual at one international service school—a place where servicemen of mixed nationalities approach objectivity in their daily discussions of international problems. There controversial matters are mulled over by high-ranking officers of several countries, and grave international issues are discussed with little, if any, personal emotion. This unusual military school is the NATO Defense College in Paris.

When General Eisenhower was Supreme Allied Commander, Europe, he said, "My efforts thus far to find suitably trained staff officers for key positions on high-level NATO staffs and my discussions of NATO problems with officials associated with national and NATO agencies have convinced me that there is a high-priority requirement to develop individuals, both on the military and civilian sides, who will have a thorough grasp of the many complicated factors which are involved in the problem of creating an adequate defense posture for the North Atlantic Treaty area."

General Eisenhower went further, voicing a need for a formal school to train individuals who were required "to serve in key capacities in NATO organizations." And following his recommendation, the NATO Defense College was founded. The institution, which was opened officially on November 19, 1951, is housed in the *Ecole Militaire* in Paris.

The "school board" of this cosmopolitan college is the NATO Standing Group in Washington, D. C. The post of commandant rotates among representatives of the various NATO countries, and normally the job is rotated among services. Each commandant serves a two-year term. The

(Continued on following page)

Students on Matador field trip listen to lecture, take notes as armed guard stands beside ready-to-go missile. The school's student body usually numbers about fifty. Most are senior military officers. Civilian officials also attend.

past commandants have included Adm. André Georges Lemmonier of France, Air Marshal Sir Lawrence Darvall of the RAF, Lt. Gen. Clovis E. Byers of the United States Army, Lt. Gen. Edmondo de Renzi of the Italian Army, and Maj. Gen. Edward Noel Keith Estcourt of the British Army (acting). At the moment, Gen. Tekin Ariburun, a Turk, heads the school. He will finish his term in the summer of 1960.

Most faculty members come from France, the United Kingdom, and the United States, although there are representatives from Canada, Italy, the Netherlands, and Belgium. Faculty members are selected not only because of their military skill but also because of their knowledge of international politics, finance, and economics. All countries of the alliance are called on to provide faculty and staff members on a rotating basis.

Generally the student body numbers about fifty. To handle many more would be difficult because of space limitations. Students are carefully chosen by NATO countries, based on a quota set by the NATO Standing Group in Washington. The majority of students are military, lieutenant colonels or above. Civilians usually come from a foreign office or from ministries of finance and defense. Only Iceland and Luxembourg of the fifteen NATO nations are not represented at the moment.

A typical day at the school goes like this:

0915–1015	Language instruction
1030–1300	Lecture, coffee, questions
1300–1430	Lunch
1430–1700	Committee work

Classroom lectures and discussions take place in both French and English. Students must be masters of one of these two languages and have a working knowledge of the other, although interpreters are present during lectures. If a lecture is in French, it is translated into English; if in English, it is translated into French, using the simultaneous translation technique developed at the United Nations. Language is emphasized and French or English instruction is part of the curriculum. Normally a student knows one of these two languages well but is weak in the second. He works at the weaker one.

Occasionally a student will have to work on both languages. "There is one officer weak in French *and* English," a Turkish colonel told me. "Last night at a restaurant he ordered snails in French and got tomato juice. And one day last week he ordered scrambled eggs in English and got lima beans."

Lecturers include prominent authorities in a given field. When I was in the Paris area about a year ago, I visited

(Continued on page 103)

Student assiduously writes notes during NATO air-base tour. At his back stands F-86D. Under examination is an F-100.

Among college's main products are mutual understanding, friendship among cross-section of NATO's top officers.

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the school and sat in on some of the classes. Typical lectures were:

"The Political and Economic Position of France," by Georges Bidault, former foreign minister of France.

"Peaceful Coexistence," by Joseph Alsop, columnist, USA.

"The Soviet Government's Foreign Policy," by Alberigo Casardi, Deputy Secretary General, NATO.

"The Middle East," by Lt. Gen. Sir John Glubb, United Kingdom, former Chief of General Staff, Arab League.

"Yugoslavia," by Sir Frank Roberts, Permanent Representative to NATO Council.

Listening to the latter, I was amazed at the amount and the complexity of the information presented. I had just finished reading a scholarly book on Yugoslavia and, as I took my seat at the back of the classroom, I expected to hear little that was new. But I was surprised. The material was most comprehensive, and it contained some pertinent observations that were barely touched on in the book I had read.

Air Force crew members stand by their planes for informal question-and-answer period with students on base tour.

Serious-visaged students in huddle on base runway. The college exposes them to vast body of diverse material.

Each day at the end of the fifty-minute lecture there is a twenty-minute coffee break, followed by a question-and-answer period in which the speaker often has to defend himself against a vigorous barrage of to-the-point questions.

In the afternoon the class breaks up into small groups which meet informally to study appropriate and timely problems. Three problems are tackled by each committee during a school year and results are presented to the group as a whole.

Defense college students also go on instructional tours. Each class travels to most of the NATO countries of Europe, visiting national capitals, selected industrial plants, and major NATO headquarters. They are briefed by foreign ministers, ministers of defense, and NATO chiefs of staff. The college students and faculty are visiting the United States and Canada this year for the first time.

Last year I worked on arrangements for a visit of the NATO Defense College to Ramstein, Germany, operational headquarters of the United States Air Forces in Europe. Here the group was briefed on the role of USAFE and given a glimpse of operations. The briefings were climaxed by an operational show that included the simulated launching of a Matador missile, an F-86 scramble, a helicopter demonstration and pickup, and a performance by the Skyblazers, USAFE's jet precision aerial demonstration team.

These tours allow the class to study NATO problems on the spot. During free time, class members from the host country show other students some of the important places which they have heard about at school. Perhaps these informal moments are one of the most important by-products of the course.

The philosophy of the defense college, in fact, is somewhat different from the philosophy of most institutions of higher learning. The students are mature men with fifteen to twenty years of service. The age range is thirty-eight to fifty, with an average of forty-five. Students are intelligent, experienced, and hand-picked. Pure instruction is not the right approach for men of this calibre. Instead, the school provides an atmosphere of discussion and exchange of ideas.

The NATO Defense College is now in its ninth year and 750 men have been subjected to its philosophy and its curriculum. Has it done any good? What have students gotten from the school?

One obvious benefit is a great gain in knowledge, as students are exposed to critical and suggestive material in several fields. They learn much during their short stay.

However, both students and faculty agree that the more important benefits have been friendship and understanding, perhaps of more consequence for the future of NATO than can be measured.

General Estcourt summed it up nicely. The British officer was addressing a group of USAF personnel at Ramstein, Germany, about the NATO Defense College. "The most valuable things we get out of our brief period together," he said, "are friendship for the fourteen other NATO nations and understanding of the problems confronting each nation. These are most significant for building the strength of the NATO organization."—END

The author, Maj. Robert E. Fuerst, is now on AFROTC duty at Davis & Elkins College, W. Va. He gathered material for the NATO Defense College article during his last assignment, in Information Services at USAFE. Major Fuerst studied meteorology at Massachusetts Institute of Technology, and his book The Typhoon-Hurricane Story *was published in 1947. In World War II he flew transports in Europe, North Africa, and India.*

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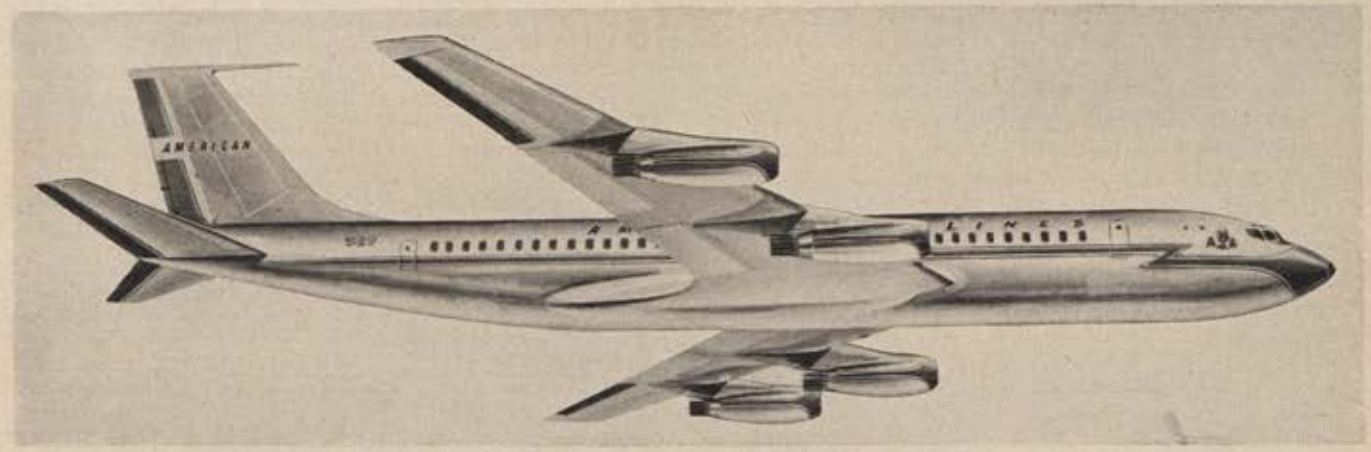

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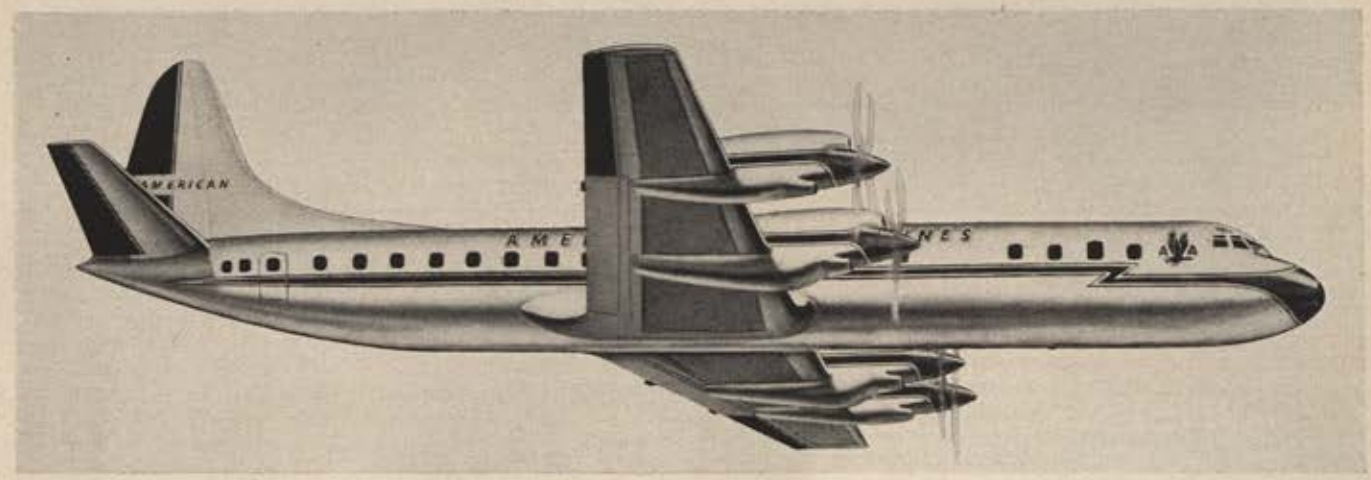

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AMERICAN AIRLINES—THE JET AIRLINE

The READY ROOM

RESERVE AND AIR GUARD NEWS

Eaton | McGowan | Maddux | McCarty | Palladino

Changes at the Top

Maj. Gen. Robert E. L. Eaton, Tenth Air Force Commander since September 1955, will succeed **Maj. Gen. Richard A. Grussendorf** as Assistant Chief of Staff for Reserve Forces at USAF headquarters in mid-August.

General Grussendorf moves up the hall from his present office to take over chairmanship of the Air Force Personnel Council.

General Eaton, a West Point graduate, compiled an outstanding combat record in World War II as a B-24 group commander in the Mediterranean. He next spent eight straight years in the Pentagon in congressional relations work before going to Turkey in 1953 to organize and command the Allied Tactical Air Force.

In another top-level change, the President has named **Maj. Gen. Donald W. McGowan** as Chief of the National Guard Bureau, succeeding **Maj. Gen. Edgar C. Erickson,** who retired May 31.

General McGowan, a Guardsman for more than forty years, has been Chief of the Bureau's Army division since November 1955, and for seven years before that commanded New Jersey's 50th Armored Division.

His military career began with service on the Mexican border. He saw combat in France during World War I and returned via the Normandy beaches in 1944.

Maj. Gen. Winston P. Wilson continues as Deputy Chief of the Bureau and head of its Air Force division.

Other new assignments to major Reserve posts were these:

Maj. Gen. Harold R. Maddux takes over the Tenth Air Force at Selfridge AFB, Mich.; **Maj. Gen. Chester E. McCarty** succeeds retiring **Maj. Gen. John Persons** as Commander of the Fourteenth Air Force at Warner-Robins AFB, Ga.; and an Army Reservist, **Maj. Gen. Ralph A. Palladino,** has been named Executive Director of the DoD-level Reserve Forces Policy Board upon retirement of **Rear Adm. Irving I. McQuiston,** USNR.

Still another change affecting Air Force Reservists appeared in the making, with solid reports that Under Secretary **Malcolm A. McIntyre** is resigning and will be succeeded by Former Assistant Secretary (Materiel) **Dudley Sharp.** The Under Secretary of the Air Force is charged with administering the Air Reserve Forces program. The report was not official at this writing.

Photo Finish

Air Guard tactical reconnaissance units will compete in the 1959 **Earl T. Ricks memorial trophy event** on September 2, leading off **AFA's National Convention** in Miami Beach. Ten **RF-84Fs** are expected to be entered in a timed combat reconnaissance mission originating at **Memphis, Tenn.,** and terminating at **Miami International Airport,** a nonstop flight of about 750 nautical miles.

En route each pilot will be **required to photograph the Florida State Capitol at Tallahassee** and **either Maxwell or MacDill AFB.** The winner will be determined on the basis of elapsed time, provided acceptable photos are made of the two targets.

For maximum safety in Miami's high-density air traffic, each pilot will officially **end his run at 25,000 feet or more over Miami** rather than on touchdown. After being logged in, the pilots will land in accordance with normal procedures.

The 1959 event is similar in concept to that of last year, when F-86D pilots were required to make a successful phase-three intercept during the run from Jacksonville, Fla., to Dallas, Tex.

Guard TAC recon squadrons eligible for this year's event are the 105th, **Nashville, Tenn.;** 106th, **Birmingham, Ala.;** 107th and 171st, **Romulus, Mich.;** 153d, **Meridian, Miss.;** 155th, **Memphis, Tenn.;** 160th, **Montgomery, Ala.;** 174th, **Sioux City, Iowa;** 180th, **St. Joseph, Mo.;** and the 184th, **Fort Smith, Ark.**

The event is named for the late **Maj. Gen. Earl T. Ricks,** Chief of the Guard Bureau's Air Force division from 1950 until his death in 1954.

Sidewinder for Guardsmen

Three Air Guard fighter squadrons are being equipped to handle the **Sidewinder** air-to-air missile.

First to receive the missile will be the **152d Fighter-Interceptor Squadron, Tucson, Ariz.,** which will represent the Air Guard in USAF's worldwide weapons meet at Tyndall AFB, Fla., in October.

Other squadrons whose aircraft are being modified to employ the heat-seeking missile, officially designated the GAR-8, are the **188th Fighter-Interceptor Squadron,** Albuquerque, N. M., and the **118th Tactical Fighter Squadron,** Hartford, Conn. All of these squadrons fly the North American **F-100 Super Sabre.**

Dramatic Climax

Final reports are still being digested on **Operation Dark Cloud/Pine Cone II,** biggest Air Reserve Forces maneuver in history, but planning has already begun on next summer's **Bright Star/Pine Cone III,** which will dwarf this year's performance.

The 1960 exercise is expected to **employ virtually every troop carrier wing and aerial port squadron of the Air Force Reserve,** plus heavy representation from the **Air Guard's eight TAC fighter and four TAC reconnaissance**

(Continued on following page)

wings. The scenario will call for the Air Reserve to lift a division-sized airborne force, which will require some 500 C-119s and C-123s.

Lt. Gen. William E. Hall, CONAC Commander, outlined the exercise in a message to the commanders of his three numbered Air Forces. He said that it will in all probability be held **in August** and will **fulfill the fifteen-day field training requirement** for all participating units in 1960.

"I look upon this exercise as a **dramatic climax to many years of effort** expended in readying the Reserve troop carrier force," General Hall said. "I am fully aware that an exercise of this magnitude will present **many problems.** However, based upon past records, I am confident in **our ability to overcome such problems** as may arise."

Global Concept

Some **225 Air Reserve Forces members** have been selected to attend the Air Force Chief of Staff's **second annual seminar** in Washington, September 24-25.

Military rank is **not a factor** in choosing seminar participants. Generals will rub elbows with airmen and noncoms. Civilian clothes will be worn.

Secretary of the Air Force **James H. Douglas** will open the seminar. **Gen. Thomas D. White,** USAF Chief of Staff, will talk on the Reserve forces. **A State Department official** will speak on international affairs. Seminar members will also hear from the **Deputy Chiefs of Staff** and **Reserve leaders.** They'll also premiere a USAF film, **"Two Hats: The Story of the Air Reserve Forces in Action,"** shot during Operation Dark Cloud/Pine Cone II this spring.

Purpose of the seminar is **twofold.** First, key Reservists are **kept up to date on Air Force planning** and thinking. Second, the **Air Force story reaches the general public** through community leaders who are identified with the Air Force in their home towns.

CONAC has been **allotted 125 spaces,** with another forty spaces for **major command Reservists.** The **Air Guard gets sixty seats.** Reservists who attended the first seminar in November of last year are not eligible for this one.

Guests will travel by military aircraft **on invitational travel orders** authorizing **no pay or allowances** but per diem of $12 including travel time. Travel will be by military aircraft, aranged by CONAC, using **Air Reserve and Air Guard planes.** Accommodations at military rates have been arranged at the **Sheraton-Park,** one of Washington's major hotels. Chartered buses will take guests to and from the Pentagon sessions.

Speakers during the second day, largely devoted to the Air Reserve Forces program, will include **Lt. Gen. William Hall,** CONAC Commander; **Maj. Gen. Robert Eaton,** Assistant Chief of Staff for Reserve Forces; and General Eaton's two deputies, **Maj. Gen. Winston Wilson** for the Air Guard and **Brig. Gen. Pick Vidal** for the AF Reserve.

Best Airmen

M/Sgt. Robert L. McLaughlin, of Van Nuys, Calif., and **T/Sgt. Hawthorne C. Evans, Jr.,** of Morristown, Tenn., have been named the **outstanding airmen of the Air National Guard and Air Force Reserve** and will be honored, along with their wives, at AFA's 1959 Convention.

Sergeant McLaughlin is a **medical administrative supervisor** with the 146th Tactical Hospital, California ANG. In civilian life he designs and maintains equipment for test pilots in **Douglas Aircraft Company's flight test** section.

Sergeant Evans, an **information specialist in the 9962d** Air Reserve Squadron at Knoxville, Tenn., is an elementary school principal in Morristown. He was cited for his work in organizing **Civil Air Patrol** and **Air Explorer activities** there.

The AFA trophy for the outstanding Air Force Reserve unit will be awarded during the Convention to the 442d **Troop Carrier Wing** of Richards-Gebaur AFB, Mo., commanded by Col. Charles D. Daily.

Meanwhile, the **8500th Air Reserve Squadron** at Hamilton AFB, Calif., has been designated the **outstanding navigation training squadron,** and the **9387th Squadron of Los Angeles** was named the **outstanding Air Reserve training center.** The 8500th is commanded by **Maj. Vincent Pettigrew** and the 9387th by **Lt. Col. Frank J. Monahan, Jr.**

Close Support

Air Guard **tactical fighter units** are making plans to give **a series of firepower demonstrations** for the Tactical Air Command at Army school graduation exercises **at Forts Bliss, Sill, Stewart, Benning, and Campbell.**

TAC has been performing these demonstrations to give Army personnel a graphic picture of **close air support.** Guard unit commanders are enthusiastic about taking over the assignment, provided mundane details like finances and equipment can be worked out.

Eighteen aircraft and crews would be used in each performance—four to deliver **500-pound bombs,** four firing **2.75-inch rockets,** four dropping **napalm,** and four performing **strafing runs,** with two planes on hand as spares.

The **122d TAC Fighter Wing, Indiana ANG,** has been assigned the first demonstration at Fort Campbell, Ky., probably in September. The Wing will make a full report on equipment and manning requirements and costs. From its findings, the Guard Bureau and TAC will decide how to handle subsequent demonstrations.

Notes in the News

Col. John W. Richardson, a Detroit DuPont executive with a mobilization assignment as Chief of Staff of the **Tenth Air Force,** was elected **president of the Reserve Officers' Association** during its July meeting in Denver. **Maj. G. Barney Rawlings,** Las Vegas public relations consultant, was named vice president for the Air Force. He has a mobilization assignment as a pilot with SAC.

Of the Air Force's three candidates for the **first man in space,** two are former Reservists. **Capt. LeRoy Cooper, Jr.,** joined the Marines in 1945, won an Army ROTC commission at the University of Hawaii, transferred to the Air Force Reserve, and was recalled to EAD for pilot training in 1949. **Capt. Donald Slayton** was a pilot in the Washington Air National Guard while employed as a Boeing engineer after World War II. Recalled with his unit early in 1951, he stayed on active duty.

The **179th Fighter-Interceptor Squadron** at Duluth, Minn., is being equipped with the **Northrop F-89J** capable of employing the Genie rocket.

This may be the last year for two **Air Guard Field** training sites. Casper, Wyo., would have been out this year except for congressional pressure. Now **Hancock Field,** at Syracuse, N. Y., may be closed. Same reason applies to both: no suitable ranges nearby to meet tactical training requirements. Also ADC, expanding its SAGE installations at Hancock, could use more room.

ANG's outstanding squadron, the **115th of Van Nuys, Calif.,** was honored with the cover story in *Flying Safety* magazine's July issue for its remarkable performance in winning USAF's flying safety award.—END

FLY NATIONAL

airline of the stars

to the Air Force Association Convention, Miami Beach, September 2-6, 1959 . . . *For convenience,* National offers you fast, frequent service throughout its route system. National serves 15 states and 38 cities in the U.S.A., plus Havana. The Airline of the Stars serves the East Coast from Boston, New York, Philadelphia, and Washington to Miami plus 17 other Florida cities . . . and extends west to New Orleans and Houston. Its interchange flights provide one plane service between California and Florida. For reservations, see your travel agent or phone National Airlines.

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UNITED AIR LINES DC-8
JET MAINLINER, BY DOUGLAS

EXTRA CARE HAS MADE IT THE BEST OF THE JETS

AFA NOMINEES 1959-1960

MARKEY

ROSENTHAL

HARDY

GROSS

AFA's Nominating Committee has selected Howard T. Markey of Winnetka, Ill., to serve as the Association's next President. The nomination, made at a committee meeting in Colorado Springs in June, will go before the National Convention in Miami Beach next month.

Named with Markey to head AFA for the coming year were Julian B. Rosenthal of New York City for Chairman of the Board; George D. Hardy of College Park, Md., for Secretary; and Jack B. Gross of Harrisburg, Pa., to continue as Treasurer. Rosenthal is currently Secretary.

Other top AFA officers during the past year, have been President Peter J. Schenk, who has served two terms, and Board Chairman James M. Trail.

Those placed on the slate for directorships are listed on the next page.

Presidential nominee Markey, Vice President for the Great Lakes Region, is a prominent lawyer, an AFA Charter Member, and possessor of a brilliant wartime record. A Reserve brigadier general, he is currently Commander, 126th Air Defense Wing, Illinois Air National Guard.

Rosenthal, nominated as Board Chairman, was a member of the small group that met in New York to form AFA in 1946. He has served as Secretary since that time. Also a lawyer, Rosenthal was an AMC legal specialist during the war.

PRESIDENT

HOWARD T. MARKEY

Winnetka, Ill.

Lawyer; age 38; married. Regional Vice President; Reserve brigadier general; Commander, 126th Air Defense Wing, Illinois ANG. Charter Member.

SECRETARY

GEORGE D. HARDY

College Park, Md.

Vice president and director of a food brokerage; age 35; married. AFA record: Squadron Commander, Wing Commander, Vice President, National Director, National Committeeman, AFA Man of the Year 1957.

CHAIRMAN OF THE BOARD

JULIAN B. ROSENTHAL

New York, N. Y.

Attorney; age 50; married. AFA record: Assistant Secretary, National Secretary, Constitution Committee Chairman. Life Member, AFA Man of the Year 1953. Charter Member.

TREASURER

JACK B. GROSS

Harrisburg, Pa.

Financing and investments; age 48; unmarried. AFA record: Squadron Commander, Wing Commander, Assistant Treasurer, Treasurer, National Director, Finance Committee Chairman. Charter Life Member. AFA Man of the Year 1958.


BEAU


BONNEY


CRAIGIE


CROSS


DEMPSEY


FONDA


FOSS


FREDERICKS


LEACH


McKAY


MONTGOMERY


MORGAN

NATIONAL DIRECTORS

LUCAS V. BEAU, Washington, D. C. AFA member since 1951. Former Squadron Commander; current District of Columbia Wing Commander. Vice President, Consolidated Diesel Corp. USAF retired; former National Commander, Civil Air Patrol.

WALTER T. BONNEY, Silver Spring, Md. AFA member since 1952. Has served on numerous national committees. Current member of Board of Directors. Public Information Manager, National Aeronautics and Space Administration.

LAURENCE C. CRAIGIE, Burbank, Calif. AFA Charter Member. Vice President, American Machine & Foundry. USAF retired; last assignment: Korea 1951.

J. ALAN CROSS, Miami, Fla. AFA member since 1953. Former Squadron, Wing Commander; current member of Board of Directors. Insurance agency owner.

JAMES R. DEMPSEY, La Jolla, Calif. AFA member since 1951. Current member of Board of Directors; national committee member. General Manager, Astronautics Division, General Dynamics Corp.

A. PAUL FONDA, Washington, D. C. AFA member since 1946. Current member of Board of Directors; former Wing Commander and member of national committees. Sales Representative (Washington), Northrop International.

JOSEPH J. FOSS, Sioux Falls, S. D. AFA member since 1949. Former member of Board of Directors. Holds Congressional Medal of Honor. Former Governor of South Dakota. Vice President of Raven Industries.

J. WAYNE FREDERICKS, New York, N. Y. AFA Charter Member. Current member of Board of Directors; former Squadron, Wing Commander. Associate Director, Ford Foundation.

W. BARTON LEACH, Cambridge, Mass. AFA member since 1947. Current member of Board of Directors, national committee. Professor, Harvard University.

HARVEY J. McKAY, Glendale, Calif. AFA member since 1947. Currently Far West Regional Vice President. Former Squadron, Wing Commander. Marketing staff member for Pacific Automation Products, Inc.

JOHN B. MONTGOMERY, Cincinnati, Ohio. Current member of Board of Directors, national committee. AFA member since 1947. Division Manager, General Electric Co.

CHARLES O. MORGAN, JR., San Francisco, Calif. AFA member since 1947. Current member of Board of Directors. Former Squadron, Wing Commander, Vice President. Attorney.

MSGR. WILLIAM F. MULLALLY, St. Louis, Mo. Current member of Board of Directors, AFA member since 1949. Pastor.

WILLIAM W. SPRUANCE, Wilmington, Del. AFA Life Member. Current member of Board of Directors. Former Vice President. Assistant State Adjutant General; Chairman, State Aeronautics Commission.

ARTHUR C. STORZ, Omaha, Neb. AFA member since 1953. Current member of the Board of Directors. Former national committee member. Received AFA's Man of the Year Trophy in 1955. Board Chairman, Storz Brewery.

ALDEN A. WEST, DeWitt, N. Y. AFA member since 1950. Current member of Board of Directors; national committee. Former Squadron, Wing Commander. Sales Manager, General Electric Co.

LEONARD A. WORK, State College, Pa. AFA Charter Member. Currently Northeast Regional Vice President. Former Squadron, Wing Commander; member of national committees. Supervisor, Post Office Department.

PAUL S. ZUCKERMAN, New York, N. Y. AFA Life Member. Current member of Board of Directors. Former national committee chairman. Partner, Zuckerman-Smith Securities Brokerage.

NOTE: The following are permanent directors of AFA because of previous service as National President or Chairman of the Board of Directors. They are "automatic" members and need not be renominated or reelected to the office of National Director: John R. Alison, Edward P. Curtis, James H. Doolittle, John P. Henebry, Robert S. Johnson, Arthur F. Kelly, George C. Kenney, Thomas G. Lanphier, Jr., Peter J. Schenk, C. R. Smith, Carl A. Spaatz, Harold C. Stuart, James M. Trail, and Gill Robb Wilson.—END


MULLALLY


SPRUANCE


STORZ


WEST


WORK


ZUCKERMAN

AFA NEWS

SQUADRON OF THE MONTH

The Squadrons of the Utah Wing Cited for

Sponsorship of the 1959 Airpower Symposium, combining imaginative planning and effective programming, to bring the airpower story to the Rocky Mountain area.

The 1959 version of the **Utah Wing Airpower Symposium,** held in May at the Hotel Newhouse in Salt Lake City, was a **smashing success.** It more than lived up to the reputation that this notable event has gained in the four years since it was originated.

The Utah Wing held an **Airpower Ball in April** to raise funds for the Symposium. More than **13,000 persons** attended the ball, at which the Air Force's **Airmen of Note** band performed. Admission to the ball was through purchase of a raffle ticket. Winners received prizes ranging from an automobile to kitchen utensils. More than fifty prizes were awarded.

Some **seventy-five leading personalities** from across Utah took part in the Symposium's **opening activity on May 14** at an airstrip in the western Utah desert. They witnessed a **dramatic demonstration of the effects of a sonic boom.** A small house, built for the occasion and furnished as an average home, was subjected to booms from **various angles and altitudes,** while Wing guests looked on from a few hundred feet away. They then **inspected the damaged building** before returning to **Hill AFB Officers' Club** where the Wing hosted a **reception-luncheon.**

Kickoff luncheon speaker was **Dr. John F. Victory,** Executive Secretary of the National Aeronautics and Space Administration, who spoke on **"A Half Century of Aviation in Retrospect."**

The Symposium next presented a series of **three half-day forums.** The initial forum's theme was **"Airspace—A Vanishing National Resource?" Harlan Bement,** Utah's Aeronautics Director, acted as moderator.

The second forum concerned itself with **"The Problems of the Jet Age."** Special emphasis was placed on construction and operation of a modern airport.

The final forum covered **"Man in Space."** Among the most impressive events of the week, it featured presentations on every phase of the problem of putting a man into space.

Winding up the Symposium was the **Aerospace Prediction Banquet.** Guest speaker **Dr. Everett T. Welmers,** Special Assistant to the President of the **Bell Aircraft Corp.,** spoke on the likely state of airpower in the year 1979.

Dale Erickson, Rocky Mountain Regional Vice President, was **general chairman** of the 1959 Symposium. He was assisted by **James R. Bonner.** A number of Wing committees handled various aspects of the Symposium. This year's program topped the previous meetings held by the Wing in every way.

New York Wing Cmdr. Lynett presents Airpower Award to John J. O'Neill of Cornell Aeronautical Labs.

At the National Science Fair, Hartford, Conn.: Maj. Gen. Leland S. Stranathan presents awards to youthful victors in Airpower and Air Exploration exhibit categories. Left to right: David W. Shong of Pewaukee, Wis.; Joie P. Jones of Abilene, Tex.; Brant E. Wadsworth, Idaho Falls, Idaho; and Robert E. Fischer of Forest Hills, N. Y. Boys will be guests at AFA Convention at Miami Beach.

Left to right: Great Lakes Region VP Howard Markey, Billy Mitchell Squadron Cmdr. Bob Gerlach, Schlitz beer executive Bob Uihlein, who received award in brief Milwaukee ceremony.

Alden A. "Bud" West, a member of AFA's Board of Directors, represented the Association at the 1959 **National Science Fair,** held in Hartford, Conn., in May. With **Maj. Gen. Leland S. Stranathan,** Director of Development Planning, USAF, West assisted in the selection of the best and second-best exhibits in the fields of **Airpower and Air Exploration** *(see cut).*

Winner in the first category was

(Continued on following page)

Joie P. Jones, 18, of Abilene, Tex. **Robert E. Fischer,** 15, of Forest Hills, N. Y., took the honors for his air exploration exhibit. Both boys will be guests of AFA and the Air Force at this year's AFA Convention in Miami Beach, Fla., next month.

West, in addition, prepared a **thorough survey of the National Science Fair** for AFA and the Air Force.

The **New York Wing Convention,** held this year on June 13 in Buffalo, was built on the theme, **"NORAD: Defense of a Continent."** A team of specialists presented the story of this joint command. The team was composed of **Group Capt. Richard C. Stovel,** Director of Plans and Requirements, Royal Canadian Air Force; **Col. Clair E. Towne,** USAF; **Col. John B. Cornett,** Commander, Syracuse Air Defense Sector; and **Group Capt. Richard L. Denison,** Commander, No. 3 Air Defense Sector, Edgar, Ontario. Stovel and Towne are assigned to NORAD Headquarters, Colorado Springs. Each discussed the joint air defense effort from his command's standpoint.

In addition, members of the **Ontario Group, Royal Canadian Air Force Association,** AFA's sister organization to the north, took part in the convention. A number of RCAFA delegates attended.

The annual New York Wing **Airpower Award** went to **Cornell Aeronautical Laboratories** for contributions to aviation research. *(See cut on page 111.)*

Mitchel Squadron, of Long Island, N. Y., was recognized as New York's **Squadron of the Year,** primarily on the basis of outstanding development and programming in the past year. The annual **Man of the Year** trophy went to **Art Wegman,** Wing Treasurer, for his devoted efforts on behalf of Wing operations. **Fred Monsees,** Deputy Wing Commander, from Lynbrook, Long Island, was selected **Wing Commander,** succeeding **Jim Lynett,** of Tonowanda, N. Y.

Delegates to the Ninth Annual Convention of the **Royal Canadian Air Force Association,** held in Montreal earlier this year, adopted a **resolution of good wishes to AFA.** It was transmitted to us by RCAFA's President, **Air Marshal W. A. Curtis.**

The resolution reads, "The delegates assembled at the Ninth Annual Convention of the RCAFA in Montreal extend to all your members sincere wishes for **your continued well being and prosperity."**

For our part, we join AFA members everywhere in responding with mutual regards.

The **Erie, Pa., Squadron Commander, Roger Ellis,** has sent word along that his Squadron has organized a **Falcon Club** whose first meeting was held on July 11. Similar groups have been busy in **Pittsburgh and Philadelphia** for several years **building model planes and airports and taking field trips.** Originators of this program were **Kay and Bob Patterson,** members of the Pittsburgh Squadron, both of whom were on hand in Erie to aid in setting up this newest unit.

CROSS COUNTRY....Paul Fonda, a member of AFA's Board of Directors, was recently appointed to the **Maryland State Aviation Commission** by Gov. Millard Tawes.... **Wisconsin Wing Commander Bob Gerlach** advises us that one of the first actions taken by his Unit after the new officers

were elected was to send congratulatory messages to the **four Wisconsin graduates** in the **Air Force Academy** Class of 1959. . . . **Will Dougherty,** Ohio Wing Commander, writes that the television film series **"Air Force Story"** is now appearing on **Cleveland station WJW-TV** each week under **Cleveland Squadron sponsorship. . . . The Chico, Calif., Squadron,** one of the nation's outstanding AFA units, has just signed **its 127th member.** Its monthly luncheon meetings regularly **attract more than 100 members.** Wonder how many other Squadrons can brag about an attendance of that size? . . . **Virginia Wing** held an election of officers on June 20. **Tommy Tucker** of Danville was elected Commander to succeed **Bentley Hahn** of Arlington. Even before the meeting, Tucker had begun efforts to organize **two new Squadrons** in the southern part of the state, and had held preliminary meetings in **Martinsville and Bristol. . . . AFA's Aerospace Education Council,** under the chairmanship of **Frank E. Sorenson** of Nebraska, met in Washington, D. C., in June to discuss an educators' meeting to be held at the **Miami Beach Convention.** Five of the seven Council members attended.

—Gus Duda

Present at Santa Monica, Calif., Squadron and Auxiliary installation dance were, left to right: California Wing Commander James Snapp; Far West Regional VP Harvey McKay; Past Wing Commander Thomas L. McKnight; Past Auxiliary President Mrs. Arthur DeBolt; Squadron Commander Joseph D. Myers; Auxiliary President Mrs. I. L. McElliott; Maj. Gen. Joseph D. Caldara, Director, Flight Safety, USAF; local Mayor Russell Hart; Past AFA President Arthur F. Kelly.

Key figures in AFA's upcoming Convention. Left to right: Florida Wing Commander Ted Koschler, National Director J. Alan Cross, VP Alex Morphonios. Alex is chairman of Convention committees; others, cochairmen of committees.

MAKE YOUR RESERVATIONS NOW FOR AFA'S 1959 CONVENTION

AFA Convention Hotels

HOTELS	SINGLE	TWIN	1 B/R SUITE	2 B/R SUITE
DI LIDO	$10	$10	$28	
SHELBORNE	$10	$12	$15	$45
NAUTILUS	$8	$10	$22	
SHORE CLUB	$7-8	$7-8	$15	$22
RONEY PLAZA	$8-12	$10-16	$30	$45-60
ALGIERS	$9-11	$11-13	$26	
SEVILLE	$10-12	$14	$28	$42
SEA ISLE	$8-10	$12	$20	$36
SANS SOUCI	$12	$12	$24	
SAXONY	$9-10	$11-12	$22-24	$33-36
VERSAILLES	$10	$10	$20	
CADILLAC	$8	$10	$20	$30
CROWN	$8	$10	$20	$30
LUCERNE	$8	$10	$25	$35
SAN MARINO	$8	$10	$24	$30
EMPRESS	$8	$10	$20	
BARCELONA	$8-10	$8-10	$20	
SORRENTO	$8-12	$8-12	$20-24	
FONTAINEBLEAU	SOLD	OUT	SOLD	OUT
EDEN ROC	SOLD	OUT	SOLD	OUT
MONTMARTRE	$10-16	$10-16	$28-32	$42-48

Send your reservation to:

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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.

CLIP & MAIL YOUR RESERVATION TODAY!

1959 Air Force Association Convention & Panorama

Type or Print
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CITY & STATE _____

_____ _____ _____
1st Choice Hotel 2d Choice Hotel 3d Choice Hotel

_____ _____
Type Room—Be specific on double or twin room. Desired Rate

_____
Others Sharing Room

_____ _____
Arrival Date and Hour Departure Date

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airman's bookshelf

The Reach for Space

***The Big X*, by Hank Searls (Harper, $3.50).**

Reviewed by Maj. Arthur "Kit" Murray, USAF

Hank Searls here spins a compelling yarn steeped in the drama of man's first gropings into space.

The authenticity of pilot-novelist Searls's first novel is little short of startling. In *The Big X* he writes of test pilots' meetings, hears and chronicles their tales, and survives their occasional celebrations. Through the composite characters he creates, test pilots from propeller to jet to rocket-powered craft will recognize their own phrases, attitudes, and approaches faithfully set down.

As a jet and rocket-plane pilot myself, I can verify that the technical descriptions, as pungent as 130-octane fuel, are also as "real" as liquid oxygen boiling off on the ramp.

Searls's "X-F18" is in its research phase. One finds many situations parallel to those encountered in the real life X-15 research aircraft. Experimental project engineers, and all others connected with the X-15, know that the calculated or demonstrated stability of the airplane can spell success or disaster for the project. So it is with the X-F18 in this book. Searls points up the major importance that the emotional stability of project personnel also possesses.

For the mature, informed reader this book offers a vivid account of the assault on the aeroballistic barrier.

The layman will find it an unforgettable and rare characterization of the behind-the-scenes activity in modern flight test circles and an especially keen analysis of the human and emotional aspects of the reach for space.

After digesting this compelling story, no lay reader, secure on the ground, will ever again be able to view a lonely, silent, and sunset-tinged contrail with quite the same detachment.

About the reviewer: *Maj. Arthur "Kit" Murray, a veteran military test pilot, now is stationed at Wright-Patterson AFB as Chief of the X-15 Research System Project Office. He has set an outstanding record as a test pilot since the war, during which he served as a P-40 pilot in North Africa. In 1954 he set an unofficial altitude record of more than 90,000 feet in the Bell X-1A.*

Harsh Words, Good Reading

***Cone of Silence*, by David Beaty (Morrow, $3.95).**

Reviewed by Lt. Col. David F. McCallister, ANG

As in his previous air novels, *The Four Winds* and *The Proving Flight*, airman Beaty scores again. This time he deals with commercial jet airline operations, using new characters but the same fictional British Empire Airways which has managed to stay in business through three books, despite ever-changing management, numerous crashes, poor aircraft maintenance, and shoddy flying operations.

Beaty builds his plot around a new, multiengine jetliner—the "Phoenix"—and the people who build it, buy it, fly it, and pick up the pieces after it crashes.

Capt. George Gort, fifty-one-year-old veteran British pilot with an impeccable twenty-year flying safety record in "conventionals," finds his career suddenly jeopardized by a Phoenix takeoff accident that kills his first officer. Gort's senior standing with BEA (in real life BEA is British European Airways) and his past record help reinstate him, but only after he passes a rigid flight check given by youthful Capt. Hugh Dallas, BEA's flight training officer. Dallas, a bit of a villain on first appearance, emerges as a strong-willed, forceful, and ethical individual.

Gort's reinstatement is achieved over company protest, since it leaves no whipping boy for airline public relations. This sets off a swirling controversy within BEA management and Atlas Aviation Corporation—builders of the Phoenix—over pilot error vs. design error. As Gort's champion, Dallas stands up to BEA officials, to his fellow pilots, and to Nigel Pickering, arrogant designer-builder of the Phoenix. The eternal triangular hassle between throttle jockeys, management and slide-rule artists gets off to a quick start and carries to a tragic end.

When Gort is killed in a second Phoenix takeoff accident, Dallas in a sense wins a weak moral victory. BEA officials and Atlas Aviation concede in private that the wing design is at fault, not George Gort. This admission is never made public.

Interwoven throughout are Dallas' romantic intentions toward Charlotte Gort, shapely, charming, devoted, and eligible daughter of the aging pilot. Also on hand is Joyce Mitchell, an overemotional BEA stewardess, some of whose experiences in the book are left to the imagination of the reader.

Exciting, descriptive, and meaningful flying scenes prove again that Beaty is a master aviation writer. These occupy a fair share of the book.

Beaty also appears, on the basis of this work, to feel that on occasion the aviation industry lacks in dignity, integrity, and honesty. This is, of course, a suggestion open to sharp dispute. It might be noted, in passing, that in any field of endeavor there are a few bad apples.

At any rate, whatever the validity of the book's moral position in terms of true life, this is good reading for any aviation enthusiast.

About the reviewer: *Lt. Col. David F. McCallister, Commander, 142d TAC Fighter Sq., Delaware ANG, and Chief, Engineering Flight Test, All American Engineering Company, Wilmington, Del., has flown more than a million jet miles, starting during World War II with the British Meteor. He is a past winner of the Ricks Trophy. A writer of aviation articles and fiction, he is an occasional contributor to* Air Force/Space Digest.

Aerospace Books

The Russian man in the street has long been exposed to translations of the writings of great missile pioneers like Oberth and Sänger. This has not been the case here, and English language translations of Russian scientific documents have been scarce. *Soviet Space Science* by Ahri J. Shternfeld (Basic Books, $6) helps correct this.

This book is one of Russian author-scientist Shternfeld's best and his latest, bringing up to date, in this semi-popular treatise, Soviet research, development, and accomplishment in the fields of artificial satellites, astronautics, and spaceflight. It was first published in Moscow in 1958 under the title *Artificial Satellites.* Last year it was translated by the USAF's Technical Documents Liaison Office at Wright-Patterson AFB, Ohio, and offered for sale by the US Department of Commerce. Except for a new title, the commercial version is an exact

(Continued on page 118)

General Electric puts

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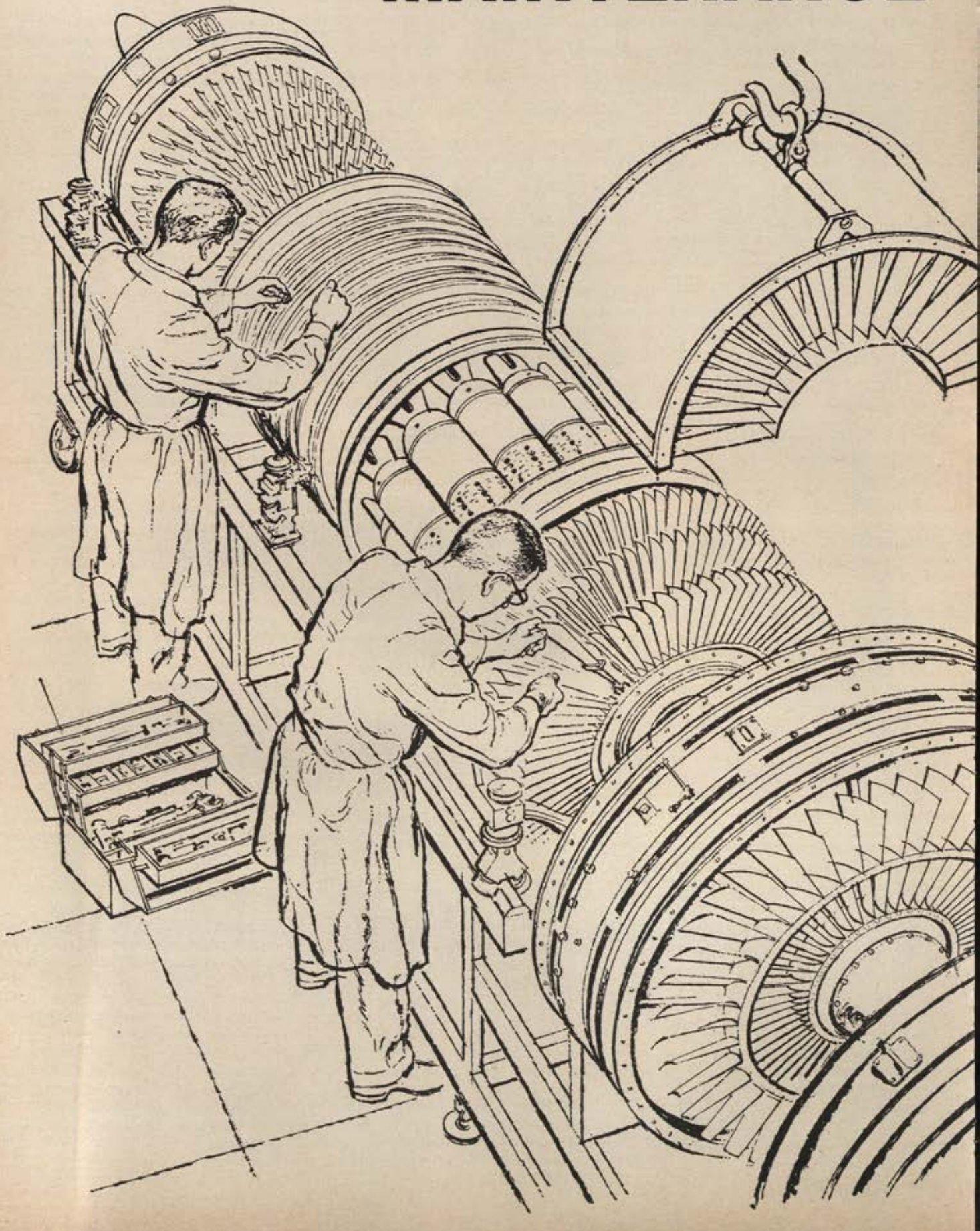

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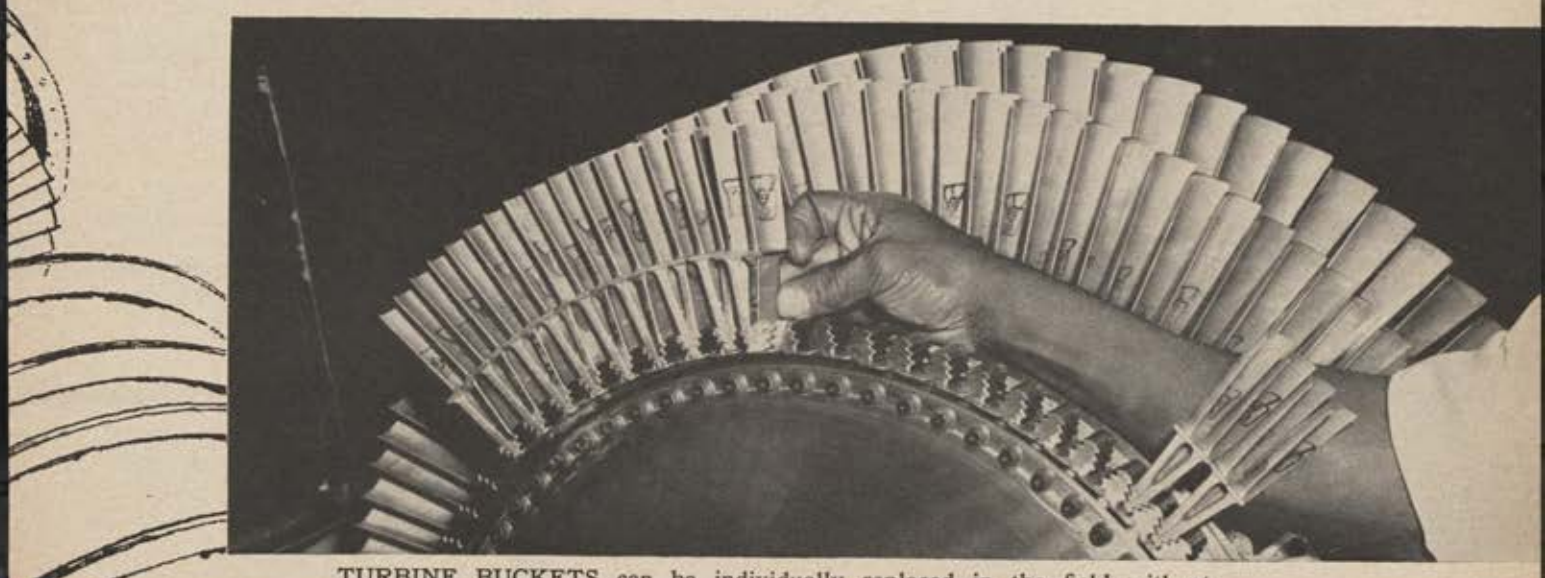

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reproduction of the USAF translation.

Major subdivisions of the work include: scientific laws governing artificial satellites; motion of satellites relative to the earth; satellite rocket starters; satellite construction and launching; man in cosmic space; observation of satellites and communications with them; descent to the earth; utilization of satellites; and others. Under these broad categories, several score chapters give detailed, nonpartisan treatment of subtopics, allowing (for the Soviet press) an unusually comprehensive and complete picture of the Russian state of the art. Rocket expert Willy Ley provides the introduction to the English edition, calling it "one of the best surveys of the subject published in any country." In his epilogue he helps Shternfeld bring the work up to date by discussing Sputnik III and Mechta.

° ° °

The professional character and quality of official Air Force writing and publications is well exemplified in *Medical Science and Space Travel*, by William A. Kinney (Watts, $3.95). It originally appeared as a series of four articles in *The Airman* magazine on the subject of Air Force research and development to equip man for travel into outer space.

More than seventy photos with detailed captions were added to the articles to round out a clear, concise, and meaningful presentation designed primarily for the young adult but of interest and value for readers of all ages. This story of the serious, fascinating achievements and objectives of aerospace medicine fills a critical gap in the current flood of "whiz-bang" space books which are eagerly sought and read by the younger set. Junior and senior high school science classes might profit especially from it. Former Air Force Surgeon General Maj. Gen. Harry G. Armstrong, USAF (Ret.), wrote the foreword.

° ° °

German science writer Theo Loebsack writes an up-to-date survey of the air ocean in which we live. *Our Atmosphere* (Pantheon, $5) is one of three volumes along these lines to appear this spring. Chapters cover the history, nature, composition, behavior, phenomena, physical property, and natural laws of the air. All types of weather, storms, forecasting, clouds, and jet streams are examined. Man's conquest of the air is studied within the framework of his scientific achievements in aeronautics, astronautics, and meteorological science. Translations in German, French, Italian, Danish, and Dutch indicate its wide appeal for the airman and layman alike.

° ° °

Air Force wives will welcome Ester Wier's *What Every Air Force Wife Should Know* (Military Service Publishing Co., $3.95). It follows closely the author's *Air Force Social Customs* and the two make an enviable reference set for the distaff side of service families. Covered in this newest wives' guide are helpful hints, suggestions, and hard-to-come-by facts on service life—health, welfare, travel, installations (ZI and overseas), official and unofficial activities, transfer, homemaking, children's activities, service schools, and a dozen other areas of vital information for the Air Force home. Included is a general discussion of Air Force duty and responsibility, organization, and missions.

° ° °

A new paperback, *Uniformed Services Almanac* (P. O. Box 40, Washington, D. C., $1) collects available

data on the benefits and rights of military personnel and their dependents. The information is available in a score or more official manuals. Here it appears digested, synthesized, and under one cover. Topics cover tangible and intangible benefits for active, Reserve, and retired personnel.

Books of General Interest

Sky Smuggler, by Geoffrey Williamson (Transatlantic Arts, $4.50).

Space Primer: An Introduction to Astronautics (Convair, Astronautics Div., General Dynamics Corp.)—Seventy-nine-page pamphlet, single copies free, write Convair, Dept. 120, Box 1128, San Diego 12, Calif.

Aircraft Annual, 1959, by John W. R. Taylor (Simmons-Boardman, $2.95).

The Individual and the Universe, by A. C. B. Lovell (Harper, $3)—A British physicist's look at astronomy today, what we know about the limits and nature of the universe through optical and radio telescopes, and what we may learn in the future.

Technical Books

Helicopter Dynamics and Aerodynamics, by P. R. Payne (Macmillan, $17).

Gas Turbines for Aircraft, by Q. W. Judge (Macmillan, $12).

Lectures on Nuclear Theory, by L. Landau and Ya. Smorodinsky (Plenum Press, $5.25).

Vistas in Astronomy, Vol. III, edited by A. Beer (Pergamon Press, $18).

Advances in Aeronautical Sciences, edited by Theodore von Kármán, A. M. Ballantyne, H. Blenk, R. R. Dexter, M. Roy, H. L. Dryden (Pergamon Press, $25).

Medical Aspects of Flight Safety, edited by E. Everard, E. P. Bergeret, P. M. Wulfften Palthe (AGARD, NATO) (Pergamon Press, $12).

Selected Topics on Ballistics, edited by W. C. Nelson (AGARD, NATO) (Pergamon Press, $9).

Advances in Atmospheric Electricity, edited by L. G. Smith (Pergamon Press, $15).

Eight-Language Aeronautical Dictionary (AGARD, NATO), edited by G. H. Frenot (Pergamon Press, $20). (English, French, German, Russian, Spanish, Italian, Dutch, and Turkish)

Aircraft Electricity for the Mechanic, by Charles E. Chapel (Aero Publishers, $5). Second edition.

Proceedings of the International Conference on the Peaceful Uses of Atomic Energy (Columbia Univ. Press, $6). The Geneva Conference, August 8-20, 1955.

Aircraft Weight and Balance Control, by Henri G. D'Estout (Aero Publishers, $3.25).

Civil Air Regulations and Flight Standards for Pilots (Aero Publishers, $2.50).

Theoretical Astrophysics, edited by V. A. Ambartsumyan, translated from the Russian by J. B. Sykes (Pergamon Press, $19). The work of four eminent Russian astrophysicists.

Hypersonic Aerodynamics, by R. W. Truitt (Ronald, $10).

Nuclear Propulsion and Engineering for Engineers, by Demetrious G. Samaras, USAF Consultant and Professor of Nuclear Propulsion, Ohio State University Graduate Center (Technical Chamber of Greece, Athens).

—Maj. James F. Sunderman

The end of the trail. Air Force planes that ruled the skies in World War II and Korea stand in precise rows, silent, erect, proud, awaiting their fate. Some of these aircraft will go to other services, private buyers. Others will surrender their valuable parts before being scrapped. The income from airplane "graveyard" helps buy new weapon systems.

On the Arizona desert stands USAF's

BILLION-DOLLAR BONEYARD

Lt. Col. Carroll V. Glines

ON THE burning sands of the Santa Cruz River valley just outside Tucson is one of the strangest, most fascinating graveyards in the world—for airplanes. It is the official cemetery for the Air Force's fleet of tired, obsolete aircraft, the fighters, bombers, transports, and trainers of yesterday.

The graveyard officially is the Air Materiel Command's "Arizona Aircraft Storage Branch," located in 1,720 acres of desert that AMC "leases" on SAC's Davis-Monthan AFB. While supersonic fighters and bombers zoom skyward nearby practicing for a day they hope never comes, tired old craft make their last approach to a runway and taxi or are towed to the Valhalla of some of history's greatest aerial warriors.

Standing in precise rows, silent, erect, and proud is the Air Force of yesterday. Twin-tailed B-25s and triple-tailed C-121s stand quietly side by side awaiting their fate. Among

The first B-24 Liberator to land in North Africa in World War II, one of a group of old planes being held for the Air Force Museum at Wright-Patterson AFB, Ohio.

F-89 jet fighters, stripped of all parts with military value, queue up for the "guillotine," which will reduce them to jagged chunks of metal fit for melting furnace.

Other government agencies have first choice of aircraft Air Force consigns to AMC's Davis-Monthan AFB facility. Coast Guard has taken this SA-16 for rescue operations.

A security guard surveys "billion-dollar boneyard" from AMC "tower." Planes are carefully maintained, guarded until final disposition in line with phase-out procedure.

others are B-26s, B-29s, B-36s, B-50s, F-84s, F-86s, F-89s, C-45s, C-46s. Scattered throughout the huge area stand solitary old-timers that are being saved for the Air Force Museum—old-timers like the first B-24 to land in North Africa in World War II, the B-29 Bock's Car which carried the A-bomb to Nagasaki, and a Junkers JU-88 captured from the German Air Force during World War II.

Busily working inside this largest aircraft storage yard in the world are 600 civilian employees whose job is to reclaim and dispose of the aircraft and their equipment. At first glance, the new visitor gets a disturbing idea about government waste and extravagance when he sees hundreds of F-86 Sabrejets stacked five high and teetering in the wind. The average taxpayer remembers the day only a short time ago when the Sabre held a magnificent fourteen-to-one victory ratio over the MIG in Korea. He forgets that the Century-series fighters have replaced the slower, obsolete F-86s and that all too soon the piles of Sabres will be replaced with similar stacks of F-100s and F-102s.

But the taxpaying visitor's worried frown will turn into a satisfied smile when he hears about the Air Force's Weapon Systems Phaseout Procedure (they call it WIS-POP). Under this plan millions of dollars are saved by reclaiming needed parts, which in turn saves dollars to buy new weapon systems and spacecraft of the future. Since the plan was put into operation in 1957, over $125 million worth of parts and equipment have been put back in stock for reuse. Many complete planes are turned over to the other services instead of being scrapped.

For example, several Grumman SA-16 amphibians were "bought" recently by the US Coast Guard for rescue work. Other planes are offered for sale "as is, where is" to bidders at regularly scheduled sales. One Texas buyer purchased several B-25s for crop-dusting what must be a King Ranch-size pea patch. Other B-25s were sold to an Oregon firm that specializes in fighting forest fires with chemicals sprayed from the air. A brace of B-47s was bought recently by a movie studio to be used as rocket mock-ups. Most planes, however, are bought for utility or executive transports. Of all the planes that taxi into the "boneyard," almost twenty percent of them are eventually resurrected and revived to fly again.

It was no accident that Arizona was chosen as the storage site. The even climate, low humidity, and absence of a significant amount of acid or alkali in the soil are all essential elements for the preservation of planes. Often civilian buyers, working on their craft for flyaway, find that the radio and electrical systems still work perfectly even though the planes have been in storage for months.

The Air Materiel Command's sys-

(Continued on following page)

B-36, the "big stick" of postwar defense policy, being towed to its final resting place at Davis-Monthan. B-47, itself aging, contrastingly trails jet smoke overhead.

Aerial view shows a portion of B-36 fleet lying in quiet obsolescence in Arizona desert sun. Engines have all been removed to fly once more in warplanes present or future.

"Guillotine," huge razor-sharp blade wielded from crane, slices neatly into fuselage of old B-29 Superfortress. This one served for period with Britain's Royal Air Force.

Next step after the knife is the "sweater," or melting furnace. Then the reclaimed metals are sold on the open market. Here melted aluminum is poured into row of ingots.

tem for wringing out every last dollar of value from old planes is simple:

- Give the other services a chance at them.
- Sell those planes that will yield a fair and reasonable return.
- Save valuable parts that can be used again.
- Scrap what's left.

Under the first step, the "buying" service reimburses the Air Force and gains a completely overhauled plane in the process. When the aircraft are sold to the highest civilian bidders, the government realizes a nice percentage of its original investment, which satisfies taxpayers and makes the successful bidders happy.

It is the third and fourth stages that make up the biggest part of the workload at the storage branch. When it is decided that a warplane is to be scrapped, reclamation crews first "demilitarize" it. Guns, radar, radios, and instruments are removed. Tires, wheels, engines, and propellers are pulled off. Wiring, tubing, small motors, Plexiglas, and fabric items are stripped out and either reclaimed or sent to separate junk piles for resale to interested bidders.

After this "gutting," the now-unwarlike carcasses are lined up to await the arrival of the "guillotine," a multiton blade hoisted aloft by a huge crane. With nary a twinge of remorse, the skillful crane operator lifts the blade above an unsuspecting hulk and drops it with a heart-rending crash. As neatly as a butcher slices bologna, the blade lops off a huge chunk of airplane and in minutes has reduced a once-proud warrior to hunks of jagged metal.

From this point the metal goes to the "sweater," or melting furnace, whose temperature is carefully kept at 1,220° Fahrenheit, the melting point of aluminum. The melted aluminum is drained off and formed into ingots. The residue left (called "spinach") is scraped out of the furnace periodically and put through additional processes to reclaim other metals or is sold as scrap.

Some of the recovered metals, especially the aluminum and magnesium, eventually find their way back into the production of new airplanes or missiles. But most of the residue could never meet the rigid specifications required of aircraft metals without going through extensive refining processes. Thus, the largest poundage of the recovered metal goes into such mundane consumer goods as electric toasters, frying pans, and washing machines.

The sweating furnaces are operated by contractors who have agreed to do all the work necessary in recovering the metal. They account for every ounce recovered and pay the Air Force an agreed price. What happens to the metal afterward is up to the contractor unless, of course, it is one of the vital metals controlled by the government in the interests of national security.

Before and after. Crane picks up metal to drop into furnace. Left, neat stacks of aluminum ingots.

The operation of reclaiming millions of dollars worth of airplanes annually is no simple junk-dealer operation. Air Force planners in the Pentagon know years ahead of time when they will phase warcraft out of the inventory. Air Materiel Command planners then know approximately how many planes they can expect to taxi that last mile from the Davis-Monthan runways. When the fateful phase-out year rolls around, the planes are scheduled in an orderly manner to assure a predictable workload. Manpower is allocated, contracts are let for the salvaging operations, "save lists" are made up, and crews and craft are ordered on the final flight. Thus, the cycle of design, development, test, production, operational use, and salvage is complete.

Like the cavalryman who hated to say goodbye to his faithful horse, pilots and crew members find it hard to justify the fact that their dependable steeds should be led out to pasture in the prime of life. Tourists driving by the busy base gasp in horrified surprise to see sleek jet aircraft being chopped to bits before their eyes. Nevertheless, the billions of dollars invested in the long, silent rows of aerial warriors have paid off by winning two wars and keeping others from starting.

The Air Force's "billion-dollar boneyard" has paid for itself many times over in peace and security long before the planes squat in final repose on the hot Arizona sand.—END

The author, Lt. Col. Carroll V. Glines, is Chief, Plans and Analysis Branch, Quality Control, Headquarters AMC, Wright-Patterson AFB. A prolific author in his spare time, Colonel Glines contributed an article on the Air Force Museum and its prized possessions, "Wanted: Old Planes," to our March issue. Soon to be published is his third book coauthored with another officer, about the aging C-47.

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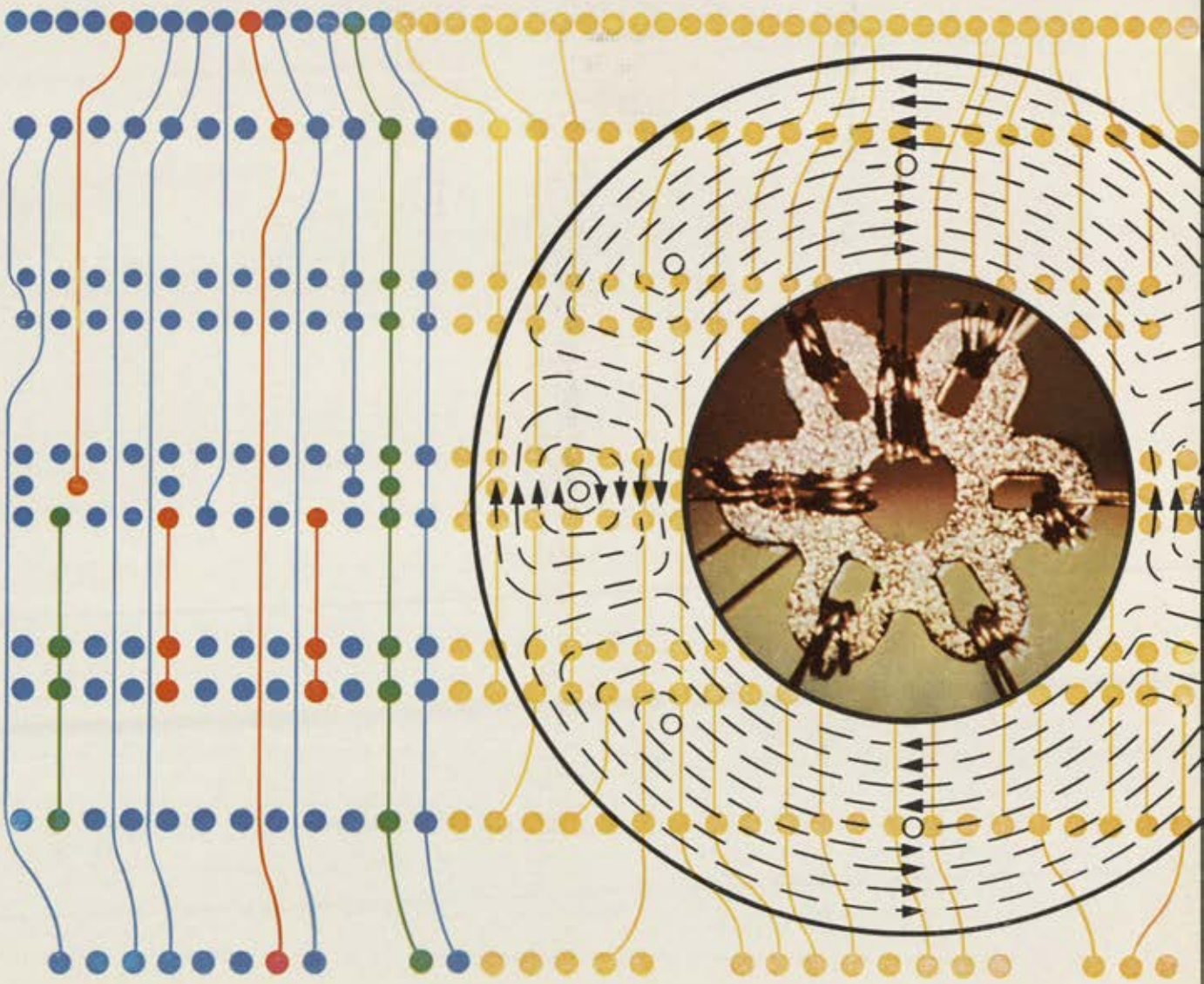

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