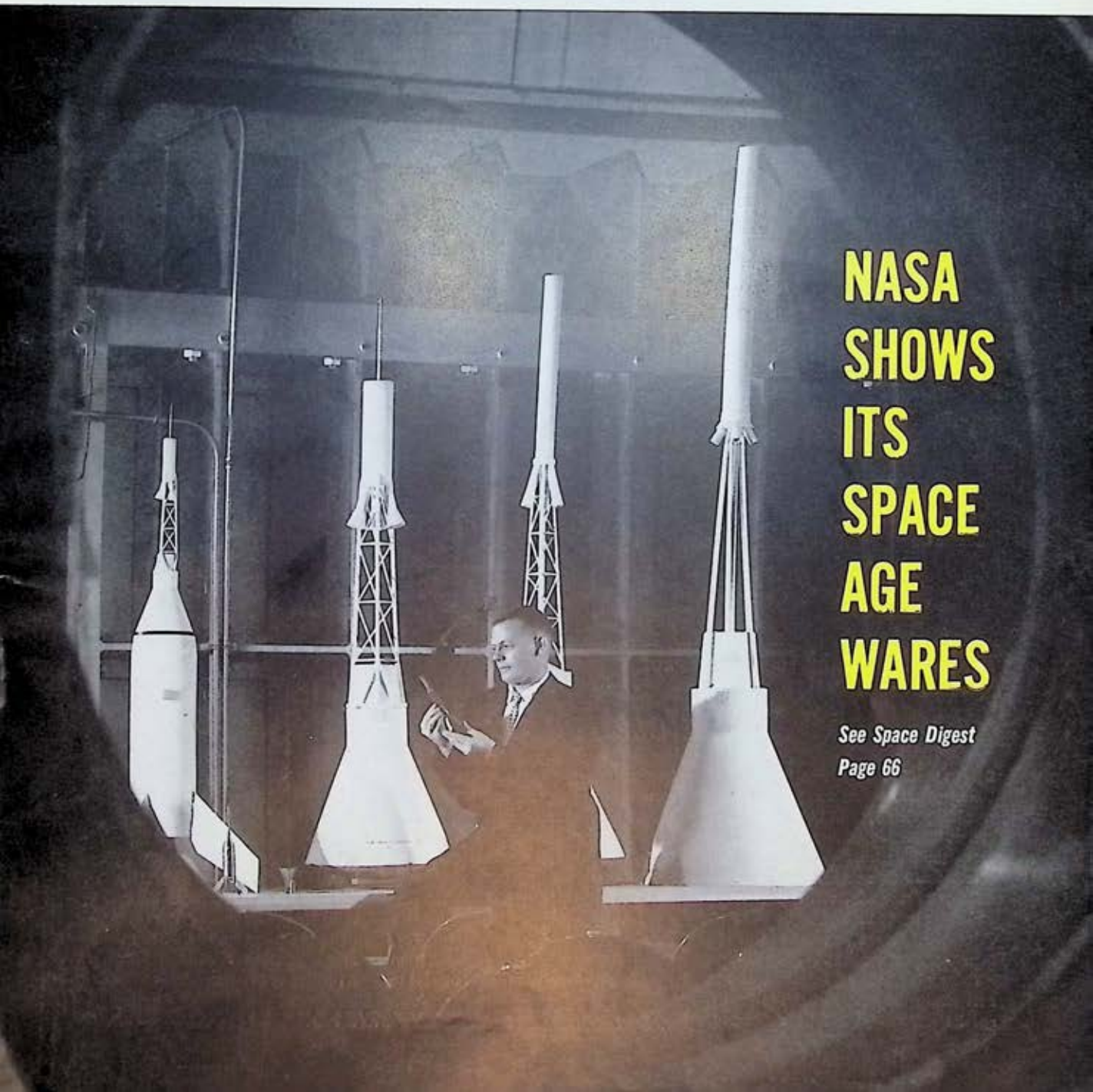
NOVEMBER 1959 / 50c

AIR FORCE

and **SPACE DIGEST**

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



NASA SHOWS ITS SPACE AGE WARES

See Space Digest Page 66

STEPS IN THE RACE TO OUTER SPACE

Nuclear Rocketship

Despite the sky-high transportation costs, Lunar manufacturing should prove economically viable. With unlimited Solar power, controlled atmospheres and advanced automation, a considerable commerce could be realized in delicate instruments, rare minerals, reactor cores and other items that might be more efficiently processed or produced in the Moon's perfect vacuum.

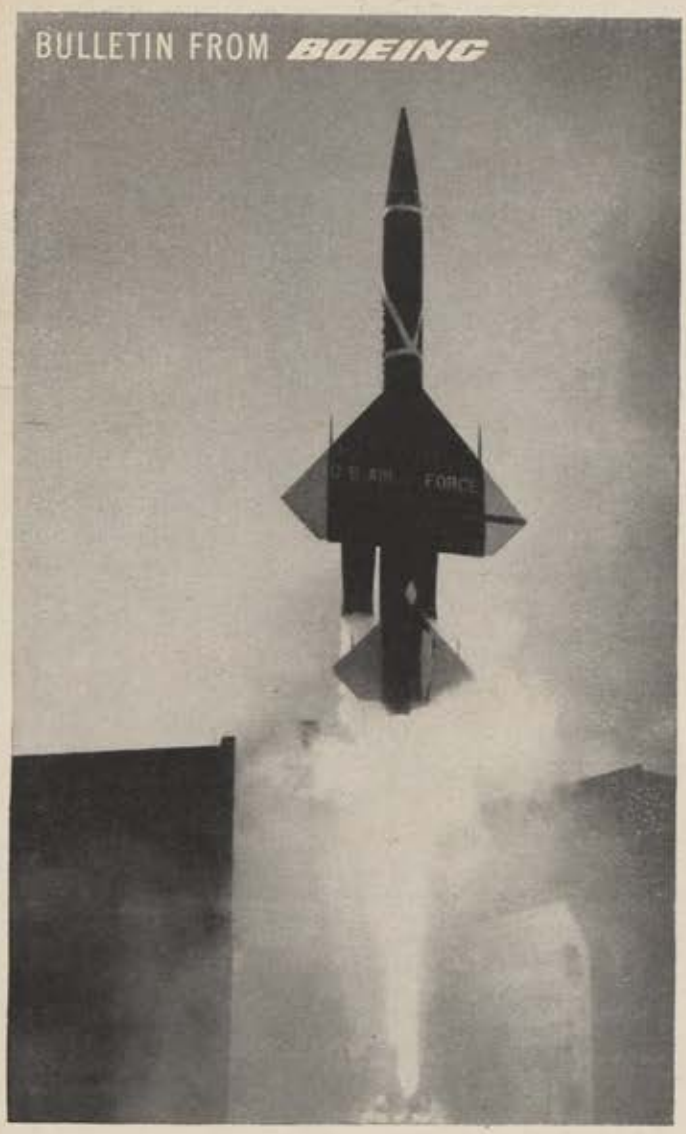
To supply the Moon colonists, and to carry their production back to Earth, special rocketships will be developed. Nuclear energy is the most promising source of propellant power. The ship shown here utilizes nuclear fission for heat and hydrogen gas as a working fuel. From pressurized tanks, the gas is fed through a heat exchanger, expanded, and expelled for the motive thrust.

When the craft leaves Earth, it carries only enough gas for a one-way trip. For, by extracting hydrogen and oxygen from Lunar rocks, Moon settlers will be able to refuel the rocketship for the return voyage. This will permit smaller fuel tanks on the craft and larger payloads.

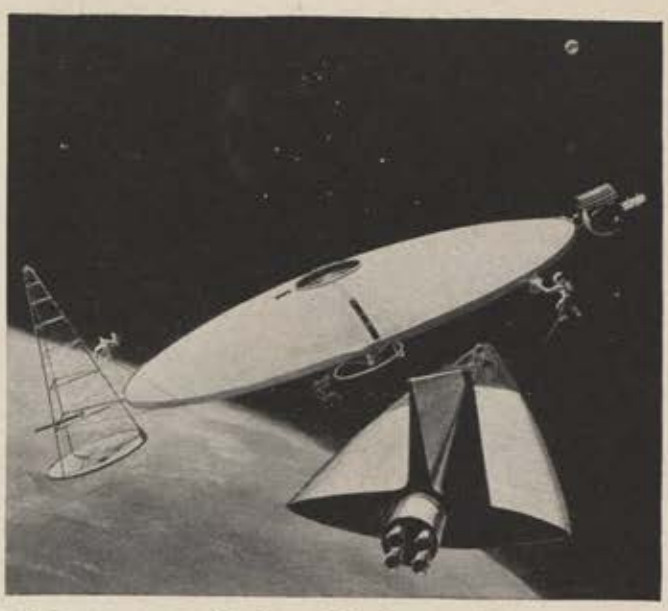
Inertial navigation systems will play an increasing role in the exploration of outer space. ***ARMA***, now providing such systems for the Air Force ATLAS ICBM, will be in the vanguard of the race to outer space. ***ARMA*** . . . Garden City, N. Y. A Division of American Bosch Arma Corp.

AMERICAN BOSCH ARMA CORPORATION

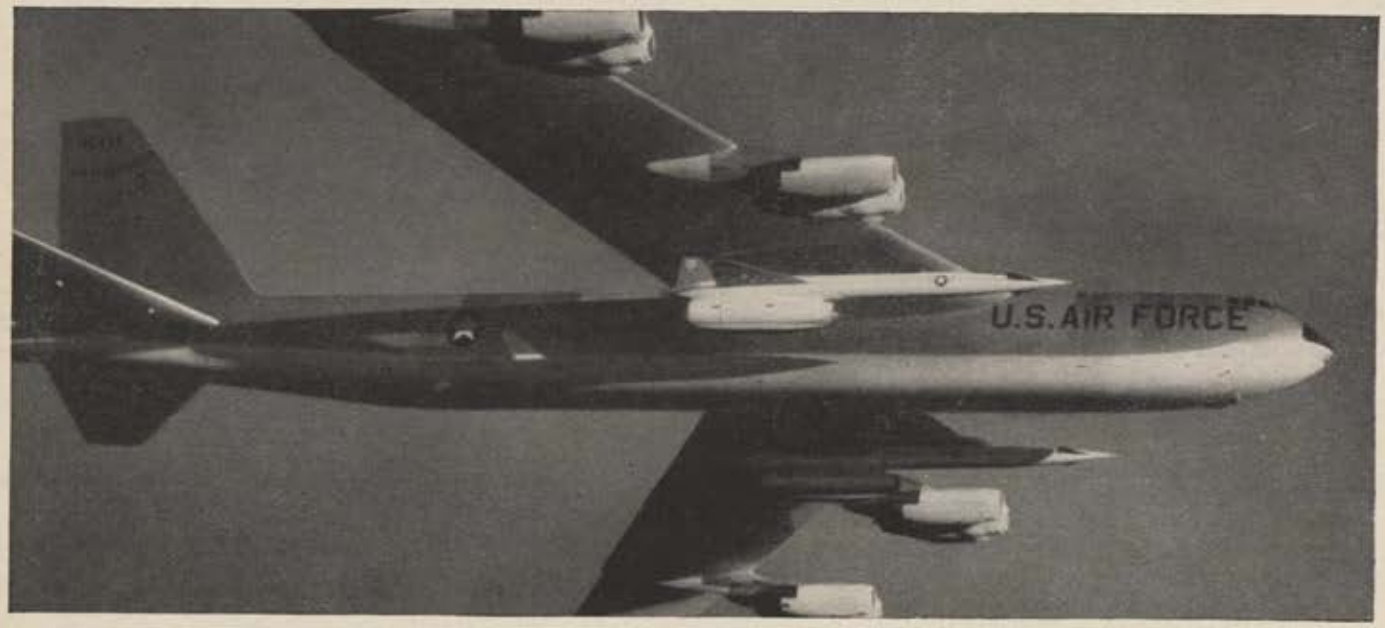
BULLETIN FROM BOEING



SUPERSONIC SKY FIGHTER. Boeing BOMARC is the longest-range defense missile under production for the U.S. arsenal. The advanced "B" model is designed for a range of more than 400 miles, which will enable the Air Force's BOMARC missile system to defend large areas against attacking aircraft. Other missile programs at Boeing include the Air Force's planned advanced solid-propellant intercontinental ballistic missile, Minuteman, for which Boeing is contractor for assembly and test.



MARS VEHICLE. Drawing of Martian space vehicle based on advanced study by Boeing scientists. Launched from an orbiting platform, vehicle would make reconnaissance trip to Mars and return, propelled by an ion accelerator receiving energy from the sun by means of solar cells. A "memory" pre-programmed into the vehicle would correct flight-path deviations. Other advanced Boeing space studies include lunar systems, orbital systems, space vehicles and interplanetary systems.



AIR-BORNE MISSILE LAUNCHER. The Boeing B-52G brings unprecedented mobility to the missile field, carrying supersonic Hound Dog missiles for in-flight launching toward targets several hundred miles away. In addition to missiles, the B-52G can carry a nuclear bomb load, and on a retaliatory defense mission could strike several targets thousands of miles apart. The B-52G missile-launcher-bomber is the Air Force's most versatile long-range weapon system.

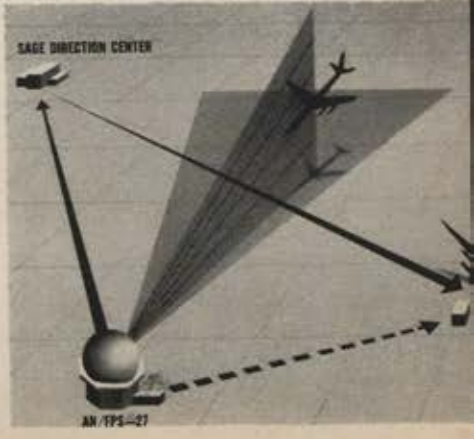
BOEING

CAPABILITIES FOR DEFENSE

Westinghouse AN/FPS-27 Radar in operation at an Air Defense Command site

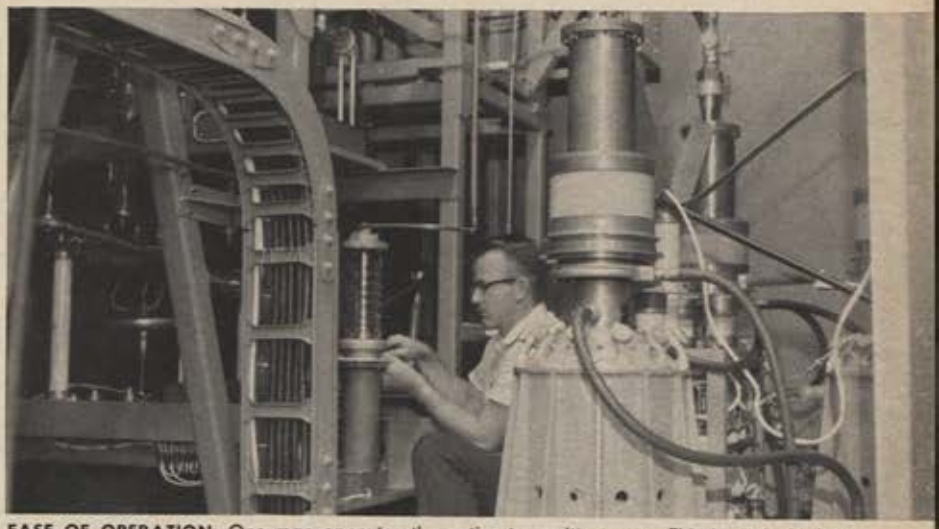
A single Westinghouse radar gets a 3-D fix on the enemy...dilutes his jamming ability

The AN/FPS-27, versatile 3-D radar designed by the Westinghouse Electronics Division for the Air Force's Rome Air Development Center, is achieving new standards of performance, reliability . . . and economy. Now under contract from the Rome Air Materiel Area, this high-power, stacked beam radar gathers range, azimuth and height data quickly and accurately while eliminating unwanted signals. These comprehensive functions in a single radar represent the application of the latest state of the art radar techniques to our nation's early warning defense.



MAINTENANCE EASE: AN/FPS-27 design stresses reliability and maintenance accessibility. A separate monitor console calibrates the receivers remotely. Equipment troubles are automatically indicated. Sub-assemblies can be replaced rapidly in case of circuit malfunction.

UNIQUE CONSTRUCTION DESIGN of the antenna system permits the inclusion of the latest 3-D height-finding techniques. Range, azimuth and height data can be automatically fed to a computer to form a composite picture of the air defense sector.



EASE OF OPERATION: One man operates the entire transmitter room. This is typical of the operational ease of the Westinghouse designed AN/FPS-27. A minimum team of six specially trained men can handle the operation and maintenance of the entire facility.

Here is the management team responsible for the development of the AN/FPS-27—within budget and on schedule. This team is typical of the Westinghouse practice of matching talent to the job.

The AN/FPS-27 is a part of a broad Westinghouse effort in shipboard, tactical and airborne radar. Current simulation studies at the Air Arm Division, utilizing the latest digital computer facilities (at right), hold promise for new approaches to the problem of long-range detection and tracking of aircraft and ICBM's.

Westinghouse

DEFENSE PRODUCTS

1000 CONNECTICUT AVENUE, N.W., WASHINGTON 6, D.C.

AIR ARM DIVISION
AVIATION GAS TURBINE DIVISION
ELECTRONICS DIVISION
AIRCRAFT EQUIPMENT DEPARTMENT
ORDNANCE DEPARTMENT
WASP

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

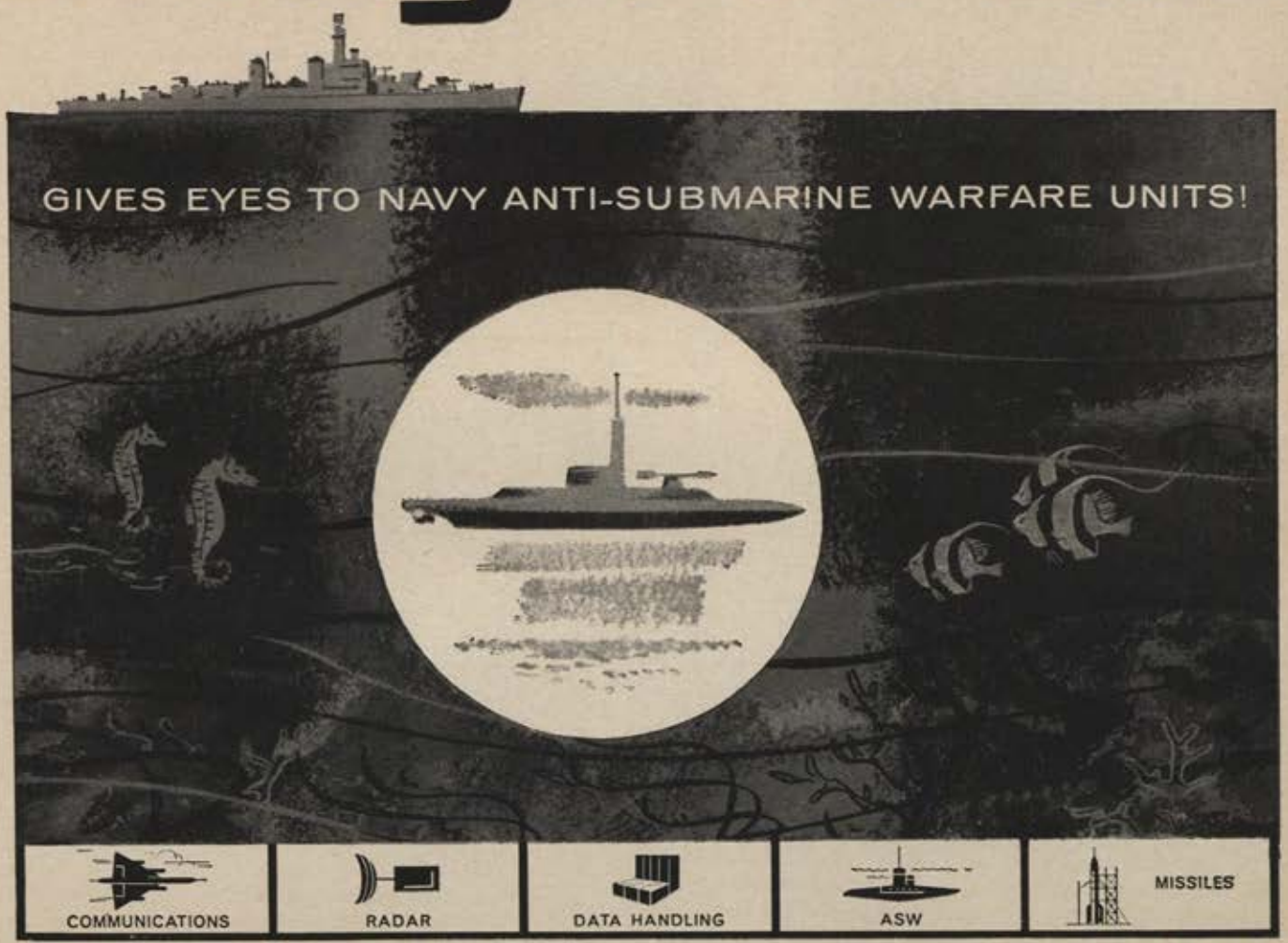
AN ASW SYSTEM... DISPLAY/AIRBORNE RECEIVER/SONOBUOYS

Anti-submarine warfare equipment designed, developed and produced by *The Magnavox Company*, in conjunction with the Navy Department, provides patrol aircraft with eyes that see underwater by day and by night. The AN/ASA-16 Display System, together with SONOBUOYS, AN/ARR-26 Receiver systems and other associated equipment provide aircraft with a clear picture of the ocean-depths below them. They are part of the continuing contributions of *The Magnavox Company* in aiding the U.S. Navy to combat the growing submarine menace.

MAGNAVOX capabilities are in The Fields Of Airborne Radar, ASW, Communications, Navigation Equipments, Fusing and Data Handling . . . your inquiries are invited.

PRODUCTS THAT SEE BY THEMSELVES

Magnavox



THE MAGNAVOX CO. • DEPT. 118 • *Government and Industrial Division* • FORT WAYNE, IND.

AIR FORCE

THE MAGAZINE OF AEROSPACE POWER

Volume 42, Number 11 • November 1959

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FEATURES

SPACE DIGEST
Starts on page 63

DEPARTMENTS

An Editorial

The Far-Sighted Misters of Mugu

John F. Loosbrock, Editor

"The Air Force today announced plans for the construction of an undisclosed number of submersible missile-launching platforms required, according to a spokesman, to enable the Strategic Air Command to carry out its global responsibilities in the field of strategic aerospace warfare.

"Backing up the submersible missile launchers logistically will be a planned fleet of underwater cargo and personnel carriers to be assigned to the Military Air Transport Service which has the support mission for SAC.

"Asked whether these plans did not infringe on the Navy's mission of controlling the seaways, the Air Force spokesman said he did not think so. He pointed out that the submersible missile launchers are not envisioned as ocean-going vessels. Instead they are to be designed for use in such places as the Great Lakes, the Mississippi River, and other inland navigable lakes and streams.

" 'We feel,' he said, 'that this is a logical extension of our program of reducing the vulnerability of the retaliatory portion of our deterrent force through dispersal. After all,' he said, 'five-fifths of this country, in fact five-fifths of the world, is covered by aerospace.'

"Old Pentagon hands were unanimous in the opinion that the Air Force proposal would not find favor in the Navy, which considers its domain to be the waters of the world, the shores which they lap, and both the air and space above them."

° ° °

By now it is hoped that the above has been recognized as a flight of editorial fancy. It was occasioned by the reading of a story in the Washington *Sunday Star* in which the *Star's* capable reporter, Richard S. Fryklund, outlines the Navy's ambitious plans to grab a chunk of the military space mission. Mr. Fryklund writes:

"Plans reportedly are being circulated among Navy leaders for extensive space and satellite programs, including space platforms manned by sailors. A memorandum being passed around in one of the other services says the plans have firm support among the Chief of Naval Operations space experts. It quotes these experts as saying the plans have been shown to—and received a tentative nod from—the Secretary of the Navy William B. Franke, and Deputy Secretary of Defense Thomas S. Gates, Jr., who is expected to succeed Mr. McElroy as Secretary of Defense late this year.

"The Navy projects," Mr. Fryklund says, "include navigation, reconnaissance, photo and infrared (heat-seeking) satellites, and research and development in bio-astronautics (keeping people alive in space) and the construction of manned satellites. This is as broad as anything the Air Force says it is planning now."

Obviously the Navy considers the announcement of September 23, which provided for "eventual assignment to the Air Force of responsibility for the development, production, and launching of military space boosters" as only an opening skirmish in a coming battle for roles and missions in space. The decision was heralded by many at the time as a signal victory for the Air Force. Many Air Force officers felt this was true.

However, as Associate Editor William Leavitt pointed out last month in "New Ground Rules for the Space Mission" (AIR FORCE/SPACE DIGEST, *October 1959, page 56*), "there is still room for scrambling on who builds what payloads." The same article predicted "the possibility of a housekeeping dispute between the Air Force and Navy at the Pacific Missile Range (next door to SAC's Vandenberg AFB). . . . Will the post-launch responsibility be Navy or Air Force?"

It is in the areas of payloads and range responsibility that the Navy is likely to make its stand. Mr. Fryklund points out in the *Star* article that the Air Force responsibility in the booster field "gives the Navy a low-cost ride into space every time it wants the Air Force to send up a Navy satellite."

And it is an ill-kept secret that the Navy plans to parlay the Pacific Missile Range at Pt. Arguello, Calif.—for which it has managerial responsibility—into a big chunk of space pie. Arguello consists of the southern 20,000 acres of old Camp Cooke, with SAC's Vandenberg AFB comprising the 70,000 acres to the north.

The Navy says the facilities now under construction at Arguello are a natural outgrowth of the Navy Missile Center at Pt. Mugu, which is being renamed "Navy Missile and Astronautics Center." Actually, Mugu is forty miles southeast of Arguello as the birds fly, with the city of Santa Barbara in between. Vandenberg, already in business as an operational and training base for ballistic missiles, is a few miles up the coast. A nonaggression pact has been signed between the Navy and Air Force regarding their responsibilities, but the fact remains that the assignment of on-shore range responsibilities to a presently nonexistent Navy facility next door to an in-place Air Force facility looks suspiciously like a bend-over-backward effort to get the Navy into the space act.

The Navy also has established an Astronautics Development and Advanced Technology Division in the Office of the Deputy Chief of Naval Operations, Development, and a Division of Astronautics in the Office of the Deputy Chief of Naval Operations, Air. Once its new Bureau of Weapons goes into operation after the first of the year, that bureau will also have a new Directorate of Astronautics. One remembers only a short time ago when the Air Force's wrist was slapped for setting up a Directorate of Astronautics under Brig. Gen. Homer S. Boushey. The name had to be changed to "Advanced Technology."

The whole business would be truly amusing were it not for the fact that legitimate roles and missions are being short-changed in the race for space. Countering the Soviet submarine threat, we submit, would be a much more lucrative field for Navy interest and Navy dollars. The Air Force itself will find it difficult to squeeze space money out of programmed budgets. Meanwhile, the Soviets apparently have plenty of money for both space projects and force in being. Maybe their next satellite should be one that hee-haws electronically every time it passes over the California coast.

Where it all will end no one can say, but we think some heads must be knocked together while there is still time.—END

The care and feeding of a missile system

It takes more than pressing a button to send a giant rocket on its way Actually, almost as many man-hours go into the design and construction of the support equipment as into the missile itself. A leading factor in the reliability of Douglas missile systems is the company's practice of including all the necessary ground handling units, plus detailed procedures for system utilization and crew training. This complete job allows Douglas missiles like THOR, Nike HERCULES, Nike AJAX and others to move quickly from test to operational status and perform with outstanding dependability. The wide experience of Douglas in producing large rocket systems has provided the company with unmatched capabilities in this field.

Alfred J. Carah, Chief Design Engineer, discusses the ground installation requirements for a series of THOR-boosted space probes with Donald W. Douglas, Jr., President of DOUGLAS

MISSILE SYSTEMS ■ SPACE SYSTEMS ■ MILITARY AIRCRAFT ■ JETLINERS ■ CARGO TRANSPORTS ■ AIRCOMB ■ GROUND-HANDLING EQUIPMENT

Sikorsky S-62 —an amphibian turbocopter of proved reliability

VERSATILE—Rescue work, towing, patrol, passenger or cargo carrying—even work as a flying crane—are easy for Sikorsky's turbine-powered S-62. A boat hull and wheels permit operation from land, shipboard, water, snow, ice, mud—almost any surface. All-weather equipment is optional.

RELIABLE—The S-62's dynamic components have been proved by more than 1,100,000 flight hours, assuring unequalled reliability. *Above: Widely tested throughout the world, the S-62 taxies on the Grand Canal, Venice, during a tour of Europe.*

HIGH FLYING—Hovering up to 15,000 feet with full gross weight and rescue missions at altitudes over 20,000 feet—important in mountainous areas—these are among the S-62's performance features.

HARD WORKING—A range of 245 miles, a useful load of 2900 pounds, an external load of 2500 pounds on a cargo sling, a passenger capacity of 12 plus crew, a towing capability of 4000 pounds tension, a rescue hoist capacity of 600 pounds, and a spacious 14 foot cabin—these are other attractions of the S-62.

SIKORSKY AIRCRAFT, Stratford, Connecticut
A division of United Aircraft Corporation

More Views on the Luniks

Following are two statements of reaction to recent Soviet lunar vehicles. They arrived in our offices too late to be included in the roundup in last month's issue (see October 1959, page 60). Senator Humphrey's statement has been abridged slightly in the interests of space—the editorial variety, that is.—THE EDITORS.

Gentlemen: The Soviet moon shot is a dramatic demonstration of Soviet superiority in space technology. One reason for this superiority is their early determination to concentrate on this fruitful field. Another reason is the high quality of Soviet scientific and technical work. The third reason is the strong support that the Russian government is giving to space technology.

The painful and continued fact of the missile gap is not in doubt. Whether this is being narrowed or whether it is still increasing is much harder for me to judge. Similarly, it is exceedingly difficult to say whether in other important military and technical fields the Russians will acquire decisive leadership in the near future.

The significance of the moon shot is that it calls to our minds all of these questions and all of these possibilities. It would be futile to try to counter it by a quick and flashy demonstration of our own program. In my opinion the only proper response is to work on sound, long-range plans to strengthen our own missile technology and all other branches of technology on which our safety and well being depends.

Edward Teller, Dir.
Radiation Lab., Univ. of Calif.
Livermore, Calif.

Gentlemen: The recent Soviet achievement of sending a space vehicle to the moon is a further refinement and reaffirmation of the message inherent in the successful launching of Sputnik I on October 4, 1957. The Soviet moon shot is merely the latest... of repeated challenges to America and the free world. The struggle between freedom and communism has been pursued for the past forty years. The Soviet moon shot was a significant milestone in the technological competition between the two systems. Any who may have doubted the seriousness of this competition should now be convinced.

The Soviet moon shot poses an immediate military strategy issue that will likely come under careful congressional attention in the coming session in January. If the Soviet Union can place within a predetermined triangulation on the moon, 230,000 miles away, an 840-pound capsule, which arrived less than two minutes off a previously announced time schedule, then is it wise for the United States (and its NATO allies) to place primary reliance upon fixed-base, concrete-imbedded missile launching centers within its own heartland and adjacent to industrial and population centers, and which could serve as a magnet to draw the full destruction of the enemy's missiles down upon an ostrichlike "fortress America"? The financial cost of attempting to escape only a portion of the problem through case hardening and limited dispersal is imposing. Congress, the Executive, military leaders, *and* the American people must give this dilemma earnest and early attention.

The Soviet moon shot also poses a more fundamental problem for all of our people. . . . Soviet competition is a present-day reality and simple survival is a personal and collective challenge. And to answer this challenge thousands and millions of individual choices must be made. Leadership—vigorous, enlightened, and honest—can trigger and temper the courage and self-discipline upon which wise individual choice must rest. Leadership can define the price which the individual must pay to best assure his and his nation's survival. But in the end, choice in a free society remains free. . . .

The purpose that gave this nation birth must now sustain it during maturity. It is a time for leadership to ask too much rather than too little; for leadership to risk the cold lash of rejection in the unending pursuit of purpose. No system can offer immunity from risk for those chosen to lead a free people.

Hubert H. Humphrey
United States Senate
Washington, D. C.

September Issue Praise

Gentlemen: . . . Your fine publication, with its fair and straightforward reporting and analyses, always receives the most careful attention at MATS Headquarters. . . .

Lt. Gen. William H. Turner
Commander, MATS
Scott AFB, Ill.

Gentlemen: . . . May I take this opportunity to congratulate you on the outstanding September issue. I have heard many fine comments from my staff concerning the exceptional utility they anticipate from this excellent reference.

Gen. Thomas S. Power
Commander in Chief, SAC
Offutt AFB, Neb.

Gentlemen: . . . This issue is packed with useful data and timely stories. The organization of its contents ensures repeated use as a handy and authoritative reference.

Now that this command has entered the space age, having already begun the integration of ballistic missiles into its deterrent force, it follows that our people will need to know more about the challenges that space poses for this command. Your publication is a competent and articulate vehicle for such information.

Maj. Gen. William K. Martin
Director of Personnel, SAC
Offutt AFB, Neb.

Gentlemen: I wish to congratulate you on the fine work done on your 1959 Anniversary Issue. Not only does it present a clear-cut summary of the progress realized within each major air command, but its compendium of useful information on Air Force people, events, bases, and hardware makes this issue an invaluable reference source. . . .

Lt. Gen. Francis H. Griswold
Vice Commander in Chief, SAC
Offutt AFB, Neb.

Gentlemen: . . . Don't mean to be gushy, but I must write this note.

The object of my emoting is the editorial, "Leadership in Being," which

(Continued on following page)

lies buried quietly in a forest of ad agency shouting on page 11 of the September issue. It describes a big, standing truth that is ignored by most of today's Air Force and today's industry. It's an important truth which has been unfortunately overlooked in the clamor of space-age ballyhoo. I hope that it is found, and read, and understood by many, many people.

Jack Shea
Tullahoma, Tenn.

Gentlemen: . . . It is one of the most interesting issues of the magazine that I have seen. It will serve us daily as a valuable reference book and be cherished as a document of historical value.

Gen. Frederic H. Smith, Jr.
Commander in Chief, USAFE
Lindsey AS, Germany

Gentlemen: . . . This is one of the finest issues that I have seen and I have made it required reading for my entire staff.

Lt. Col. F. D. Henderson
Eglin AFB, Fla.

Gentlemen: . . . I especially enjoyed Gen. Thomas D. White's article "Air Force Progress Toward the Future" and Gen. Thomas S. Power's "Strategic Air Command."

There is only one bone I have to pick with you. As an ex-WAF, I believe the women could have received a little more attention. . . .

S. B. Page
Victorville, Calif.

Corrections for the Record

Gentlemen: As ever the 1959 Anniversary Issue of AIR FORCE Magazine is a topnotch edition. The material contained in this issue should prove itself invaluable. . . . We are particularly proud to have our participation in the Lebanon crisis cited in the USAFE command summary.

I would like to call your attention to one apparent oversight in the Operation Forces section of the Command and Staff photo chart on page 69. I note that identity of the 322d Air Division (Combat Cargo) is omitted from the USAFE command chain while our PACAF counterpart is shown.

Maj. Albert E. Audick
APO, New York, N. Y.

Gentlemen: In your Anniversary Issue the Boeing IM-99A and B Bomarc is erroneously described on page 212 as being powered by Marquardt "ramjet liquid rockets."

The IM-99A is launched by an Aerojet-General liquid rocket; two chemically fueled Marquardt RJ43 ramjet engines take over for cruise propulsion.

The IM-99B is launched by a Thiokol solid-propellent rocket with two chemically fueled advanced Marquardt ramjets taking over for cruise propulsion.

In summary, the essential difference between the IM-99A and IM-99B missiles, as far as fuel is concerned, is that the IM-99A is launched by a *liquid rocket* and the IM-99B is launched by a *solid-propellant rocket.* The ramjets are chemically fueled (JP-4 or the high energy fuels). The IM-99B, often referred to as Super Bomarc, more than doubles the capabilities of its predecessor. The confusion arises from different fuels used for the rocket boost phase; chemical (liquid) fuels are used on both missiles for ramjet cruise propulsion.

Hank Alcouloumre
The Marquardt Corporation
Van Nuys, Calif.

Gentlemen: I was chagrined to note on page 249 of the September issue of AIR FORCE Magazine the omission of the awards given by Aviators' Post No. 743 of the American Legion.

Currently we have three awards that we give:

- The Billy Mitchell Award presented periodically to that US citizen making an outstanding contribution to aviation progress. Past recipients include J. H. "Dutch" Kindelberger, Gen. Jimmy Doolittle, Gen. Curtis LeMay, Gen. Nathan Twining, Jacqueline Cochran, and many others.
- The Arnold Sabre Award presented annually to the outstanding cadet of the Air Force Academy.
- The Valor Award Medal presented annually to the rated person of the Air Force who distinguished himself by a conspicuous act of personal courage and valor in aerial flight. An official medal is presented and governed by Air Force Regulation 35-4, Section 8.

I know that this was a pure oversight from lack of information. However, members of the Post have pointed this out to me so that next year in your Anniversary Issue you may make such mention as you care.

I think your last issue was one of the finest and I assure you many of us read it cover to cover—otherwise such omissions as I just mentioned would not be picked up.

Roger J. Browne, Commander
Aviators' Post No. 743
American Legion
New York, N. Y.

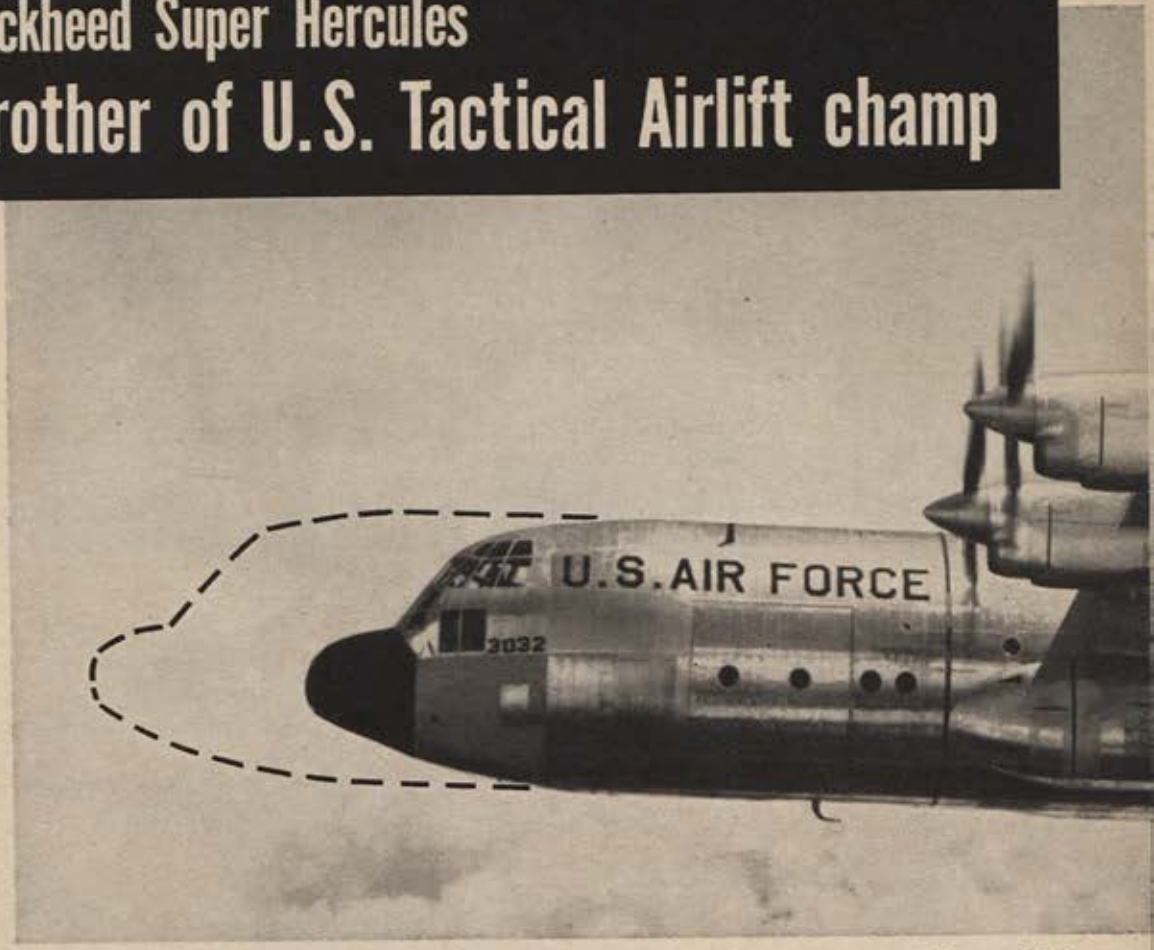
STILL A PILOT'S AIR FORCE

His plane looks like a missile. It carries missiles. It is an automatic machine itself – almost to the point of push-button control. But the Air Force pilot gives his aircraft *discretionary* guidance – a generalship that pilotless weapons can't match. Along sensitive borders today, we depend on pilot judgment and reason to keep our guard up without overstepping. The pilot's combat reliability is the foundation of our "mixed forces" concept of deterrent strength through missiles and manned weapons. And getting this keen observer out into space is the immediate goal of U. S. space-science efforts.

AERONAUTICS · ASTRONAUTICS · ELECTRONICS · GENERAL DYNAMICS · RANGE SYSTEMS · RESEARCH

CHANCE VOUGHT
DALLAS, TEXAS

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

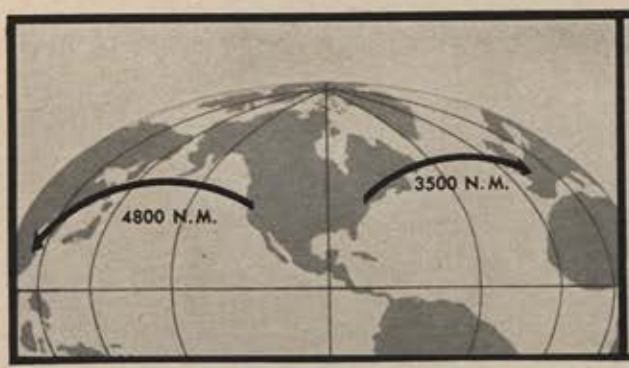


An ocean-spanning logistic support transport, the Super Hercules is a "stretch" version of the C-130 Hercules—famous for its headline-making feats in over 2½ years of service with USAF's Tactical Air Forces.

The Super Hercules has a fuselage 24 feet longer than its brawny brother's. Its wing span is 12½ feet greater...its propeller-diameter has been expanded by 3½ feet...internal fuel capacity has been increased to 11,512 gallons for greater range.

Powered by four new GM-Allison T61 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: 77,000 pounds.

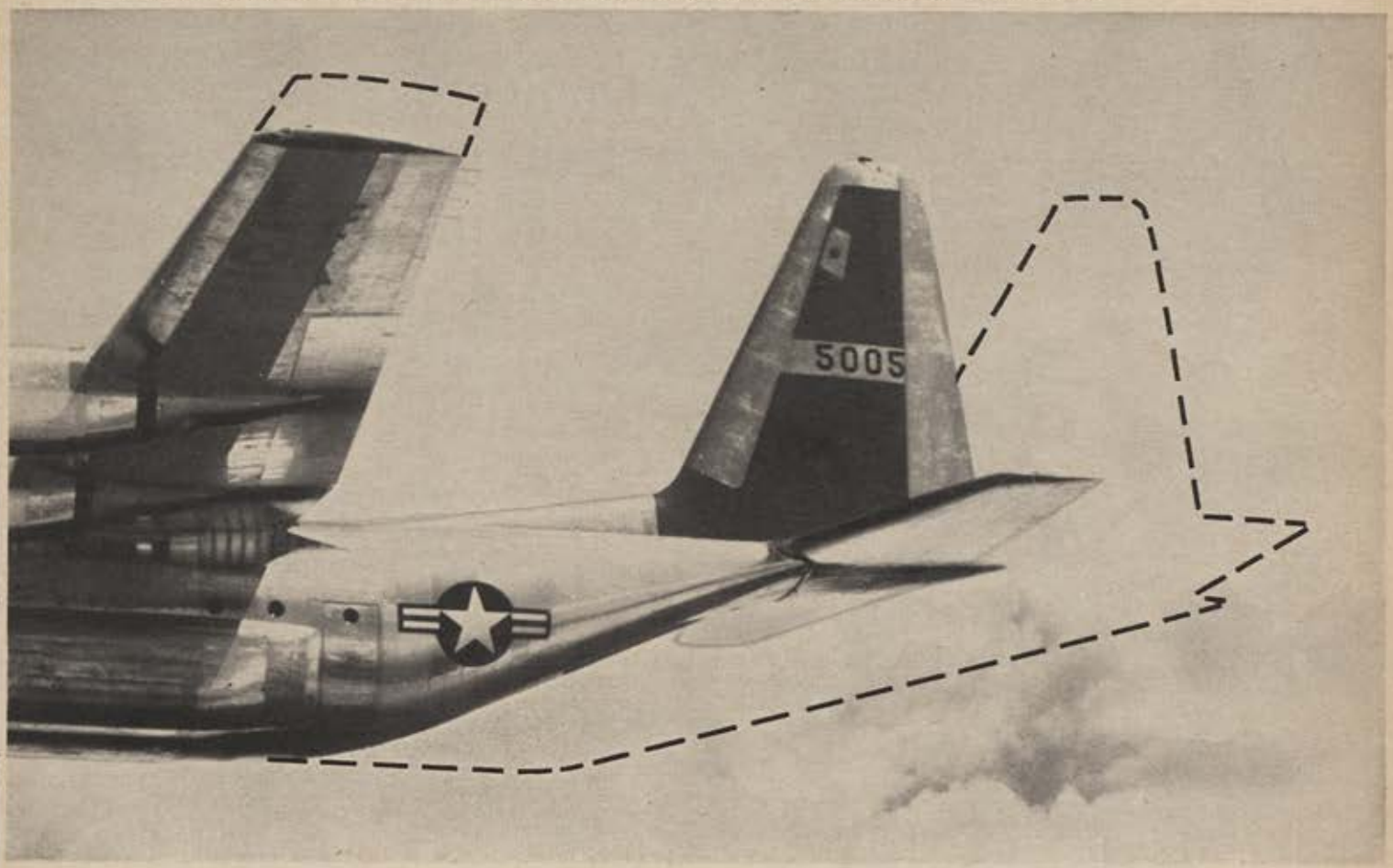
The Super Hercules will come off production lines at Lockheed's Georgia Division. Like all Lockheed aircraft, the Super Hercules is designed for long life, easy maintenance, and low cost of operation. Result: maximum airlift, for minimum dollars.

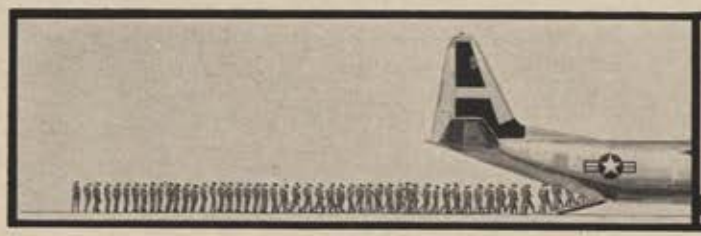


Transporting 50,000-pound cargoes non-stop across the Atlantic—or, spanning the Pacific non-stop carrying 16-ton loads 4,800 nautical miles—is the mission of Lockheed's new Super Hercules.

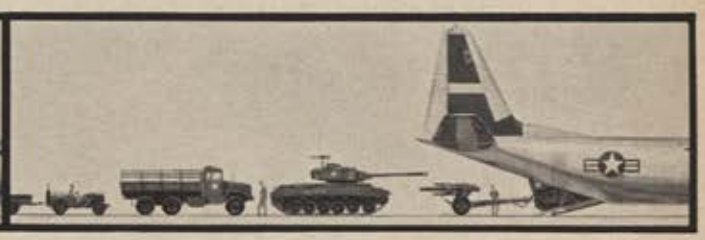
Crew efficiency on long flights is assured by flight station design approved by experienced transport pilots. Super Hercules' crew compartment includes relief crew sleeping space, galley facilities for hot meals in flight.

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

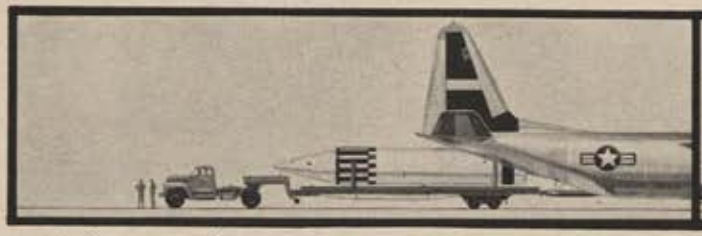




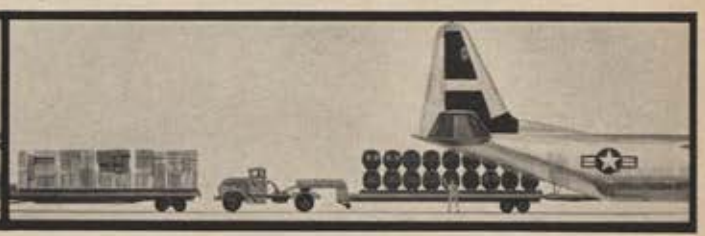
152 combat-ready troops, or 116 paratroopers can be transported in the Super Hercules cargo/troop carrier. With airline type seats, it can carry 105 persons.



Combat vehicles can be driven up the hydraulically controlled ramp-door of the end-loading 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 Lockheed 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.

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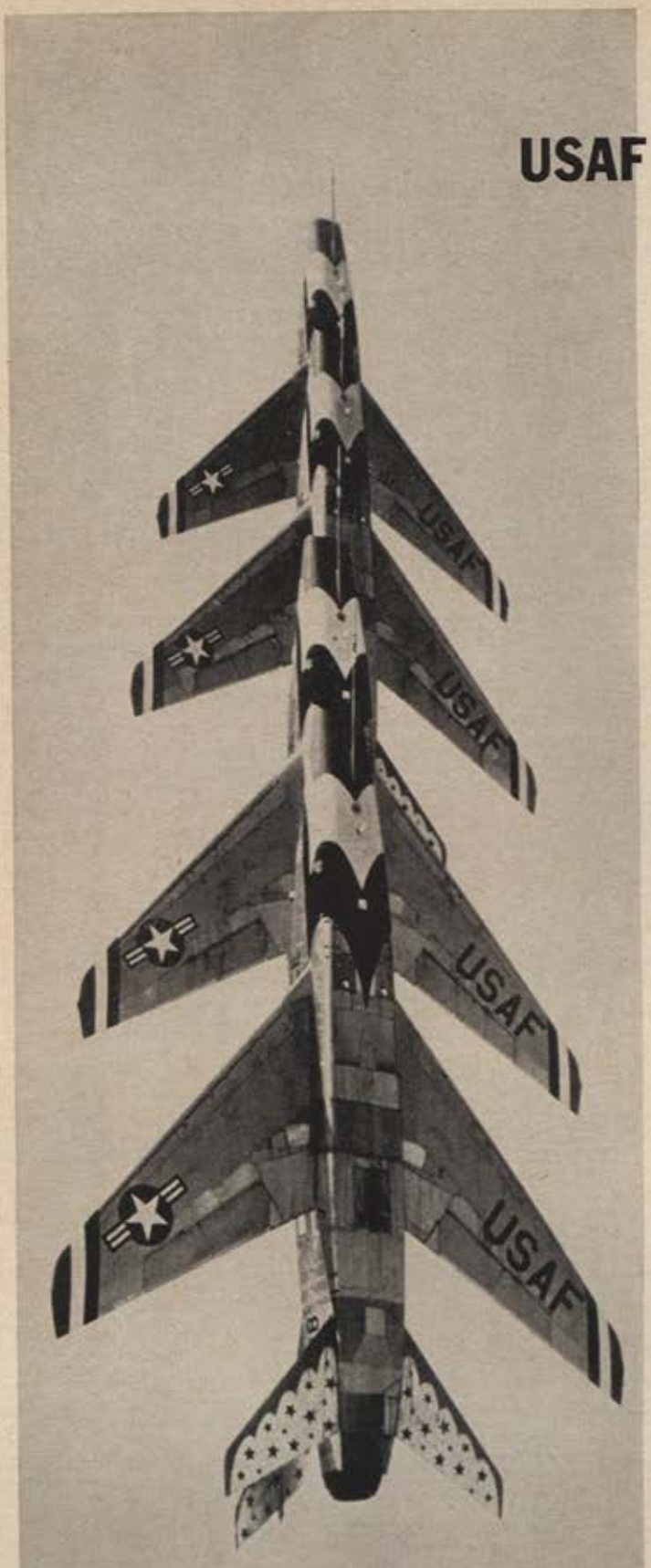
USAF Thunderbirds

Subject Hamilton Standard Fuel-Air Starters to Grueling Field Use



Tight as a Totem Pole

That's how the Thunderbirds barrel into their famous corkscrew roll. They take off in tight formation, too, with pushbutton starts from Hamilton Standard fuel-air starters.

1,000 successful starts in 5 months prove ruggedness and dependability of Hamilton Standard's FAS-450-9 units

By installing Hamilton Standard self-contained fuel-air starters in their F-100Cs last April, the Thunderbirds found they could put their show into motion right on the ground with fast, simultaneous starts. In fact, between April and September, each plane logged over 200 successful starts. What's more, the Thunderbirds have eliminated 3,000 pounds of equipment from their baggage.

Field reports like these reinforce one of the outstanding starter records in the industry. Over 14,000 Hamilton Standard starters . . . pneumatic and fuel-air . . . are in service today on 27 types of front-line aircraft. That's experience you can count on.

Model FAS-450-9. Weighs 44 lbs. Delivers 150 hp. Starts Thunderbirds' J-57P-21 engines (16.3 slug ft.^{2} moment of inertia) in 10 seconds. Complete data available on request.

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AIRPOWER in the news

Claude Witze
SENIOR EDITOR

Budget vs. National Security

WASHINGTON, D.C.

"The decision to discontinue the F-108 development," the Defense Department has announced, "was reached after completion of a study which discloses that the already great and rapidly rising costs and the personnel and materiel requirements of advanced weapon systems dictate revision of certain existing projects."

There is no doubt about it, Texan Maury Maverick, who coined the word "gobbledygook," was stirred in his grave. It is equally clear that the AF is going to get along without a Mach 3 long-range interceptor because the Administration will not make available enough money to pay for it and that this decision will increase the risk we are taking.

There are a good many people in Washington who would like to create the impression that USAF has shown questionable judgment in the past and that one example was the requirement for the F-108. Now it has dawned, according to this school, that the unmanned missile can do the job and that the piloted interceptor will pass, at least by the mid-1960s. On the contrary, there is no evidence that USAF is ready to put this kind of confidence into antiaircraft missiles with a range that is measured in hundreds of miles. There remains a stern requirement for the F-108.

Basically, this requirement stems from the role played by interception in the maintenance of our deterrent power. It has been suggested that too many Americans are inclined to confuse retaliation with deterrence. It is the deterrent power of the Strategic Air Command that has maintained the peace, a power that comes from our retaliatory capability.

The point has been made with clarity by Bernard Brodie in his current book, *Strategy in the Missile Age:*

"Known ability to defend our retaliatory force constitutes the only unilaterally attainable situation that provides potentially a perfect defense of our homeland. Conversely, a conspicuous inability or unreadiness to defend our retaliatory force must tend to provoke the opponent to destroy it; in other words, it tempts him to an aggression he might not otherwise contemplate."

It probably is true, as Mr. Brodie points out, that military people have a bias in favor of offensive power and it is not generally understood that they frequently consider defensive weapons part of the deterrent force.

USAF recognition of the F-108 as part of the deterrent power goes back at least to 1955 when a Mach 3 capability became a goal. In addition, the requirement was for an interceptor with long range—1,000 miles—and equipped with radar and fire control systems that would work independent of ground installations. At the time, the state of the art would not permit this and there was some effort to compromise because the true goal could not be reached by the 1960 to 1961 period. It was a couple of years before the North American F-108 configuration became plausible and work was pushed concurrent with the same company's B-70 bomber. Both were to use high-energy fuel.

This was the "big step" USAF development and procurement officers were talking about in early 1957. The Russian manned bomber still was considered a major threat, although Moscow since has switched emphasis to ballistic missiles, creating the "gap" that faces us as a threat in the next few years. Two years ago, when USAF was programming for the mid-1960s, this was not anticipated, but the program remained flexible.

Lt. Gen. Clarence S. Irvine, then Deputy Chief of Staff, Materiel, was questioned about the F-108 early this year before a subcommittee of the House Appropriations Committee. The exchange, in retrospect, made it clear why flexibility was retained. Here is a sample:

Mr. Mahon: With the continued emphasis of our potential enemy on ballistic missiles, should this country be spending money on the development of advanced interceptor aircraft such as the F-108?

General Irvine: As long as we think the Russian is going to maintain an active bomber fleet and as long as he is working on a supersonic bomber, I feel we have no choice. . . . This is the reason we are going ahead with the airplane.

Mr. Mahon: Will we not get the F-108 in a period when we reasonably conclude that there will be a considerable capability in the ICBM field by us and by the Soviet Union?

General Irvine: We will; yes.

Mr. Mahon: Are we not emphasizing the ICBM over other weapon systems?

General Irvine: Yes, because if we were considering the airplane the major threat in that time period, we would be talking about buying——of these airplanes instead of talking about buying——of them.

Mr. Mahon did not ask any more questions, but he could have learned that while we run in second place in the missile race we must rely on our stock of B-52 long-range bombers, their life extended by every means possible. And USAF considers the F-108 an important tool to protect both the B-52s and the ICBM bases that will be part of the arsenal in a few years. In its original plan USAF projected a defense force for about 1966 that would rest, in the main, on twenty squadrons of F-108s and thirty-six of Bomarc missiles. If the interceptor had been sacrificed to provide more than thirty-six squadrons of Bomarcs some of the risk would have been alleviated. But this is not so. The military requirement still exists and *both* programs have suffered in the scramble to gain top priority in the shopping list. Bomarc, in fact, has taken more than its share of financial abuse in decisions made on Capitol Hill.

There is concern over this situation. USAF must always assume that the potential enemy is working on the same weapon ideas that prevail here and the standoff bomb—Hound Dog and air-launched ballistic missiles are examples—is one against which we have no defense. As matters

(Continued on following page)

stand, it is an achievement that cannot be realized without an interceptor with the range, speed, and fire capability of the F-108.

Other projects have been dropped in addition to the F-108. USAF Secretary James H. Douglas has pointed to the chemical (high-energy) fuel program, the B-58B, and a cut in facilities that includes elimination of the controversial Bong Air Force Base in Wisconsin. There is more to come, and the struggle over the fiscal 1961 budget, now nearing a climax in the Pentagon, reflects the seriousness of this effort.

The number of wings in the Air Force will continue to decline as operating costs are slashed to meet the missile procurement burden. There are 105 wings today, with 102 programmed for the beginning of the next fiscal year. The actual number probably will be ten less than that, or ninety-two. This will permit a slash in forces, possibly 20,000 military and 7,000 civilians before fiscal 1961 is very old.

Contracting will get under way in fiscal 1960 for the hardening of ICBM bases, with the big cash outlay for all this steel and concrete in fiscal 1961. If the procurement allocation changes at all it is not expected to provide more money, so there must be more cancellations, presumably in aircraft and related equipment. The most pessimistic observers in Washington are convinced that some projects which escaped the axe in recent weeks will be dragged to the block some time after the new year.

As in the case of the F-108, none of these fatalities will come about without a long discussion and searing battle with budgetary necessity. And most of them, also like the F-108 decision, will involve an increase in the risk we are taking.

1947 Peace Proposal Dropped

Speaking of canceled programs and how they may affect our military stature, you probably have not heard about the speech made in Washington a few weeks ago by William B. Bergen, youthful new President of the Martin Company. Let's bring you up to date.

Mr. Bergen was asked by one of his audience for an opinion on what is wrong with the US space program. "What is wrong," he replied, "is that we don't appreciate that you cannot buy time or life with money."

He thereupon hauled out of his brief case a heavy document in a yellow cover and announced that he could not let his audience peek but would give a few details. The report was dated 1947 and showed the feasibility at that time of building a rocket vehicle that could launch a 1,450-pound payload into orbit. It also could have been used for an ICBM. What became of it?

Nobody was interested, Mr. Bergen said, but if the program had been undertaken without any crash priorities we would have had a satellite in orbit before the Korean War. Then he asked a question:

Would there ever have been a war?

Hurry, Hurry, Hurry

If you have any doubt that the Air Transport Association, which is composed of airlines, is beating the Military Air Transport Service over the head with a bag of bricks, you should get on the ATA mailing list. It's a rewarding experience.

Most recently we are in receipt of fifteen editorials, reprinted from magazines and newspapers as diverse as the New York *Times*, the Oshkosh (Wisc.) *Northwestern*, and the Dyersburg (Tenn.) *State Gazette*. All of them have one thing in common—an attack on MATS—and some have more than one thing in common. Some of them attack MATS in identical language, using the same phrases, the same line of reasoning, and, obviously, the same sources.

The sources are not disclosed, but our incoming ATA mail already has included a sixteen-page pamphlet extracted from the *Congressional Record*. It is almost solidly a criticism of MATS, its present and future programs. Some of it is quoted in some of the fifteen editorials, which probably demonstrates how an egg produces a chicken, or vice versa.

At least five of the editorials, including those from the *Journal of Commerce*, *Business Week*, and the Rochester *Democrat & Chronicle*, say in almost identical sentences that the Hoover Commission advised the government it could save money by using commercial airlines instead of MATS. This is true and the way in which this boiler plate is used indicates that none of the editors took the time to check MATS, where he would be told MATS has no argument with the Hoover Commission and, in fact, agrees with it.

COL. EDWARD L. WILSON, JR., 1918-1959

The nation, the Air Force, and the Air Force Association last month lost a loyal citizen, a distinguished combat veteran, and a devoted servant.

Col. Edward L. Wilson, Jr., USAF (Ret.) forty-one, Director of Military Relations for AFA, died on October 14 at Walter Reed Army Medical Center, Washington, D.C., after a courageous fight against a cruel combination of physical disabilities.

Ed Wilson was born in Oklahoma and raised in New Jersey. He was graduated from Colgate University, Hamilton, N.Y., class of 1940. A year later, he entered military service as an Army Air Forces aviation cadet.

During World War II he flew B-24s with the Fifteenth Air Force in the ETO. In Korea, he was a squadron commander and deputy group commander of B-26 night-intruder units. His decorations included a Silver Star, two Distinguished Flying Crosses, a Bronze Star, eight Air Medals, and three Distinguished Unit citations. He was retired from the military service on medical grounds in 1957, and joined the AFA staff in July 1958.

Colonel Wilson was buried in Arlington National Cemetery on October 20, with full military honors. It was a sad day for us all.—THE EDITORS

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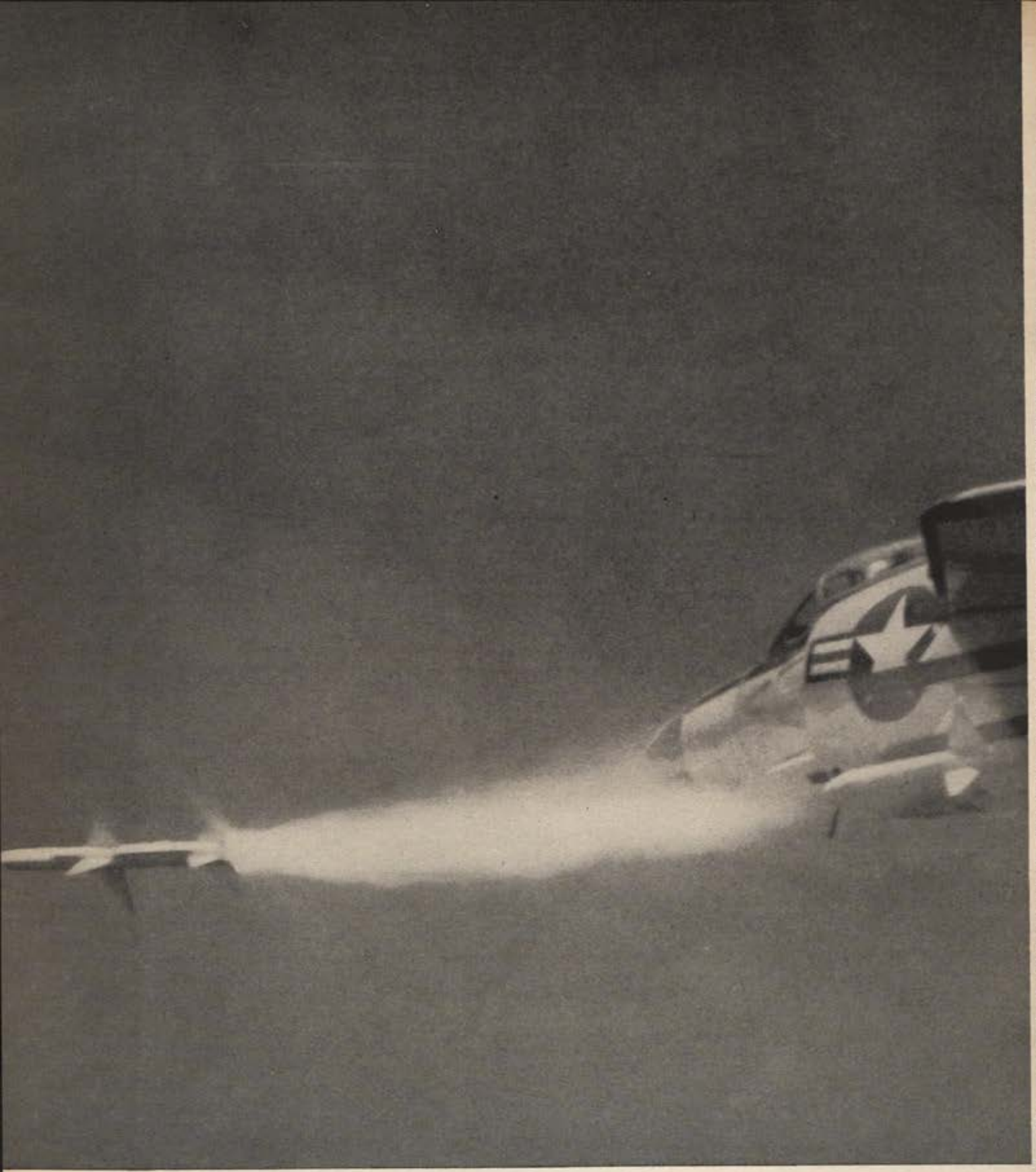
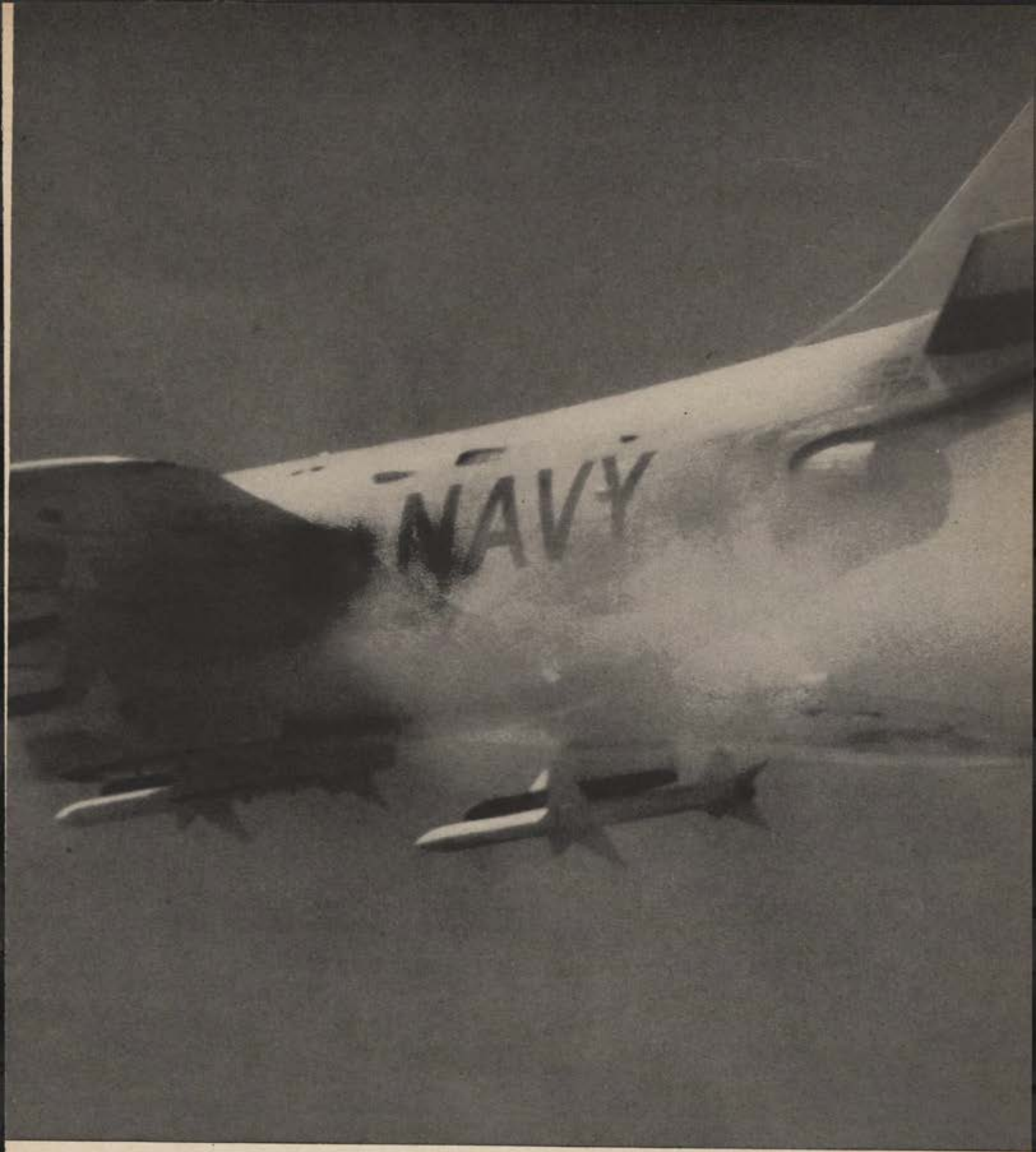


Sparrow III Navy air-to-air missile is now

Raytheon is prime contractor for this potent



operational with both the Sixth and Seventh Fleets.

weapon system.

RAYTHEON COMPANY, WALTHAM, MASS.

RAYTHEON

EXCELLENCE IN ELECTRONICS

New London and Aberdeen

Submarines and rifles are remote from the normal interests of this column but the lull after Congress went home gave us a chance to look at both of them in action. We have spent twelve hours on the USS *Skipjack* SS(N)585, on a cruise out of New London, Conn., and another working day at the Aberdeen Proving Ground in Maryland as a guest of our Washington neighbor, the American Ordnance Association.

This cross-pollinization raised eyebrows on some of our confreres, who looked upon it with a mixture of suspicion and incredulity. The invitations, however, were extended by the Navy and the Army, which indicates that both may be less parochial than some of their best friends. If the visits donated any grist to our mill, and we are certain they did, it is grist that will go into our editorial case for real unification.

The *Skipjack*, a nuclear-powered craft designed to battle other submarines, is an amazing piece of machinery. The weight alone is in the neighborhood of three thousand tons, contained in a hull that is shaped like a football. It is this shape that gives *Skipjack* its underwater agility, both speed and an ability to maneuver that would startle a veteran aviation editor. Cmdr. William W. Behrens, Jr., the skipper, says the press can report only that the *Skipjack's* speed capability is in excess of twenty knots (twenty-three mph) and that it can operate in depths of more than four hundred feet. Both figures are modest.

USS *Skipjack*, nuclear powered, is the world's fastest submarine. There is no deck and no exterior armament.

The *Skipjack's* unusual shape will be used on almost all new Navy submarines, including those planned as mobile underwater bases for the Polaris ballistic missile. Commander Behrens feels that experience in operation is the biggest void remaining to be filled, with most of the technological problems well in hand. Communications always will be a major concern for the sub commander, but there clearly has been big progress in this area.

Somehow, the *Skipjack's* complexity and performance were very much what we expected, like the results when Sam Snead drives a ball on the golf range. What impressed us most about our underwater cruise was not the ship, but the men who operated it. In more than a decade of military reporting we have spent a great deal of time on Navy ships, most of them aircraft carriers. This is the first time we have returned to the beach with a conviction that every manjack in the crew, commissioned and enlisted, was fully expert at his job. Much of this is credited to Vice Adm. Hyman Rickover, who has found a way to staff his nuclear vessels with select men from a select service. So far, the system has been a success. The only mishap the admiral has met came when he ran into a whale on a recent test maneuver, a collision that sent him limping back to port.

At Aberdeen Proving Ground "The Army of the Future" demonstrated a collection of new weapons, ranging from a couple of machine guns to a 155-mm howitzer and a truck that swims. A great deal of the show was centered on firepower, including demonstrations of Army missiles—the Sergeant can be emplaced and made ready to fire in eight minutes and eight seconds—mortars and other tools for the GI. We were most impressed by the Vulcan, which is a multibarrel 20-mm gun that can fire 6,000 rounds a minute and was described by the announcer as an aircraft weapon system.

There is no doubt about it, the Army finally is doing something to make its equipment more easily transportable by air. Aluminum hulls are fairly common on the new vehicle designs and the weight of some units has been cut as much as forty and fifty percent. Helicopters were used to show how rockets can suppress ground-based menaces to the troops and the Little John rocket can be moved, at 150 miles an hour, to new and unsuspected launching sites. The M-60 tank, with a cruising range of 250 miles, fired its British-made 105-mm gun.

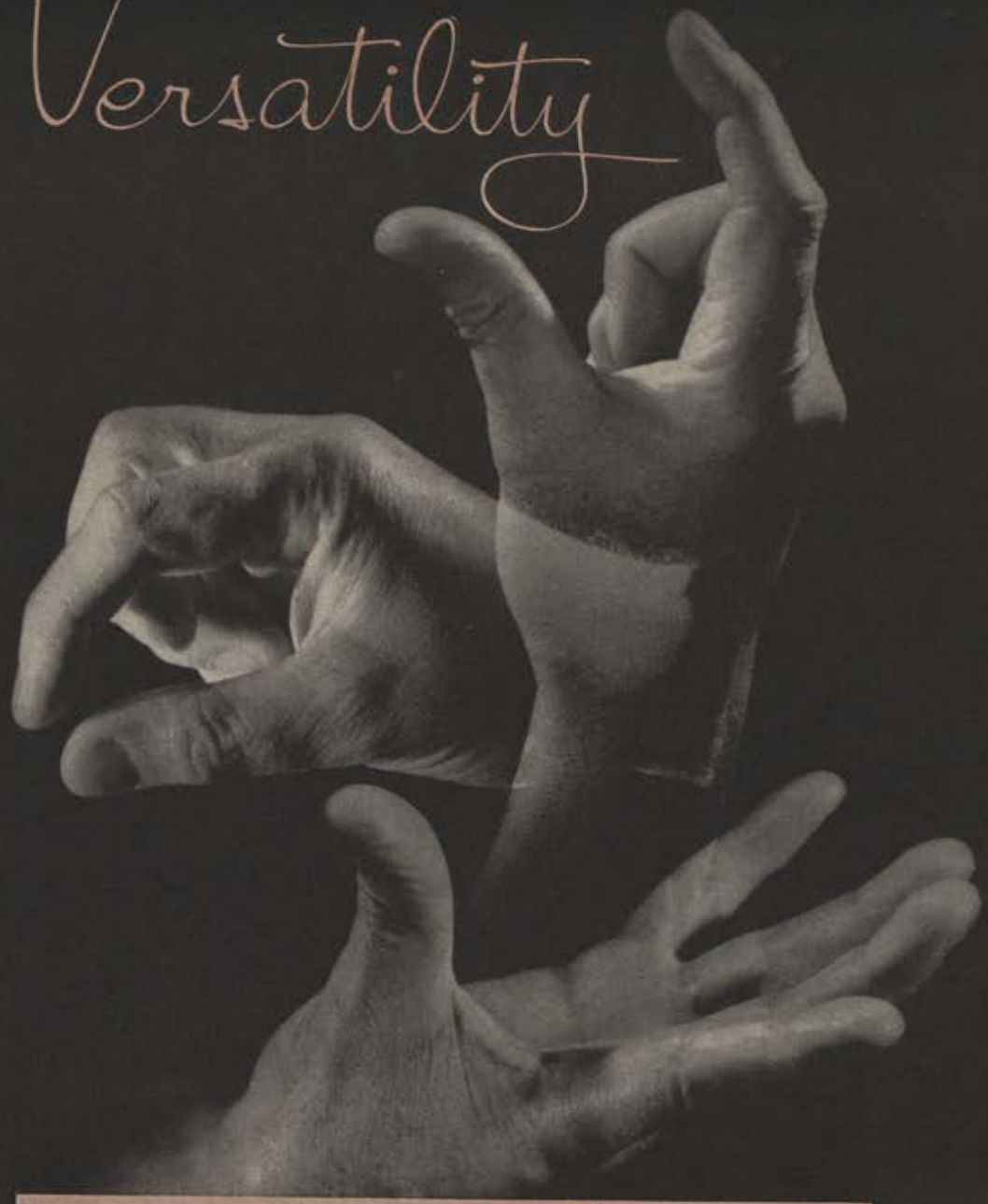
M-60 is the Army's new Main Battle Tank. It is capable of defeating any armored vehicle now known to exist.

In all of the Army demonstrations the most obvious feature was the contribution of American industry to our new weapons for the foot soldier. True, the arsenals were mentioned for their contributions to development and, in a few cases, for production. But the bulk of the work has been done by many of the same defense contractors who contribute to Air Force and Navy strength.

The trouble is, there is more work to be done. Gen. Lyman L. Lemnitzer, Army Chief of Staff, was blunt about it and said he believes the Army's most pressing problem is the job of getting these weapons into production and then into the hands of the troops. The most striking new equipment on hand was in the form of prototypes, samples that prove only what *can* be done.

Here is where we come back to the Navy. The *Skipjack's* skipper, Commander Behrens, said his submarine also is a prototype. Like the newest Army tank, it shows what *can* be done. When we asked him what is being done to meet the Russian threat of more than four hundred underwater killers this officer could answer only with a shrug of the shoulders.—END

Versatility



It takes three things to make a corporation versatile: large and varied facilities, a corps of experienced specialists...and administrators who can bring them all together. We have all three: whether the project product is large or small, simple or complex, we have the machines and the team to bring the contract through on schedule. In research, development, engineering, fabrication and assembly, American Car and Foundry can do almost anything with metal. 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.

Engineering and production versatility at ACF permitted the design, testing and mass production of the Army's M-52 Self-Propelled 105-mm Howitzer vehicle.

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FLIGHT LINES

The **Air Force-industry team** that developed and proved the **Lockheed F-104 Starfighter** will receive the **1958 Collier Trophy** next month. Awarded annually since 1911 for the greatest achievement in aviation during the year, this year's award will be made by the National Aeronautic Association and *Look* Magazine in December. The recipients: **Lt. Col. Howard C. Johnson,** USAF, for establishing a world land-plane altitude record of 91,249 feet on May 7 at Palmdale, Calif.; **Maj. Walter W. Irwin,** USAF, for establishing a world straightaway speed record of 1,404.19 miles an hour on May 16 at Edwards AFB, Calif.; **Clarence L. Johnson** of Lockheed Aircraft Corporation, for design of the airframe; **Neil Burgess and Gerhard Neumann** of the Flight Propulsion Division, General Electric Company, for development of the J79 turbojet engine.

Lt. Gerle L. Buckner, SAC pilot who lost his right arm and was severely burned in the crash of his B-47 last February, was the **500th flyer** to receive payment under the **Air Force Association's Flight Pay Protection** plan. The twenty-eight-year-old pilot, married and father of a three-month-old girl, survived the takeoff crash only because his ejection seat hurled him more than 450 feet from the wrecked plane. The Air Force Association Flight Pay Protection plan has paid more than $1¼ million to 500 claimants in the past four years.

Air Research and Development Command is reorganizing to streamline its headquarters and to regroup some of its center and subcommand activities. ARDC Headquarters will be **divided into six divisions:** Plans; Research and Engineering; Intelligence; Materiel; Personnel; and Comptroller. At the field level, the Directorate of Systems Management and major elements of Wright Air Development Center will combine to form the **Wright Air Development Division,** to be responsible for program direction of aeronautical and related systems.

A new **Command and Control Development Division** will be formed at Hanscom Field, Mass., to include the former Cambridge Research Center, to be responsible for communications and electronic control systems. The present Office of Scientific Research, the European Office of ARDC, and other basic research activities will be combined into the **Research Division,** to be in the Washington, D.C., area. No changes are planned for the **Ballistic Missile Division.**

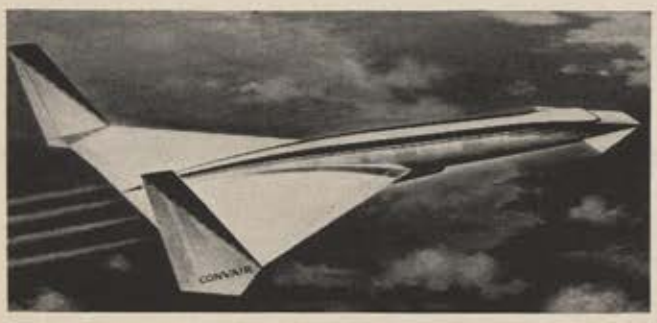
The reorganization, expected to take about six months, will place responsibility, authority, and the necessary resources at the operating management level, as part of ARDC's effort to **shorten the time required between drawing board and operational capability.**

A Convair B-58 Hustler hedgehopped across 1,400 miles

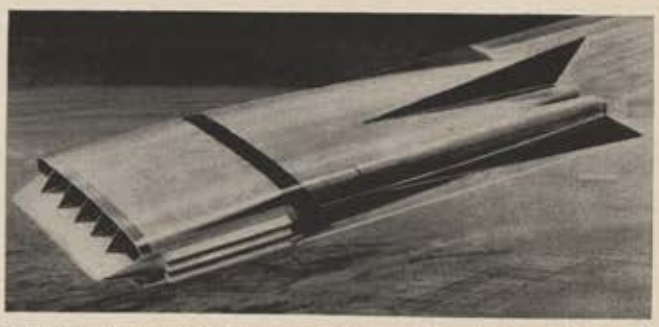
(Continued on following page)

Cessna 407, four-seat utility-training version of T-37 jet trainer. Mock-up of new Cessna plane was on display last month in Washington for top brass of all services.

The Lockheed JetStar has been selected by the Air Force in the UCX competition for a jet navigation trainer. USAF did not state any definite plans to buy the JetStar in 1960.



The Mach 3 airliner of the 1970s, according to Convair, may fly at 2,000 miles an hour, up to 80,000 feet. Passengers will have television receivers instead of windows.



The Lockheed entry for the airliner of the future will travel sixty-two miles a minute to carry a cargo over the Atlantic from New York to Amsterdam in ninety-eight minutes.

Gen. Curtis E. LeMay presented the Legion of Merit to M/Sgt. Horst W. Tittel as he retired on September 30, after fifty years, nine months, and twelve days of service.

on a round trip from Texas to California last month to prove that a supersonic jet bomber can sneak in under radar defense for a **low-level attack against enemy targets.** At heights of less than 500 feet above the ground and a speed of 700 miles an hour, the simulated low-level bombing run on Edwards AFB took two hours. The pilot then headed into the stratosphere and flew back to Fort Worth, for a round-trip time of four hours and three minutes.

The **Federal Aviation Agency,** under its **Project Friendship,** plans to take over the operation of about 2,095 military **air traffic control facilities** at 337 locations around the world—ninety-eight in foreign nations. The FAA estimated it will need additional air traffic controllers and technicians, about 15,000 men, to do the job, replacing some 20,000 military people assigned to these stations. Elwood R. Quesada, FAA Administrator, represented Project Friendship as "perhaps the **most progressive step taken to date to attain the air traffic control service that this country needs and deserves.**" The FAA, under its establishing act of 1958, is charged with the development and operation of a **unified military-civil** air traffic control system. Mr. Quesada estimates that some of the military flight inspection functions can be absorbed by the end of this year, and that others will be phased in over the next four years.

Two planes unveiled and soon to fly: **Canadair's Forty-Four** long-range four-engine turboprop transport, on order for the Royal Canadian Air Force, the Flying Tiger Line, and Seaboard & Western; the **Beechcraft 65 Queen Air,** twin-engine executive transport.

STAFF CHANGES . . . **Maj. Gen. Jarred V. Crabb** has been transferred from Chief of Staff, ADC, to become Deputy Commander for Military Affairs, National War College, Wash., D.C. . . . **Brig. Gen. Kenneth O. Sanborn** was reassigned from Commander, 4347th Combat Crew Training Wing, SAC, to be Commander, 42d Air Division, SAC, McConnell AFB, Kans. . . . **Brig. Gen. Gladwyn E. Pinkston,** former Deputy for Operations, EADF, is now Commander, Montgomery Air Defense Sector and NORAD Montgomery Air Defense Sector, at Gunter AFB, Ala.

Brig. Gen. Irving L. Branch, former Deputy Commander, AFSWC, ARDC, is now Assistant DCS/Development for Nuclear Systems. . . **Brig. Gen. William E. Elder,** who was Vice Commander, 26th Air Division (SAGE), is now Commander, Boston Air Defense Sector and NORAD Boston Air Defense Sector, ADC, replacing **Brig. Gen. Von R. Shores,** who is now Commander, 25th Air Division (SAGE) and 25th NORAD Division, ADC, McChord AFB, Wash., in turn replacing **Brig. Gen. Charles R. Bond,** who is the new Commander of the 28th Air Division and 28th NORAD Division, ADC. General Bond replaced **Brig. Gen. Curtis R. Low,** who became Vice Commander, WADF, ADC, at Hamilton AFB, Calif.

Brig. Gen. Frank W. Gillespie, who was Commander of the 31st Air Division, ADC, is now Commander, Seattle Air Defense Sector and NORAD Seattle Air Defense Sector, ADC, McChord AFB, Wash.

Brig. Gen. Gilbert L. Pritchard, former Commander, Iceland Defense Force, has replaced **Brig. Gen. Arthur C. Agan, Jr.,** as Commander of the New York Air Defense Sector, ADC, McGuire AFB, N.J. General Agan is now Deputy for Plans, ADC, Ent AFB, Colorado Springs, Colo., replacing **Brig. Gen. Cecil P. Lessig,** who became Commander of the 29th Air Division and 29th NORAD Command, Malstrom AFB, Mont. . . . **Brig. Gen. Kenneth H. Gibson** has been reassigned from duty as Commander, EADF, ADC, to become Commander, Chicago Air Defense Sector and NORAD Command, Chicago Defense Sector, ADC.

Brig. Gen. Julian M. Chappell, who was DCS/Operations, CONAC, is the new Commander, ARRC, CONAC, Denver, Colo. **Brig. Gen. John N. Ewbank, Jr.,** former DCS/Operations, 3d Air Force, USAFE, is now Commander, 4520th Combat Crew Training Wing, TAC, Nellis AFB, Nev. . . . **Brig. Gen. Frederic H. Miller,** who was Deputy Director of Supply and Services in DCS/Materiel, Hq. USAF, Wash., D.C., was reassigned as Director, European Region, in the Office of the Assistant Secretary of Defense for International Security Affairs, also in Washington. . . . **Maj. Gen. Otis O. Benson, Jr.,** who has been the Commandant of the School of Aviation Medicine, Air University, is now Commander, Aerospace Medical Center, ATC, Brooks AFB, Tex.

Brig. Gen. Willard W. Smith has been relieved from duty as Deputy Director, Net Evaluation Subcommittee, National Security Council, to become Deputy Director of Operational Requirements, DCS/Operations, Hq. USAF. **Maj. Gen. William H. Blanchard,** and **Maj. Gen. Charles B. Westover** have traded jobs. General Blanchard, former Commander of SAC's 7th Air Division, is now Director of Plans, SAC, Offutt AFB, Neb., replacing General Westover, who is now Commander, 7th Air Division, SAC, APO 125, N.Y.

In the reorganization at ARDC: **Maj. Gen. William M. Canterbury** is now DCS/Research and Engineering; **Brig. Gen. John E. Dougherty** is DCS/Intelligence; **Brig. Gen. Lee W. Fulton** is DCS/Materiel: **Brig. Gen. Melvin McNickle** is Director of Research, Development and Engineering, in DCS/Research and Engineering; **Brig. Gen. Dorr E. Newton, Jr.,** is Chief of Staff and DCS/Plans; **Brig. Gen. Ralph L. Wassell** is Assistant DCS/Research and Engineering.

RETIRED: **Brig. Gen. John M. Schweizer, Jr., Maj. Gen. Donald J. Keirn, Maj. Gen. Lewis R. Parker, Maj. Gen. Olin F. McIlnay, Maj. Gen. Frederic E. Glantzberg, Brig. Gen. Harold Q. Huglin, Brig. Gen. William L. Lee, Maj. Gen. James H. Wallace, Brig. Gen. Thomas J. Dubose, Maj. Gen. Pearl H. Robey, Maj. Gen. John J. O'Hara, Brig. Gen. Don Z. Zimmerman, Brig. Gen. Edwin L. Tucker, Brig. Gen. Richard L. Scott, Brig. Gen. William A. Matheny, Maj. Gen. Harold H. Bassett.**

—MICHAEL B. MILLER

P&WA POWER KEYS FLIGHT PROGRESS...

1925—The original P&WA Wasp was the first radial engine to reach 400 hp. This engine, and its more powerful successors, helped bring world leadership in air power to America in less than five years.

1930s—P&WA power in early airliners pioneered the transcontinental and transoceanic operations of U.S. flag carriers.

1940s—P&WA and its licensees delivered over six hundred million horsepower to the war effort, half of all the horsepower powering the combined American air forces.

1950s—P&WA developed high-power, low-fuel-consumption jet engines for bombers, fighters, tankers, missiles and commercial jet airliners...

...AND THE STORY OF FLIGHT HAS ONLY BEGUN.

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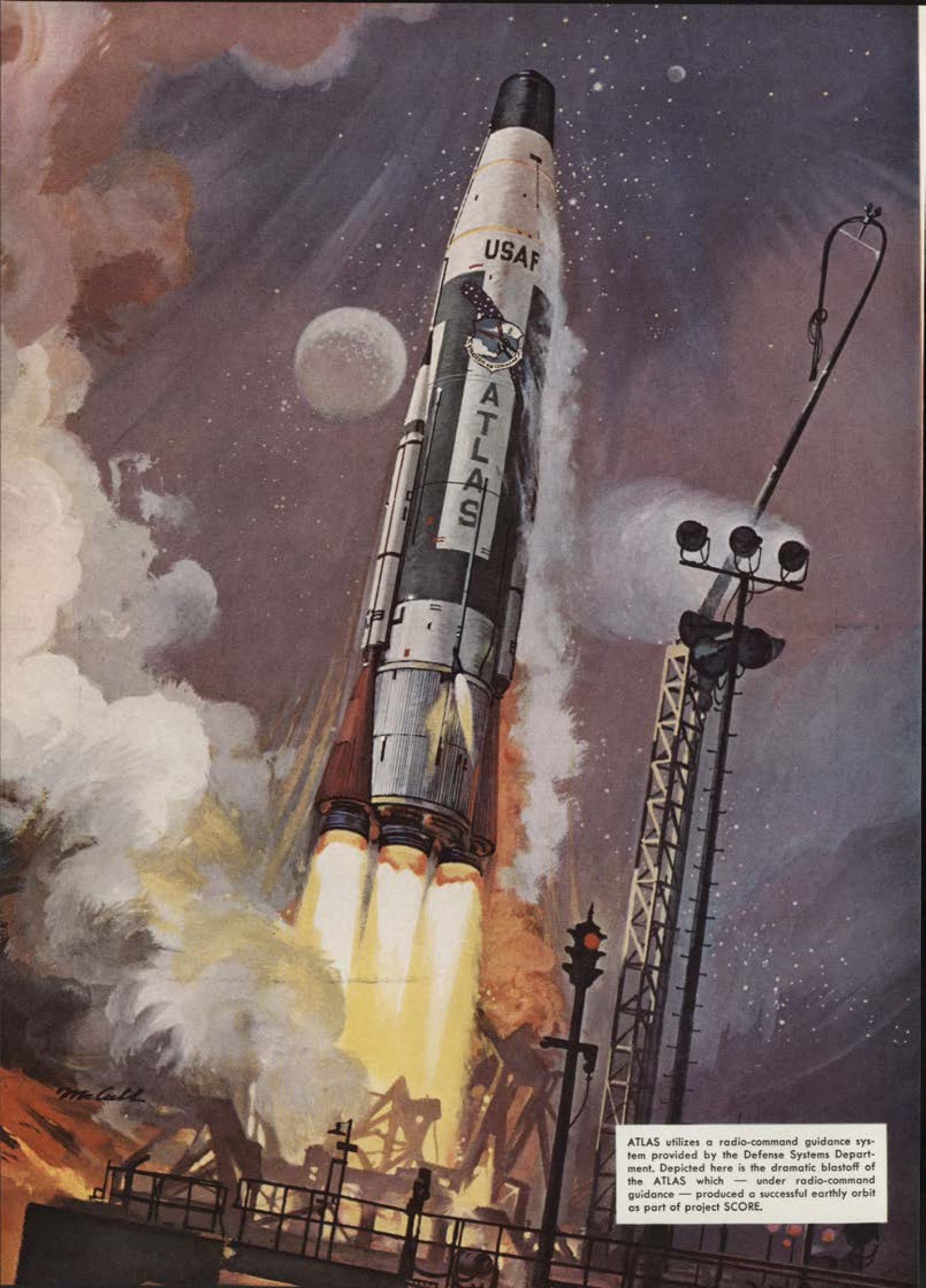
The exciting conquest of space depends on power—and power is Pratt & Whitney Aircraft's job. One of America's newest space projects, for example, will depend on an advanced, high-energy upper stage rocket propulsion system, the XLR-115, designed and developed by Pratt & Whitney Aircraft. The system draws heavily on Pratt & Whitney's unmatched experience in handling liquid hydrogen fuel.

This is only one of many projects which demonstrate that power is indeed the key to flight progress.

Flight Propulsion by **PRATT & WHITNEY AIRCRAFT**

East Hartford, Connecticut
A division of United Aircraft Corporation



ATLAS utilizes a radio-command guidance system provided by the Defense Systems Department. Depicted here is the dramatic blastoff of the ATLAS which — under radio-command guidance — produced a successful earthly orbit as part of project SCORE.

GENERAL ELECTRIC'S DEFENSE ELECTRONICS DIVISION

Organized for a Full Range of Systems Requirements

DEFENSE SYSTEMS DEPARTMENT

The Defense Systems Department, Syracuse, N. Y. — newest of the Division's five functionally organized departments — is the focal point of those integrating capabilities so vital to major prime and support systems for national defense. Made up of the Company's top systems management and technical talents, DSD is G.E.'s single point of authority and responsibility for major, long-range defense programs.

ORDNANCE DEPARTMENT

POLARIS

. . . whose inertial guidance and fire control equipments will be provided by the Ordnance Department, Pittsfield, Mass. — center of the Division's capabilities in precision electro-mechanical elements of sea and land-based weapons systems. In addition to POLARIS equipments, the Department produces radar antennas, directors, launching and handling equipment and underwater ordnance.

LIGHT MILITARY ELECTRONICS DEPARTMENT

SIDEWINDER

. . . the deadly air to air missile whose infrared guidance and control units are provided by the Light Military Electronics Department, Utica, N. Y., is representative of its capabilities for military electronic subsystems and equipments contained in, or launched from, air vehicles. Its additional contributions range from electronics countermeasures to integrated avionic systems.

HEAVY MILITARY ELECTRONICS DEPARTMENT

DATA PROCESSING AND DISPLAY EQUIPMENT

. . . for air space management is being developed and produced by the Heavy Military Electronics Department, Syracuse, N. Y. — center of the Division's capabilities for the design, production and installation of land-based and sea-borne detection, guidance and control equipment. Major contributions of this Department range from long-range sonar to the largest known radar systems.

MISSILE AND SPACE VEHICLE DEPARTMENT

RE-ENTRY/RECOVERY VEHICLES

. . . such as the ATLAS experimental nosecone — largest re-entry vehicle ever recovered from space — are designed and built by the Missile and Space Vehicle Department, Philadelphia, Penna. Experienced in space technology, MSVD developed operational ATLAS and THOR re-entry vehicles. Other responsibilities range from certain missile arming and fuzing projects to the re-entry/recovery vehicle of the DISCOVERER satellite.

226-3

Copies of this illustration, in full color and suitable for framing, may be obtained by writing the Defense Systems Department, P. O. Box 457, Syracuse, N. Y.

DEFENSE ELECTRONICS DIVISION

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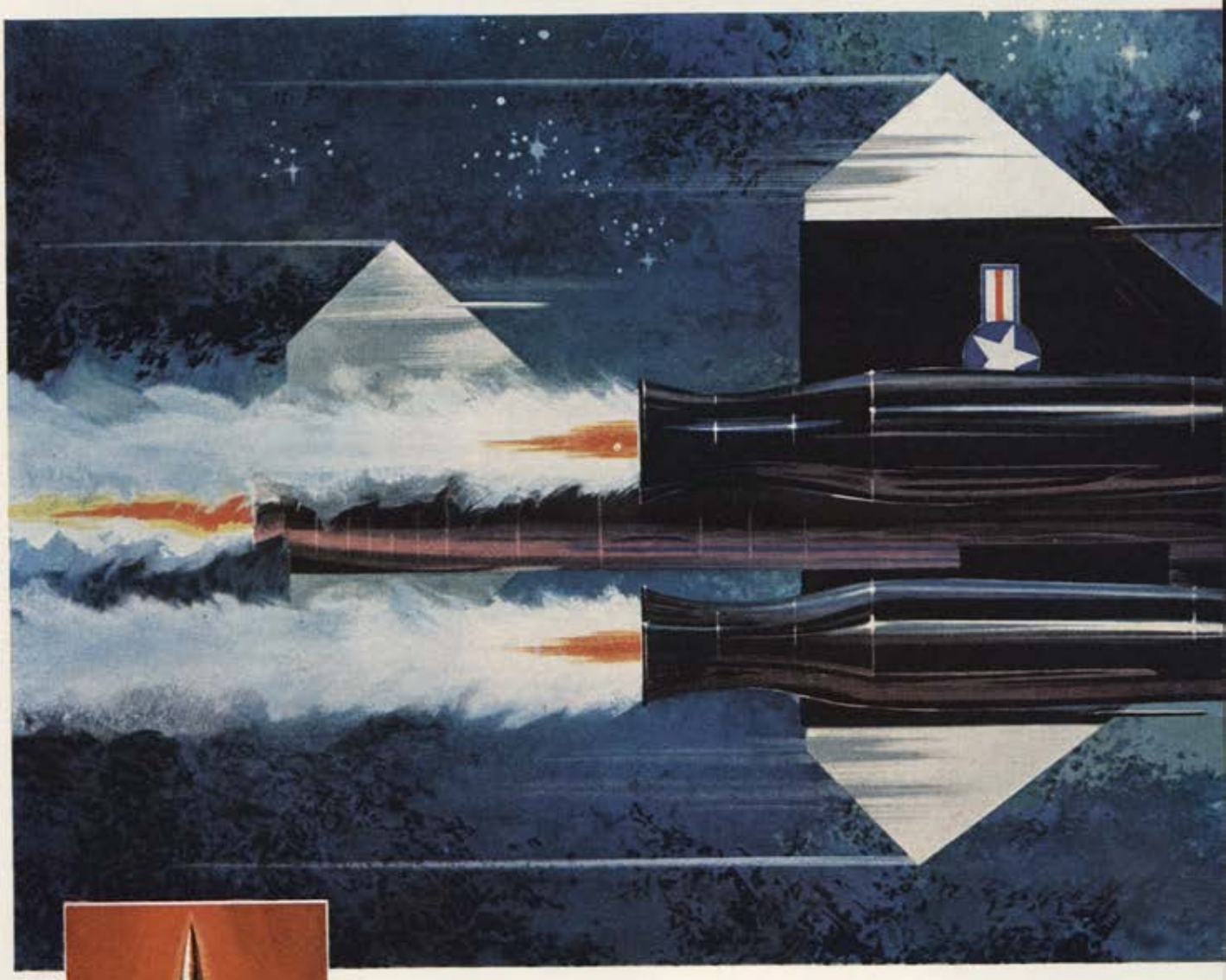

Keeping pace with the nation's missile
BOMARC "B" by BOEING. To be launched
motor — this new weapons system when

OFF THE GROUND FASTER FOR MORE

To strengthen our defenses, the armed forces and industry — as a team — ceaselessly strive to improve America's weapons systems. The U.S.A.F.'s BOMARC "B" highlights this unified effort.

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with a THIOKOL solid propellant
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DISTANT INTERCEPT than earlier models

altitudes to meet attacking aircraft are the promises of these specially designed powerplants.

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From this underground control center near Omaha the Strategic Air Command directs global operations. SAC commanders can contact instantly all world-wide key bases as well as distant flight missions by an adaptation of a radio technique known as single sideband. Practical use of this technique was made possible by research of Collins Radio Company whose air and ground SSB radio communication system serves as one of the major lifelines for SAC's operational efficiency.

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What's New With ★ RED AIRPOWER

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

Russian medium bombers are now in position to strike hard at the Mediterranean-based US Sixth Fleet in the event of hostilities. Intelligence reports say that IL-28 Beagles and TU-16 Badgers are stationed in force in Bulgaria, Albania, and at Soviet naval bases along the Black Sea.

Red subs, believed to have shadowed past US fleet operations in the Med, have long been considered a potential threat in the area. The same medium bomber-sub one-two punch would probably face the US Seventh Fleet in the Far East if the cold war suddenly boiled over.

The planes, part of Russia's large but wholly land-based naval air arm, carry missiles designed for attack on surface vessels. They can also carry bombs. The missiles are based on German designs developed late in World War II. More advanced German missiles and glide bombs of this type were controlled by radio or radar. The Germans also worked on television guidance to target.

The Russians took over the best of the German techniques and have embodied them in their so-called "Komet" system. This requires radio direction of the missile after it is launched from an aircraft. The missile then can be directed over a course of fifty miles or more by radio. Some versions of this weapon call for radio guidance to be cut off as the missile nears its target, at which time radar takes over and guides the weapon during the last few moments of its flight.

To date, Soviet "Komet" missiles are all thought to be subsonic, though some have been equipped with ramjet engines improved over similar German engine models. The warheads are atomic.

• • •

Russia, with truly impressive space attainments, appears to be gaining less scientific information than might have been expected from its satellites and exploratory rockets. The United States, on the other hand, is doing quite well at milking each of its space shots of valuable data.

US scientists who have reviewed Soviet space findings conclude that the Russians are getting a small amount of information per day from their satellites, compared with the seven miles of telemetry tape rendered by US satellites. The observers grant, however, that the Reds could be learning a lot more than they are letting on.

So far, Russian scientists are felt to have come up with nothing in the way of space science advances to rival either of two major US discoveries—the Van Allen radiation belts around the earth and the fantastically high temperatures that exist close to the sun.

• • •

New information on a Russian plane reported to have set a world's altitude record this summer is that it was a turboprop rather than a turbojet. The aircraft, identified by the Russians as a hitherto unheralded "T431," set an altitude record exceeding that of USAF's F-104, according to Russian report.

US engineers had assumed on initially learning of the alleged record that the Russians may have come up with a dual spool engine or a rocket engine to gain new heights. The fresh report that the plane was a turboprop came as a surprise and was partially discounted.

Pilot of the T431, incidentally, was said to be Maj. V. W. Ilyushin, thirty-two-year-old son of Soviet aircraft designer **Sergei Ilyushin.**

• • •

During Vice President Nixon's visit to Russia earlier this year, Premier Khrushchev is said to have told him that the new Russian AN-10 commercial transport "can be used for airborne troops" as well as airlift of heavyish weapons. The Russian leader informed Mr. Nixon that he had watched a demonstration in which self-propelled guns were loaded aboard the plane, which then "landed on a dirt strip and was unloaded very quickly."

The AN-10, powered by four turboprops, has been in service for a comparatively short time inside Russia. Built to land on sod fields, the plane is used for the most part in the northern part of the country and in Siberia, where there are few fields with cement or tarmac runways.

The plane has a high wing and it is believed the engines mounted on it are high enough over the ground so that they will not pick up stones and other foreign material from soft, unswept runways.

• • •

During the subsequent Khrushchev visit to this country, observers received the impression that Russia does not have very many of its newest and largest TU-114 jet transports. The Premier himself came here by TU-114, as have two previous important Red visitors—First Deputy Premiers Anastas Mikoyan and Frol Kozlov. But courier flights from Moscow to Washington during the Khrushchev stay were accomplished in older and shorter-range TU-104s.

The courier planes thus required at least two refueling stops en route. The TU-114 completes the distance nonstop. If the TU-114 is a quantity-production widely used aircraft—as claimed—why would the Russians hesitate to utilize it under these circumstances? One possible conclusion, in the absence of any Russian-released figure on the subject, was that not very many of the proud TU-114s are now in existence.

In this connection, the visiting Russians noted unofficially to Americans who talked with them that the Boeing 707 had a lower noise level than either the TU-104 or the TU-114.

• • •

Russia is building still another great scientific center, this one at Irkutsk in Siberia. The second such major center to be put up in Siberia, it will devote major attention to the critical subject of metallurgy. The other center is at Novosibirsk.

• • •

Increasing references to development of two- and three-stage aircraft have been appearing in Russian publications. Either rockets or turbojets would be used to fire the first two stages. The third stage, fired by a rocket, would be designed to fly at extremely high altitudes. The first and second stages, fully recoverable, could be used again and again.—END

VIEWS & COMMENTS

The Message of Science

MANKIND is facing the vast realm of the unknown which must be conquered. From any point along that frontier of knowledge, the imagination and curiosity of individual men start treks that radiate in all directions into this virgin jungle. Through trial and error, one gradually comes to single out the right path, as the successful survivor from the multitude of tested and discarded blind alleys. Now, what endows a trek into the wilderness with such survival value? What makes it right? Simply the fact that it has not remained a blind and isolated venture, but has met, instead of missing, other new or familiar lines that had struck out from other points, merging with them in mutual reinforcement. Success lies in the confluence of thoughts from many diverse directions.

This is of first importance. A blind path driven into the unknown stays blind, its fate unknown, until it meets with other paths, the intersection giving both a valid check of their respective bearings. The unknown is not conquered until it has become so thoroughly pervaded by this network of trails that trains of thought can travel from any place or any subject of the universe to any other place or subject without encountering stops or gaps or frontiers with a sign "Do Not Trespass." This is what gives to science its coherence and consistency, with a stable interconvertible intellectual currency of terms and units, modes of operation, and standards of proof or disproof.

—From "The Message of Science," by Paul Weiss, reprinted with permission of the Rockefeller Institute Press. Full text from which this is excerpted was delivered at "Day of Science," Brussels World's Fair.

With ALL Our Ingenuity

THE SOVIET propaganda drive is especially impressive to the people of nations with little industry or technology of their own. Millions are taking the technological accomplishments the Russians publicize so well and effectively as models for their own ambitions. Not knowing fully how these advances were made, they reason that the Russian peasant hoisted himself by his bootstraps in less than a lifetime, lifting himself to technological peaks in all areas. Uncritically they wonder if other marginal peoples might not be well advised to step in quietly along behind the Communist bandwagon in the hope of being swept on to Utopia, overnight and practically painlessly.

That, in essence, is the international problem we face. To counter the spreading Communist influence that is based on Soviet space accomplishments, it is imperative that the United States pursue its own space program actively, effectively, and with all the ingenuity we can muster.

We have been given a challenge, not only by the Soviets but by the millions of people all over the world who have yet to make up their minds whether to turn to the East or West. We must not refuse to carry out our destiny—a destiny that depends, in large part, on fostering and improving all of our nation's capabilities in science and technology. And space is the newest and most exciting arena in which to extend our efforts.

We all recognize that the world is inexorably caught up in the flood of the times, a flood that individually none of us can stem or control. I have supreme faith that as a nation, wisely utilizing our resources and marshaling our individual capabilities, we shall ride out these turbulent waters and once again demonstrate the overwhelming and enduring strength of a free society.

—From remarks of T. Keith Glennan, Administrator of NASA, before the Economic Club of Detroit, Michigan, on September 28, 1959.

The 'Other' Side of the Moon

IF AMERICANS are serious about wishing to make as great contributions to world knowledge about outer space or to learn as much about it for their own advantage as the Soviet experimenters are doing, they must ask themselves searching questions.

This is not solely a matter of spending money. Billions could be poured out with little effect if poorly directed. Also, the outcome goes back to whether grade school pupils in the United States will study hard enough to master mathematics and physics or whether in college they will prefer soft courses and rock 'n' roll.

And while congressmen pore over how much to allot to space exploration in proportion to defense and other governmental needs, they must face the fact that its returns are intangible. So are the many returns from slum clearance, foreign aid, and other purposes which are alternate areas of spending.

It is in this context of asking "Just what are the national purposes?" that the decisions must be made on how much energy and fortune to devote to modern counterparts of the expenditures of Magellan and Frobisher. This is the "other side of the moon" in American thinking; and it will stand some exploration.—END

—Excerpt from an editorial published in the Christian Science Monitor *of October 6, 1959 as comment on the need for US "goal" decisions in the space age.*

Here you see a specially trained North American crew carefully loading a Burroughs computer. Professional crews such as these move electronic computers valued as high as three-quarters of a million dollars each.

Why Burroughs uses North American Van Lines for shipping electronic computers

"Because of North American's superior handling and delivery service, they are awarded a large portion of all shipments of our expensive and delicate electronic computers," asserts W. A. Reed, Traffic Manager, ElectroData Division, Burroughs Corporation.

He goes on to say, "North American's custom floor-to-floor delivery service is especially important in transporting items of this size and weight. Their crews have the necessary equipment and know-how to place the computers exactly where our customers desire. And by using North American's services we can ship our computers almost 100% assembled."

This is just one more example of how North American Van Lines' Kid-Glove handling and complete service all the way eliminates the many problems involved in shipping High Value Products.

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Business end of the Titan—by Avco—The nose cone for the Air Force's Titan—designed to withstand the scorching heat and incredible shock of atmospheric re-entry—is a product of Avco research. Now, with the successful flight of this ICBM, the Air Force has assigned two new and important projects to Avco: an advanced design nose cone for the Titan and the nose cone for the third generation of intercontinental missiles—the mighty, solid-fueled Minuteman.

Avco

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SHOOTING THE BREEZE

WITH THE EDITORS OF AIR FORCE MAGAZINE

Now there's a space baby. She's eighteen-month-old Shelley Elizabeth Pickard, daughter of a scientist at NASA's Goddard Space Flight Center near Washington, D. C. Daddy put baby's picture into orbit aboard the Vanguard III satellite that made the team in September. Tucked in the satellite's Silvercel battery package, little Shelley's photo, printed below, has now soared around this earth of ours an astronomical number of times. There's something she can tell her grandchildren some cold winter evening as they gather around the hearth of their one-family space station.

° ° °

A friend of ours inadvertently dialed 72736 at the Pentagon recently. It was the wrong number—perhaps in more ways than one.

A girl answered, "Missiles and Space."

"Whose office is this?" our friend asked.

"Deputy Chief of Staff for Operations, United States Army," she replied.

Our friend scratched his head, sent us a quick note, and dialed again.

° ° °

Want to join a "flying community" some thirty miles or so north of New York City? John R. Nelson of Croton-on-Hudson, N. Y., has a proposition for anyone who would. Mr. Nelson owns the forty-eight-acre Croton Airpark, which he writes that he may have to sell shortly. If he can interest twenty-three persons in buying two acres each of his airpark, retaining two for himself, Mr. Nelson feels, an ideal flying club or community can be set up. It would include recreational and living arrangements as well as flying facilities. Might be worth checking into for aviation folk in that part of the country.

° ° °

A four-engine Air Force Globemaster transport a few weeks ago flew a thousand miles over the Pacific on a bare "wing and a prayer" in circumstances reminiscent of many a wartime saga. Three of its four engines were out. The plane, with a seven-man crew aboard, lost its left inboard engine through fire just short of the point of no return on a flight from Honolulu to Travis AFB, Calif. Two crewmen, Sgts. Robert C. Blair and Carl A. Haug, crawled into the wing to douse the fire as 1st Lt. John A. Elkin, the pilot, turned back for Hawaii. Within minutes two further engines lost power through hydraulic failure. Pilot Elkin, with one engine functional and intermittent power available from two of the others, managed to limp back to Hilo on the island of Hawaii, forty miles closer to the mainland than Honolulu. But he made it.

° ° °

Have you an ace up your sleeve? A group of Air Force researchers at Air University, Maxwell AFB, would be grateful if you jotted them down and sent the lists along to us for forwarding their way. The researchers are hoping to bring out a complete, wholly authoritative list of all AAF flyers who destroyed five or more enemy aircraft in aerial combat during World War II. They are grateful for any names put into their possession for checking against their own records. Past anniversary issues of AIR FORCE Magazine have of course contained solid listings along these lines. So have a number of books including last year's *Five Down and Glory* by Mark Friedlander and Gene Gurney.

° ° °

A question in military semantics. Only terminological purists need read further. Zone of the Interior, or ZI, has until now been a military way of saying United States. Now that Alaska and Hawaii have joined the Union, are they included? If not, they would have good reason to feel they were being treated as step-children defensewise. If so, we now have a ZI stretching in one case through a sovereign foreign nation and, in the other, over a few thousand miles of international ocean. Neither Canada nor the eastern Pacific can truly be considered within our ZI, although of course neither could be allowed to fall into enemy hands. Perhaps the answer is that the whole area is part of the ZI of the free world, the US itself being only part of the whole—but now we are turning from pure semantics.

° ° °

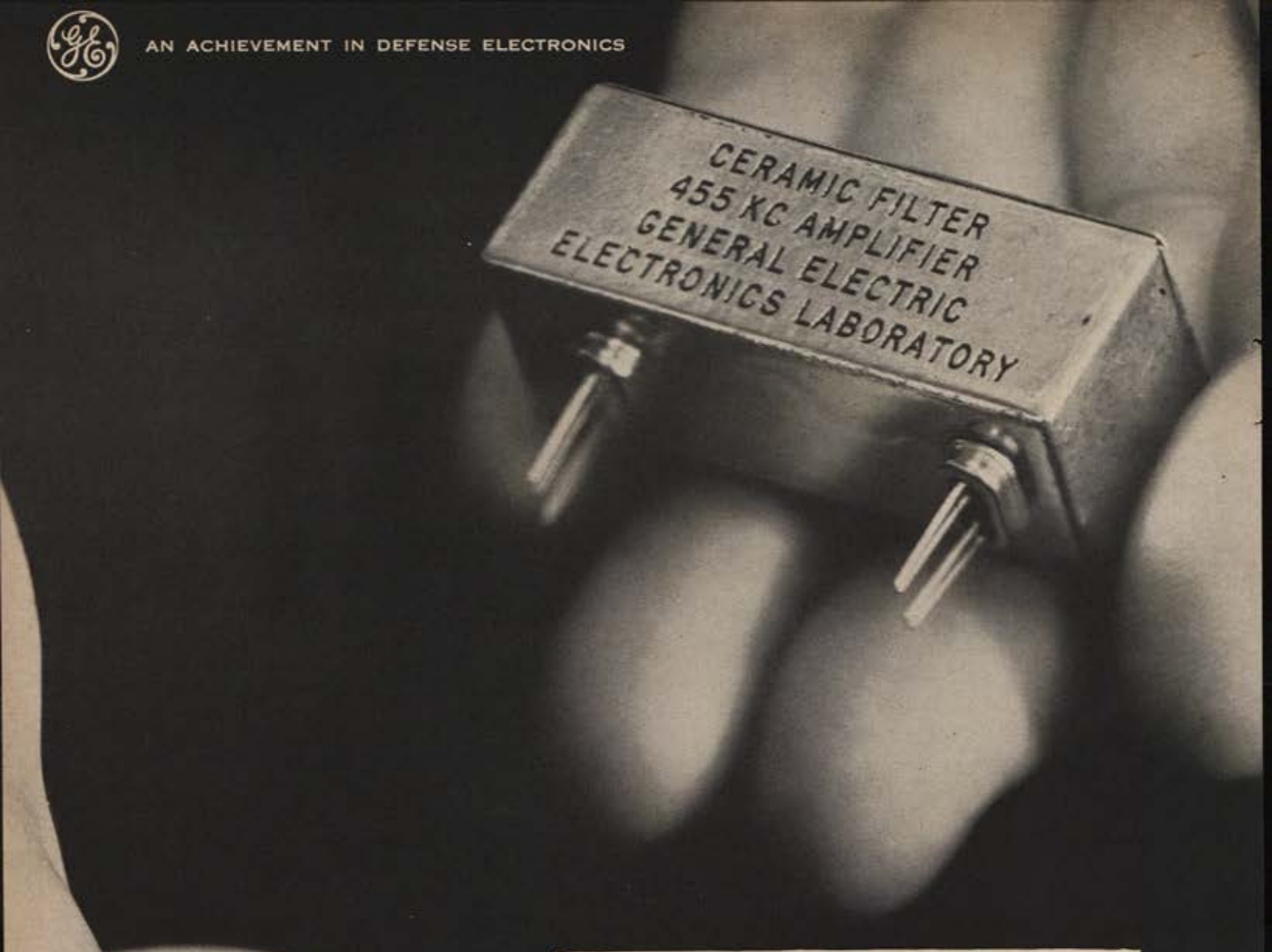
"The Blacklanders," of 9900 E. 23rd Street, Independence, Mo., are seeking names and addresses of persons who served at Blackland AFB, Tex., during the second World War. Plans call for a reunion in Waco in 1960.

° ° °

Lost and found note: A gold lodge ring, found at the Miami Beach Convention, is awaiting its owner at AFA offices in Washington.—END

America's space baby, in a whirl of her own for the past couple of months. She is Shelley Elizabeth Pickard, the eighteen-month-old child of a Washington-area scientist. Little Shelley, a true child of the age, is introduced further above.

AN ACHIEVEMENT IN DEFENSE ELECTRONICS



NEW AMPLIFIER PACKS 90 DB IN HALF CUBIC INCH VOLUME

New 455 kc three-stage amplifiers developed by the U.S. Army Signal Corps utilizing the facilities and competence of General Electric produce up to 90 db gain with 5 kc bandwidth in one-half cubic inch volume. This degree of miniaturization evolved from sustained research and development in solid state filters, delay lines and transformers at the Electronics Laboratory, Electronics Park.

The unique bar-shaped transformers developed for these amplifiers, combined with improvements in existing ferro-electric ceramics, permits the most compact packaging with extreme gain. This achievement in research and development is indicative of General Electric's technical competence in defense electronics.

227-2B

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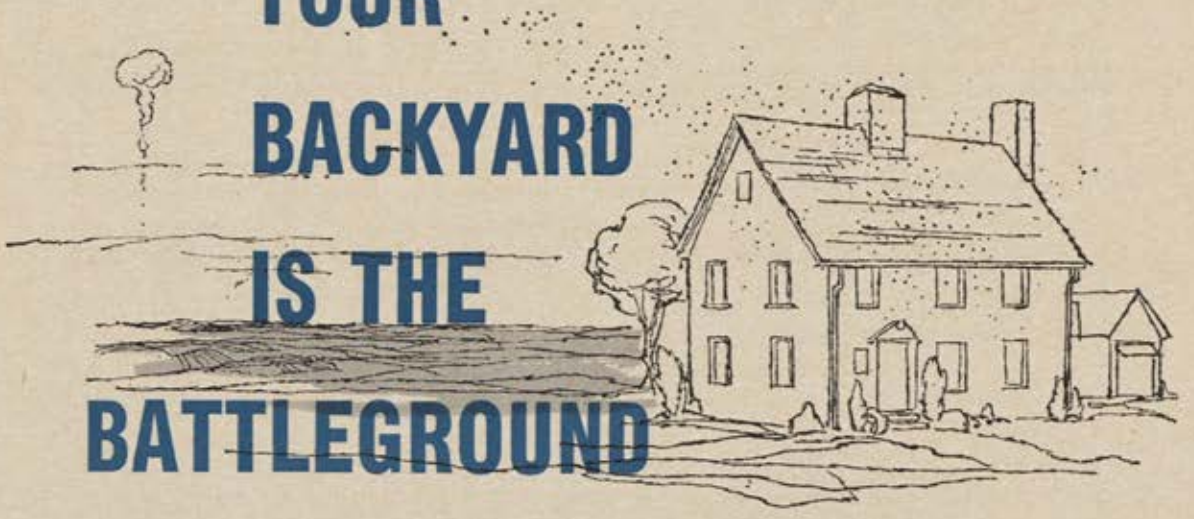
SYRACUSE, NEW YORK

YOUR BACKYARD IS THE BATTLEGROUND



Leo A. Hoegh

DIRECTOR, OFFICE OF CIVIL AND DEFENSE MOBILIZATION

For years civil defense has been an operational and fiscal orphan. Now, with the promulgation of a National Plan for Civil Defense, at least a framework exists around which to build a truly effective civil defense organization. More and more people, including ourselves, are convinced that civil defense can make a positive contribution to the deterrent posture of this nation. This article, by the Director of the Office of Civil and Defense Mobilization, outlines the position of the federal government under existing legislation. Articles in future issues of AIR FORCE Magazine and Space Digest *will explore the civil defense problem in depth, in an effort to stimulate public understanding and discussion of a problem which vitally affects us all.* —THE EDITORS

BETWEEN December 1941 and May 7, 1945 American planes flew about 1,500,000 missions against Germany. About 2,700,000 tons of bombs were dropped by the American forces alone with an equal quantity credited to the British.

The war might have lasted longer had Germany developed a civil defense geared to massive, unrelenting raids with high-explosive weapons and incendiary bombs. A Strategic Bombing Survey made by the United States during the occupation disclosed this. German civil defenses were devised to protect against "relatively small and isolated attacks." There was neither the equipment nor the organization to absorb saturation bombing.

The German weakness in World War II provides a trenchant lesson for defenders of freedom in the thermonuclear age. Today a single plane can deliver a hydrogen bomb with more destructive energy than all of the bombs delivered by both sides in World War II.

Historically, there was always time for defensive techniques to catch up to new and more powerful weapons. But the time factor is critical today. That is one of the reasons the military gives so much attention to the anti-missile missile program and to radar devices which might enable us to track these deadly parcels from the moment they leave the launching pad.

The same kind of reasoning obtains in our civil defense program. The protection of our people, our farms, and our factories against the worst effects of a nuclear attack not only assures the survival of our nation, but also tells the potential enemy that a sudden blow will fail—that the United States cannot be knocked out of contention quickly or easily.

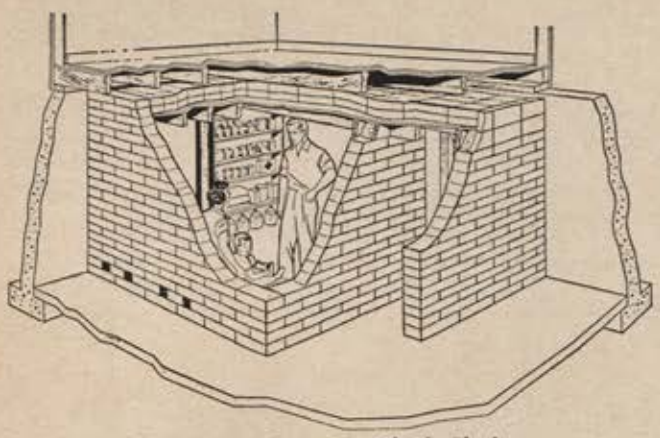
Civil, or nonmilitary, defense must be planned and prepared in advance, just as military defense. Modern weapons make it vain, tragically vain, to depend upon last-minute patchwork responses. Today there is no time to throw up defenses after a war starts.

It was this need for a sound organizational structure that brought about the recent merger of the Civil Defense and Defense Mobilization responsibilities under the Office of Civil and Defense Mobilization. The new agency was placed in the Executive Office of the President on July 1, last year.

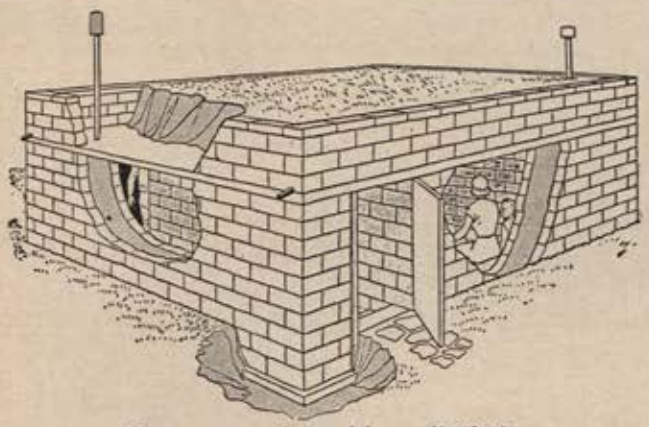
There was also evident a need to provide a framework for the herculean effort of mobilizing the human and material resources of the nation for effective defense. President Eisenhower met this need with the promulgation of the National Plan for Civil Defense and Defense Mobilization in July 1958. This single document describes the nonmilitary defense tasks assigned the federal government, the states and their political subdivisions, industry, nongovernmental organizations, and the individual citizen. Forty-one annexes will cover specific functions and responsibilities in greater detail.

The National Plan is a flexible document which takes account of the quickening pace of scientific and technological progress. Obsolescence is no less a problem for civil

(Continued on following page)

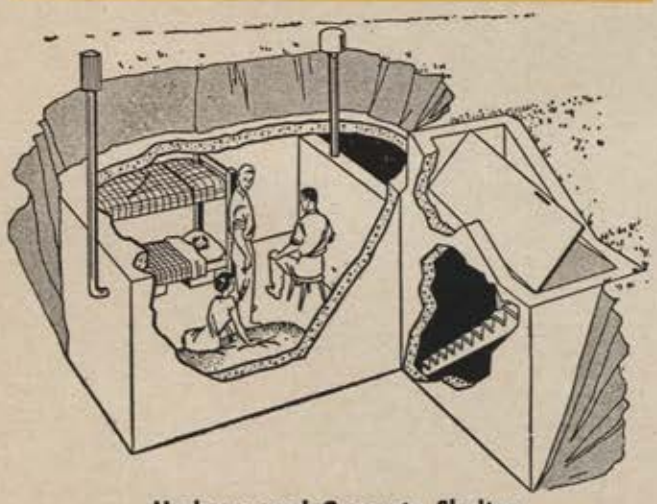


Basement Concrete Block Shelter



Above-ground Double-wall Shelter

Preshaped Metal Shelter



Underground Concrete Shelter

defense than it is for military defense. For example, a communications system to warn the country of enemy planes three hours away is not good enough to warn of missiles which arrive at their target in a half hour or less. It is a constant problem to keep abreast of the swiftly changing weapons picture.

What is the purpose of the National Plan? It is to make certain that every American citizen, regardless of station or walk of life, knows his part of the job of assuring national survival if we are attacked.

Two basic objectives of the National Plan are:

- To protect life and property by preparing for and by carrying out nonmilitary functions to prevent, minimize, repair, and recover from injury and damage.
- To mobilize and manage resources and production.

I mentioned earlier the importance of a reliable system of communications. The North American Air Defense Command is responsible for detecting an enemy air or missile attack. OCDM warning officers are on duty around the clock in major NORAD headquarters and some SAGE regions. They receive the same information as the military—and at the same time. If an attack is verified they will flash a warning to more than 300 key points in every state within a matter of seconds. At this stage the local warning system takes over, relaying the word to every community in the state. The siren is the basic device for outdoor warning. It is frequently augmented by horns and whistles.

The decision to invoke CONELRAD also rests with NORAD. Under the plan, more than 1,200 radio stations would operate on two wave lengths—640 and 1240—to broadcast emergency information and instructions. All other radio and TV would go off the air. Additionally, OCDM maintains communications at all times with its regions and the states over command channels.

The one question underlying everything that goes into the National Plan is: How can our country prepare for disaster? The answers must always reckon with some unpleasant but necessary assumptions.

We know, for instance, that private communications will be disrupted and perhaps rendered completely inoperable. Transportation facilities which normally carry food, medical supplies, fuel, and almost everything else needed in our daily lives might suddenly be cut off. In short, thousands of communities are likely to become islands unto themselves, isolated for indefinite periods of time.

This means that civil defense must be just as effective on the community level as on the federal level. Directives from Washington may help, but in the final reckoning the states and local communities and the individual citizen must take the steps necessary for survival.

The National Plan reckons with this prospect. Under it, the Director of the Office of Civil and Defense Mobilization is the President's principal civilian staff officer in this connection. Governors and mayors are commanders of their respective jurisdictions and civil defense directors their principal staff officers. This chain of command reflects the importance of maintaining authority in an emergency.

The National Plan also recommends that governments, "to ensure their continuity in the event of attack or other disaster," will:

- Establish and promulgate lines of succession to official positions.
- Provide for the safekeeping of essential records.
- Establish control centers and alternate sites for government emergency operations.
- Provide for the necessary protection and maximum

use of government personnel, resources, and equipment.

Thirty-four states now have constitutional procedures for automatic succession in depth of key government officials. All fifty states have completed survival plans modeled after the National Plan. We can now look forward to a successful program of organization and training to implement these plans in every city and county throughout the country.

But the most intricate, complete, and skillfully devised plans are only as good as the people responsible for them. In the case of civil defense much of the burden falls to the individual citizen and his family. A finely engineered warning system can send its vital message to everyone, but only those familiar with warning signals will know what to do.

Every individual in America must know these warning signals. Each person must know his community plan for emergency action, what to do about radioactive fallout, how to administer first aid, and how radio will help with CONELRAD.

Individual action is especially needed to get adequate protection from fallout, the most widespread menace in a nuclear assault. We know that fallout can kill more people than the blast and heat generated by the explosion.

Why is this so? Blast and heat devastate the target zone. But an atomic burst on the ground sends up a mushroom cloud which can deposit radioactive dust hundreds of miles away. This deadly, silent, and often unseen foe is not confined to target areas. It moves with the wind. The lesson is: Fallout shelter is needed everywhere and could save millions of lives.

That is why our national policy on shelters includes an intensified campaign "to bring to every American all the facts as to the possible effects of a nuclear attack . . . and the steps he can take to minimize such effects." In line with this policy OCDM recently published a pamphlet called, "The Family Fallout Shelter."

This manual contains simple-to-read plans for family fallout shelters costing as little as $150. We expected a large demand for this publication, but nothing like the flood of requests received to date. The people are throwing off the delusion that fallout will leave us helpless and hopeless. They are now coming to realize that adequate protection can be obtained for a very modest expenditure—a small price to pay for survival.

How well will the National Plan work? It is a question which crops up in one form or another at every one of our policy sessions. This kind of self-examination is essential to sound planning. This summer I received a letter from Gen. E. E. Partridge, then Commander in Chief of the North American Air Defense Command. He said: "From my observation, the National Plan for Civil Defense and Defense Mobilization appears adequate and should certainly provide a basis for effective nonmilitary defense actions. In addition, I have had my staff take a careful look at the plan and they, too, confirm its completeness."

But the National Plan will acquire full meaning only as each of us recognizes and fulfills the personal and official obligations under it.

To be sure, we have our critics. Some contend, for instance, that we should rule out evacuation completely and place sole reliance on a system of shelters. Such an approach could risk the security of the nation for the simple reason that nobody can predict exactly where an enemy attack will be concentrated or how large it will be. Which areas will suffer direct hits?

Because of the vagaries of wind and weather, who can say which cities will be spared the ravages of fallout and which will need shelter? The answer is that the people of every community must be ready to seek shelter or evacuate as local conditions require.

This booklet, published by OCDM, has already gone to 13,000,000 American families. You can get one from your local civil defense office or by writing to "Box Home Shelter," Battle Creek, Mich. The sketches used to illustrate this article have been reproduced with permission from the booklet.

Another misconception that has gained some currency is that the military should run civil defense. The services traditionally have assisted civil authorities in national emergencies, but they are sure their responsibilities in a nuclear attack would be vastly greater than anything faced in the past.

They have testified repeatedly that nuclear war would preclude the diversion of time, energy, and manpower to civilian problems. The first mission of the military services is to meet and destroy the enemy. They cannot be deflected from it.

In taking inventory of our present state of nonmilitary preparedness, one factor is uppermost. Advances in civil defense must be measured by progress in weapons and delivery systems. As weapons improve constantly, so must our civil defenses.

But if we're unable to say precisely how far we must go, it is possible to measure how far we've come. Recently the Radiation Subcommittee of the Joint Committee on Atomic Energy asked such a question in a thought-provoking way. Assumptions were laid down for an attack, with no warning or evacuation, on 224 targets by 263 weapons totaling 1,446 megatons.

OCDM technicians then went to work assessing damage, tracing fallout patterns, and gathering resource data which gave the simulated assault real meaning. Their finding was that three-fourths of our population survived this hypothetical attack.

Compare these results to the gloomy mood of just a few years ago when the annihilation theory prevailed with the experts and the public alike. A word like "despair" best describes the first popular reaction to the peril of attack with hydrogen weapons on the United States. In the public mind there seemed little hope of countering the "ultimate" weapon save to possess a capability to retaliate in kind.

Our reprisal strength rightly remains the principal deterrent to war. It has been buttressed, however, by a steadily hardening civil defense which gives us staying power and assures that in any future war the United States will survive, recover, and win.—END

Leo A. Hoegh, fifty, is the first Director of the Office of Civil and Defense Mobilization. As Director of OCDM, he is a member of the Defense Mobilization Board and the National Security Council. At the invitation of the President, he regularly attends Cabinet meetings.

WE NEED 'PROS'

Vice Adm. Hyman G. Rickover

The following has been excerpted from Admiral Rickover's testimony before the Committee on Appropriations, House of Representatives. It is part of a long report comparing the educational system of the Soviet Union with that of the United States. We think Admiral Rickover's views on professional training of naval officers provides food for thought for career officers of all services, especially the younger ones. In reading, just substitute Air Force for Navy whenever it appears and we think you'll get the general idea.—THE EDITORS

NAVAL education aims to develop officers with a high standard of professional competence. At least this is the ostensible aim of naval education. But over many years I have been observing the attitudes and mental habits of a great many naval officers. I have come to the conclusion that our naval education program does not develop or even encourage the kind of professionalism which is absolutely necessary if we are to build and maintain an officer corps capable of meeting the challenge of nuclear power and of the coming space age. It does not prepare them adequately for the problems which arise as technology advances. To be a good naval officer a man must be as much a professional person as a physician. And this he is not.

I am deeply concerned over the fact that the majority of young officers lack the attitudes and standards which characterize a professional person. I would sum these up as continuous self-education to keep abreast of new developments, and ability for independent judgment in matters involving technical competence. . . .

As I see it, a professional person differs from a technician by reason of his broad general education, his mastery of a specific area of higher learning, and his ability to apply this specialized knowledge to practical problems. He applies to his work a broad base of knowledge and a habit of independent and logical thought. He sees the problems he meets in his work in their proper setting and solves them by applying his professional and general knowledge individually to each problem. He uses his mind afresh for each of these problems—none are pure routine.

The technician's work differs from that of the professional man chiefly in that it is largely routine. He has not been trained to solve every problem individually. His education has generally been much too limited to do this. The difference between him and the professional man is a difference in education, motivation, and outlook. The technician has been trained to do his specific kind of routine work; the professional man has been educated to handle unforeseen situations requiring new solutions which involve ability to translate concrete problems into abstract principles, and abstract principles back to the solution of concrete problems. The officer is or ought to be a member of the profession.

Many of the officers I have talked with have been devoting their energies almost entirely to the practical and material problems of their job, and they go on year after year with hardly an hour spent in increasing their basic education and maintaining intellectual interests in fields such as mathematics, science, and history. . . .

Apparently the young graduate of the Naval Academy believes that the formal or theoretical phase of his education is over and that his task from that point on is merely to apply, in a largely routine manner, what he has learned of the trade of a naval officer. . . .

As I talk to older officers—executive and commanding officers of ships—it becomes clear to me why many young officers do not maintain professional attitudes after graduation; why they quickly and almost completely abandon all further study when they come aboard a ship or naval station. They are conditioned to follow the lead of their superior officers and these do not themselves set them an example in professionalism. Indeed, the superior officers do not even seem to realize the necessity of holding their officers to professional standards. What they do require of their officers is a high standard in the day-to-day operations of the ship and its equipment and in the handling of men. They judge officers almost entirely by their competence in these respects.

It is little understood that essentially the operating of a ship and the handling of men and equipment are routine tasks—tasks that a well trained technician could handle. That officers handle them better than enlisted men is, of course, merely a consequence of the fact that officers have received longer and more intensive training in this field. Beyond requiring officers to perform these essentially routine tasks and to perform them excellently, superior officers rarely demand any strictly professional competence of the younger officers. Seldom do they encourage these young officers to continue their general and professional studies. Except for those who go on to postgraduate school, the education and development of the naval officer's specific professional competence is presumed to have been completed in four years at the Naval Academy or at college.

The constant intellectual development of the naval officer's mind is a necessity if he is to be able to handle in an imaginative and creative manner the increasing responsibilities which will be his with time. The practical skills which many of these officers have acquired tend to mask the stagnation of their intellectual level. This is only revealed when they are put into top positions where outstanding leadership and insight are required to guide the Navy through the innumerable unforeseen problems of these rapidly changing times. . . .

I believe that the problem which I have just stated is perhaps the most important one facing the Navy as well as the Army and Air Force today. Our top officers are continuously called upon to make technical and administrative decisions which will have an important effect on the future of their service and our country. To ensure that the greatest number of those future decisions are wise and correct, no surer investment of time and effort can be made today than encouraging our officers to broaden their knowledge and their ability to think and to pass that encouragement on to those who serve under them.—END

He put a new twist in an old trick

His problem was to take a 3"x6"x 3-foot piece of wave guide tubing made of .08-inch thick aluminum and to twist one end 90° to the other *without buckling or stretching any part of it...so that a cross section taken anywhere along its length remained a perfect rectangle.*

The standard solution for a problem like this: Support the tube internally with a solder-like substance that's melted in, cooled, melted out after twisting. It won't work here because the mass of the substance is too great.

Here's how this AMF production engineer found the answer. First, he visualized the concept that, in any symmetrical twist, *the center axis never moves.* Then he applied this concept by stringing a metal rod through the center of 288 rectangular shims, inserted them in the tube, cushioned them with the same solder-like substance. Jaws clamp on either end. One of them rotates *slowly* (twisting time: over 2 minutes) giving the metal time to flow. The result: Perfect twists, every time.

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This bit of production know-how is a sample of the ingenuity AMF brings to every assignment.

AMF people are organized in a *single operational unit* offering a wide range of engineering and production capabilities. Its purpose: to accept assignments at any stage from concept through development, production, and service training... and to complete them faster...in

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AN ALLIED AIRPOWER FEATURE

LIGHTNING IN THE

A close-up look at the RAF's new Mach 2.3 interceptor . . .

English Electric's swift, powerful new addition to free world airpower.

Robert R. Rodwell

NOW being readied for service with Britain's Royal Air Force Fighter Command is the English Electric Lightning, an immensely powerful, single-seat interceptor with a top speed capability of about Mach 2.3, a landing speed of 130 knots, and full all-weather combat effectiveness.

Married to the great firepower of two de Havilland Firestreak infrared homing missiles or forty-eight two-inch rockets, as well as two 30-mm cannons, these characteristics should make the Lightning one of the hardest hitting fighters in the world and an important addition to Allied airpower.

For the first time in a British fighter, full all-weather capability has been built into a single-seat machine. The Lightning will replace both the elegant but transonic Hawker Hunter, which is currently the RAF's standard day fighter, and two-seat Gloster Javelin, which mounts the night and all-weather defensive screen. The Lightning is scheduled to go to operational squadrons in the next few months. It is now undergoing test flights—one of which, unfortunately, resulted in a recent crash in the Irish Sea. This did not, however, diminish official enthusiasm for the aircraft.

Britain was late getting into the manned supersonic aircraft field, due mainly to a government decision made in 1945 to rely on supersonic research with unmanned models only. In 1949 this decision was reversed. Design began in Britain on two supersonic research aircraft, one of which became the Fairey Delta 2, a one-time world speed record holder, and the other the P-1, progenitor of the Lightning.

In 1953 the British Air Staff decided that there was a need for a manned supersonic fighter in addition to guided interceptor missiles. Major developmental work began on the P-1. Two flying prototypes and a static test airframe were built of an interim design, the P-1A, which went supersonic on its first flight in August 1954. It was the first British airplane to do so. Further design work concentrated on the P-1B, the full combat version.

The P-1B, since named the Lightning, was seen to be a totally different airplane when it first emerged in April 1957, bearing only a superficial resemblance to the lower-powered interim machine.

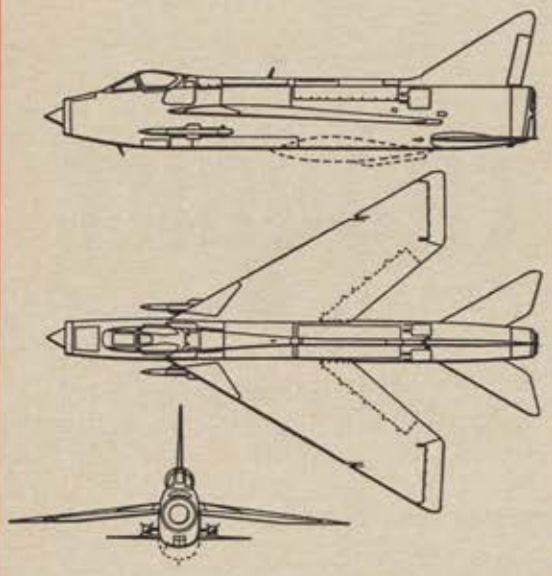
The Lightning was the first British airplane to be treated as a complete weapon system. Its importance to the British Air Staff can be gauged by the fact that an unprecedented number of preproduction airplanes were ordered "off the drawing board." Systematic and concurrent development of all the integrated items which make up a weapon system followed. Of this batch, three prototypes and twenty preproduction development models, the majority are now flying.

The powerplants are two Rolls-Royce Avon 24R turbojets, officially stated to be type tested at 11,500 pounds of thrust. Each is fitted with an afterburner, raising the total thrust to about 29,000 pounds. The engines are mounted one above the other, staggered fore and aft to reduce the cross-sectional area.

All necessary drives are duplicated. The Lightning can be flown safely on one engine. The position of both engines on the axis line means that there is no imbalance if one engine should fail or be deliberately cut.

The untapered wing is swept at an angle of sixty degrees. The horizontal stabilizer, of similar shape, is mounted low beneath the vertical stabilizer. This avoids the pitch-up tendency encountered by supersonic airplanes with high-

BRITISH SKIES



ENGLISH ELECTRIC LIGHTNING DATA SHEET

DESIGNERS: Initial conception, W. E. W. Petter; designer through development, F. W. Page.
ENGINES: Two Rolls-Royce Avon 24R turbojets with afterburners.
CREW: One.
LENGTH: 50 ft., 0 in.
SPAN: 34 ft., 10 in.
WEIGHT: Not released.
MAXIMUM SPEED: Approximately Mach 2.3.
TAKEOFF RUN: Approximately 800 yards loaded.
LANDING RUN: Approximately 700 yards.
LANDING SPEED: 130 knots.
CEILING: In excess of 65,000 ft.
ORDNANCE: 4 Aden 30-mm. cannons or 2 Firestreak infrared homing missiles and 2 Aden cannons or 48 unguided, spin-stabilized, 2-inch rockets and 2 Aden cannons.

Second view of new jet shows fuel-bearing ventral bulge, Firestreak guided missiles.

mounted stabilizers when flying at subsonic or transonic speeds. The thickness/chord ratio of the wing is approximately five percent, with the ailerons mounted across the tips from leading to trailing edge, parallel to the lateral axis.

"Saw cuts" have been designed into the leading edges of the wings to aid flow distribution. They were considered preferable to the more usual and easily damaged boundary layer fences.

Mounted in the Lightning's nose is the scanner of the Ferranti Airpass system. "Airpass" stands for Airborne Interception Radar and Pilot's Attack Sight System. This is a target-acquisition and fire-control system developed concurrently with the airplane. It is said to be suitable for installation in even lightweight fighters.

The Lightning carries a full range of tactical and navigation aids, including many other specially developed instruments and an autopilot. The aircraft is also equipped with autostabilization. This latter aid is solely to reduce the load on the pilot, enabling him to devote his full attention to the interception. It does not imply tricky handling characteristics. Preproduction Lightnings have been flown and maneuvered at Mach 2 without autostabilization.

The flight characteristics of the Lightning have drawn praise from pilots of several countries who have flown it. Among these have been a number of US Air Force aviators. It has been accorded the most complete tunnel testing of any plane ever built in Britain.

The ventral bulge seen under the Lightning in the accompanying photographs was originally intended to house a Napier Double Scorpion kerosene rocket together with its hydrogen-peroxide oxidant. This rocket would have provided extra power at altitude or during the climb. But improvements on the Avon engine and its afterburner, together with the increased performance of the Firestreak missile, have rendered installation of the rocket unnecessary. The bulge has been retained for extra fuel capacity.

The Lightning has a wide track undercarriage, which retracts outward, both the undercarriage legs and the wheel-well doors being inboard of the wheels. The nosewheel retracts forward into the lower center body strut. Forward opening slab airbrakes are mounted in the fuselage topside just below the junction of the dorsal spine and the fin leading edge. Deceleration on landing is aided by a ten-foot-diameter ring-slot parachute housed beneath the variable area jet nozzles.

Early in May a two-seat version of the Lightning, designated the P-11, made its first flight. Intended as an operational trainer, this airplane retains the full combat capabilities, and houses the same range of electronics and armaments, as the single seater. The two seats are placed side by side.

The aircraft is identical to the Lightning apart from a fattening of the upper, forward fuselage. The trainer version will be available early in the service life of the RAF's newest and best interceptor.—END

The author, Robert Rodwell, has been a frequent contributor to AIR FORCE/SPACE DIGEST. *A British aviation writer, he last reported in these pages in May '59 on the emplacement of Thor IRBMs in his country. Mr. Rodwell has flown, as a passenger, in many current US and British military jet aircraft in the past several years.*

At Maxwell AFB, Ala., USAF's top field-grade officers go back to school at the War College and talk of grand strategy within a framework of international issues . . . from technology to religion, from explosives to farm implements to power politics . . .

TINDERBOX FOR THOUGHT

Willard A. Hawkins

ITS PROPER name is the War College. Less formally, College for Colonels, Generals' Preparatory School, or Big Picture Institute would be equally descriptive.

For here, at Maxwell Air Force Base, Ala., the Air Force's top field-grade officers go back to school and talk of grand strategy within a framework of international issues from technology to religion, from explosives to farm implements to power politics.

A fair proportion of the students become generals. Whether one does or not, the ten-month course sends him to his next assignment immeasurably better prepared to serve as a decision maker and leader on the global Air Force team.

The philosophy behind the War College is simple. By the time an officer has attained the rank of colonel, he

War College, primarily designed for promising USAF officers at midcareer, also draws students from other services.

knows the Air Force from the ground up—its men and machines, its capabilities, missions, and problems. He is a man of competence and responsibility. But, unless the circumstances of his earlier career have been somewhat unusual, he probably has not had an overabundance of time for reflection on the myriad factors that affect national strength and security. Or on questions of long-term military strategy and doctrine.

So, thirteen years ago, the War College (officially the Air War College until July 1 of this year) came into being to provide just such an opportunity for the cream of Air Force officers at midcareer. The late Gen. Muir S. Fairchild sounded this timeless keynote for the War College at the opening ceremony in 1946:

"Should we succeed in educating and producing such planners and future leaders that they may design an Air Force so adequate that it need never be used, we shall have completely fulfilled our mission."

It is interesting to note that these words came almost simultaneously with the formation of the Strategic Air Command, whose major operational mission has been to prove "so adequate that it need never be used."

General Fairchild organized the then Air War College and the Air University of which it became the nucleus. He was the first commanding officer of the Maxwell educational complex.

To date, nearly 1,850 carefully selected senior officers of the Air Force have been graduated from the War College. Officers from other US and allied services also have been included in each class.

Translation of War College objectives into ten months of concentrated study is not a simple matter. It involves much that is open to varied interpretation—critical, constantly changing military, national, and international issues.

Basically, the College presents the student with a vast body of authoritative information and opinion on the conduct of modern warfare and a broad field of related subjects. It carefully steers clear of doctrinaire approaches or oversupervision.

No dogmas or fixed rules of strategy are advocated; differing viewpoints each have their full day in court. National and international policies, systems, and organizations are critically analyzed with a view to stimulating judicious, constructive thinking on these subjects.

The outgoing Commandant, Maj. Gen. Robert F. Tate, described the approach this way: "First let us understand completely why things are the way they are and the basis of their evolution to present standards. Then, and only then, can we deal realistically with current problems of national security and project our thoughts meaningfully and usefully to the problem of the future." New Commandant is Maj. Gen. Richard H. Carmichael.

The curriculum undergoes continuing evolution in a free academic environment as befits the professional stature of the students. At the same time the College maintains a stable approach to basic matters of strategy, military leadership, and warfare that remain constant regardless of the specific nature of the struggle.

The major problems facing high command and staff officers today are generally of such complexity as to require staff action or group solution. The system of instruction, emphasizing the seminar method, has been designed with this in mind. Lectures, forums, conferences, and a heavy volume of reading play major roles in the curriculum.

Discussion is often spirited in the seminar groups. It is not unusual for one or more students, examining problems in the light of individual experience, to file a "minority report" in rebuttal to strategic solutions suggested by the majority.

A thesis requirement supplements the student seminar program. It aims to increase professional knowledge on significant aspects and problems of air warfare and other problems of special significance to the military establishment. It is also expected to increase the student's ability to analyze, evaluate, and write effectively, and thus help prepare him to take part in decision making at the national level.

The curriculum is divided into three phases.

The first phase is devoted to consideration of factors influencing international relations—with emphasis on power politics, past and present. This phase deals with the current world picture in terms of history, governments, technological advancement in various parts of the world, religions, economic growth, psychological matters, wealth, ambition, military strength, and other issues.

The second phase covers current military strategies in situations of total, local, or cold war. The first part of this phase is concerned with the many and varied factors which influence the current military strategy of the United States —firepower, mobility, national security policies, the decision-producing processes at the highest governmental level, doctrines, roles, missions of the various military departments, Defense Department organization, development of new weapons and weapon systems, national economy, Congress, public opinion, foreign military aid, scientific development, and coalition strategy.

War College came into being thirteen years ago, became nucleus of Air University, Maxwell AFB, pictured above.

The students then go on to deal with strategy proper, interpretations of US defense policies, and military requirements to deal with potential wars. The capabilities and planned employment of forces, and especially air forces, in the implementation of war plans is basic to this part of the course.

The principal question considered is the capability of the United States to wage war. This question is raised in the context of conflicting philosophies of operation and conflicting priorities for the development of weapons to be employed. Special force requirements for limited war capability are also examined.

Phase three deals with possible wars of the future and strategy to fight them. Special emphasis is placed on the continuing revolution in military weapons and their means of delivery—both east and west of the Iron Curtain. The urgency with which military thought must be recast to keep pace with such developments as the ballistic missile is faced squarely.

During this third phase the student considers such matters as whether any nation or group of nations is likely to emerge to challenge the US and USSR as the world's superpowers during the 1965-75 period. Will English, French, and Red Chinese development of nuclear capabilities affect the world balance of power in years ahead?

(Continued on page 49)

HOT GAS SYSTEM COMPONENTS NOW AVAILABLE FROM CHANDLER EVANS

CECO SYSTEMS CONTROLS

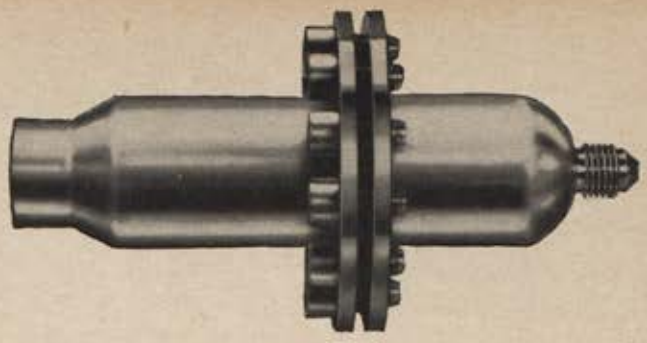
As by-products of extensive development work in the field of high-pressure pneumatics, Chandler Evans has—over the past several years—designed, developed, tested and produced a number of hot gas servo system components, some of which are presented here.

The products shown and described were developed for use with high-pressure hot gas generated from liquid or solid propellants, and are suitable to such applications as auxiliary and control power systems for guided missiles and space vehicles.

All the components shown are developed items, ready for use. However, because they have been fabricated to meet the requirements of particular applications, the specifications presented should be considered only representative. Design modifications can readily be made to adapt these devices to *your* requirements.

If you, too, are engaged in hot gas systems work and want to save considerable time and money in development, by using proven components not heretofore available, CECO will be happy to afford you its traditional cooperation.

For detailed information on these and other components, or for data on CECO's hot gas servo *systems*, contact any of the Field Engineering Offices listed at the right.

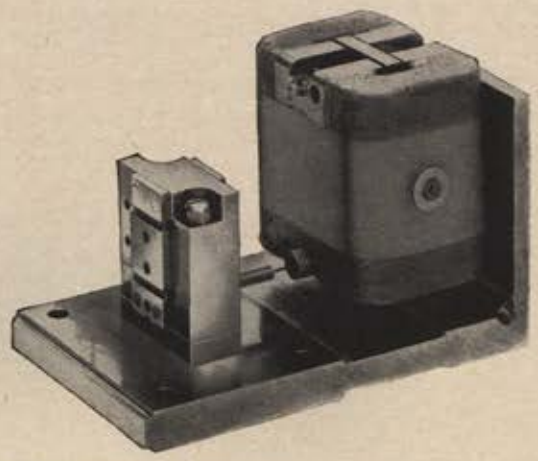


LIGHTWEIGHT HYDRAZINE REACTION CHAMBER

This reaction chamber, containing a suitable catalyst bed and injection nozzle, is used to generate hot gas. When hydrazine from a pressurized source is introduced, the catalyst immediately initiates a chemical reaction which continues until the fuel supply is exhausted.

Representative specification:

Operating temperature	to 1800°F.
Operating pressure	to 2000 psi
Flow capacity	.10 lb./sec.
Operating time	in excess of 5 hrs.
Weight (including catalyst)	1.27 lbs.
Size	1.50″ O.D. x 5.00″



REED-SUSPENDED, CLOSED CENTER SERVO VALVE

Developed for use with hot gas produced by decomposition of liquid propellants, the servo valve shown here is currently available in a variety of sizes to accommodate the requirements of individual applications.

Representative specification:

Inlet gas supply pressure	to 2000 psi
Inlet gas supply temperature	to 1500°F.
Operating temperature (ambient)	to 350°F.*
Valve stroke	±.004″
Flow capacity (total gas flow)	.01 lb./sec. air @ 1500°F., 2000 psi
Overboard leakage (valve at null position)	10% of total flow
Power input (maximum)	2 watts
Natural frequency	430 cps
Weight	1.00 lb.
Size	1.75″ x 2.75″ x 1.75″

** With additional torque-motor cooling, ambients to 1200°F. can be tolerated.*

CHANDLER EVANS CORPORATION

PROPELLANT FLOW MODULATING AND PRESSURE REGULATING VALVE

The problem of operating hot gas generators at a specified constant pressure level led to the design, test and development of the liquid fuel regulating valve pictured here.

This valve may be described as a spring-loaded, spool-type throttling valve. Full open when the pressure at its outlet port (gas generator pressure) is low, it progressively closes off as the outlet pressure increases.

With minimum leakage an important objective, the valve shown meets the following specification:

Flow (hydrazine)	.002 to .02 lb./sec.
Upstream pressure	500 to 3000 psi
Regulated pressure	500 to 2000 psi
Temperature	0° to 200°F.
Weight	.38 lb.
Size	1.75" O.D. x 3.00"

Limited changes in regulated pressure can readily be accomplished by means of a simple adjustment screw. Broader changes in regulated pressure or in flow capacity can be accomplished through slight re-design of the spool or spring elements.

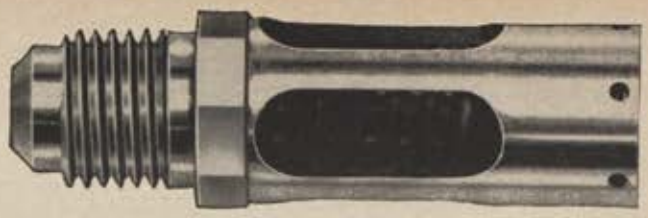
SOLID PROPELLANT HOT GAS FILTER

Since small-orifice areas of servo valves cannot tolerate contaminants produced by combustion of solid propellants, CECO found it necessary to develop the special hot gas filter shown here. Unlike those heretofore available, this filter can easily be cleaned for re-use and has amply demonstrated its ability to withstand the temperatures and pressures encountered in hot gas systems.

It operates as follows: hot gas flows into an annulus between the filter element and housing, then diffuses through to the outer surface of the element, depositing solid particles as it goes. With gas flow at .015 lb./sec., this filter operates for several minutes, with average contamination, filtering out particles as fine as 10 microns.

Representative specification:

Operating temperature	to 1800°F.
Operating pressure	to 2000 psi
Initial pressure drop at .015 lb./sec.	2 psi @ 1000 psi
Filter housing size	1.38 O.D." x 5.00"
Weight	.88 lb.

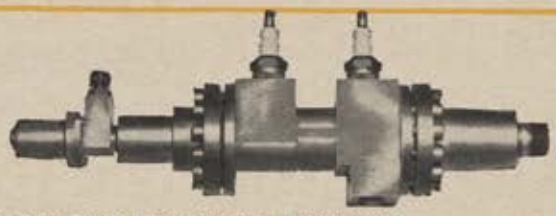


HOT GAS PRESSURE RELIEF VALVE

Typical of component hardware developed by CECO in its work with hot gas servo actuation and reaction systems is the valve pictured here. While it can easily be modified to satisfy other requirements, specification for the valve shown is as follows:

Relief pressure	1000 psi*
Reseat pressure	950 psi
Flow	.02 lb./sec. @ 1000 psi
Temperature	1800°F.
Weight	.032 lb.

* *Adjustable from 800 to 1200 psi.*



HOT GAS REACTION CHAMBER FOR LABORATORY USE

This unit is used as a "workhorse" hydrazine reaction chamber to provide clean, hot, high-pressure gas for test purposes.

Ideal for laboratory use, its flow rates range between .001 and .1 lb. sec., and may be extended in either direction by changing nozzle and load orifice sizes. Operating temperatures are between 1200°F. and 1800°F. with pressures to 2000 psi.

The chamber is preheated by an electrical coil, a feature which facilitates repetitive starting without need for disassembly between test runs to renew the catalyst.

The above picture shows CECO's generator with the pressure regulating and flow modulating valve in position. For those who require a complete, "packaged" system for providing a continuous supply of hot gas, Chandler Evans can supply a complete laboratory model hot gas generator system including the fuel storage, pressurizing, purging and pressure regulating elements in addition to the gas generator reaction chamber described above.

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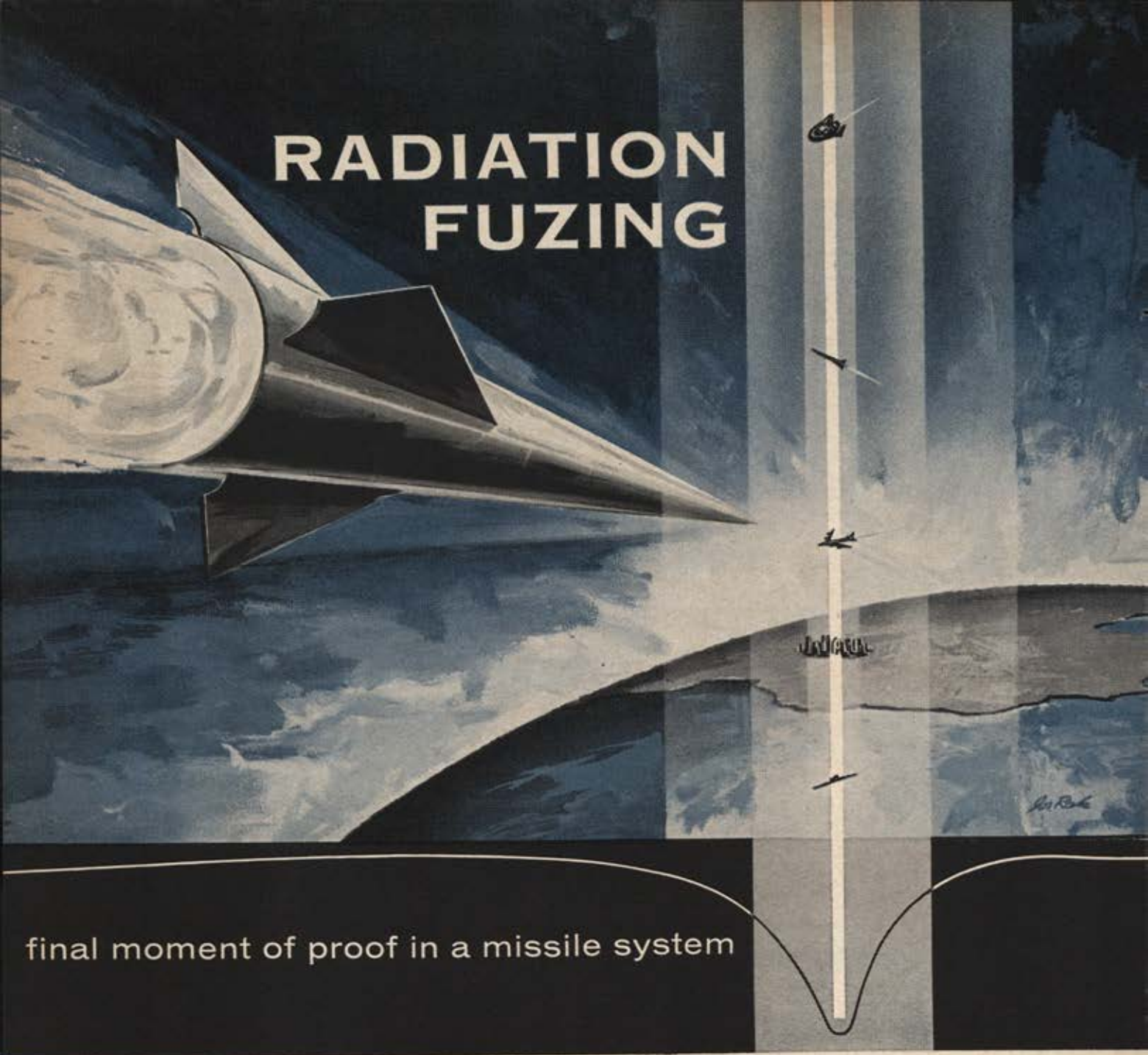
CHANDLER EVANS CORPORATION

Literature, including a reprint of this ad, available by request to Department 69.

CHANDLER EVANS CORPORATION



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A DEPARTMENT IN THE DEFENSE ELECTRONICS DIVISION

War College curriculum includes heavy year-long reading load. Here students avail themselves of reading room in Fairchild Library, named for school's first Commander.

Major assembly hall for lectures, presentations is the school's large auditorium, above. Guest speaker program boasts top educators, military leaders, industrialists.

During this period, also, authoritative lecturers visit the College. The chiefs of staff of the different services address the student body. Experts in international relations, business, science, and other areas also appear.

To complement student efforts during this portion of the curriculum, the class is augmented by a representative group of distinguished civilians from various segments of American life. This group is collectively labeled the National Security Forum. The Forum has just completed its seventh year as a part of the College program. Members attend lectures, seminars, the discussion periods. It is interesting to note the civilian reaction to the experience.

A department store executive who took part this year said he was "most impressed by the quality and dedication of the student officers, their broad general interest in all that is going on in the world, their interest in congressional attitudes and those of civilians generally."

Another civilian, a Dallas oil executive, was "particularly impressed by the seminar proceedings and the complete freedom of discussion." He added that he was "a trifle skeptical" when he arrived at Maxwell but quickly changed his mind once he became a part of the student structure.

"I got a lot out of it," he said, "and I felt much better about our present capability for preserving national security after I had been at the War College a few days."

Especially impressive to anyone who visits the War College is the quality of lecturers regularly presented. During the last National Security Forum week, speakers included Allen W. Dulles, head of the Central Intelligence Agency; General Dynamics board chairman and past Army Secretary Frank Pace, Jr.; USAF Chief of Staff Gen. Thomas D. White; Dr. Henry A. Kissinger, Director of Studies at Harvard University's Defense Research Institute; and SAC Commander in Chief Gen. Thomas S. Power.

The spirit of academic freedom pervades the College. No thoughts are excluded, no views suppressed on any subject under consideration. It is felt that only in this atmosphere of open and frank exchange of ideas can true intellectual advancement for students be achieved.

Students are assigned various books and selected articles to read on a continuing basis through the War College course. Available to the students is the new and modern Fairchild Library, named for General Fairchild. It provides research, reference, and documentary services to the Air University and the Department of the Air Force. The library contains more than 230,000 books and bound journals and over 500,000 classified military documents. It receives 1,500 periodicals and newspapers, both domestic and foreign. Complete files of regulations, manuals, and directives from USAF Headquarters, numbered air forces, and major air commands are maintained.

The War College, in addition to its regular curriculum, is also engaged in a continuing research and writing program. The objectives of this program are the general advancement of knowledge relative to the employment of airpower, the solution of specific problems of current importance to the USAF, the preparation of official papers and manuals having to do with doctrine and employment of airpower and the several components of air weapon systems, the building of one agency comprised of individuals who are highly informed in the several more or less specialized categories of employment of airpower, and the enrichment of the War College curriculum.

From the start, the quality of War College students has been stressed. Each is carefully selected by a board of general officers on the basis of past performance and potential for future growth. Rigid criteria have been developed to exclude those whose future usefulness to the Air Force is limited.

Each member of the small faculty is a distinguished earlier graduate of the College and an active Air Force officer. Faculty members are organized in teams for the preparation and presentation of curriculum studies.

Faculty members are encouraged to pursue individual research and are expected to become competent authorities in assigned fields during tours of duty. Thus they not only plan and implement the instructional program at the War College, but they are themselves engaged in a program which is designed to develop their capabilities and enhance their professional stature as senior officers of the Air Force.

The faculty is composed, under the Commandant and Vice Commandant, of a Deputy for Academic Instruction, an Assistant Deputy, an Educational Adviser, a Research Adviser, directors of curriculum phases one, two, and three, study directors, and assistants to the directors.

An integral and important part of the War College organization is the Evaluation Staff, which is composed of three divisions. The divisions are Employment, Doctrine, and Concepts and Development. Each senior officer assigned to this staff is a specalist in some phase of aerial

(Continued on following page)

One of last year's lecturers was the then Commander of the Mediterranean-based US Sixth Fleet, Adm. Charles R. "Cat" Brown, shown above in discussion of his carrier force's capabilities in the vital Middle Eastern area. Below, a student from abroad, British RAF Wing Commander Peter Ottewill, delivers one of a series of student talks.

warfare. A large portion of this group's effort is toward developing doctrine for strategy and employment of airpower. It continuously analyzes and assesses Air Force planning and the effectiveness of Air Force weapons.

Important, too, is the small advisory staff working closely with the Commandant and Vice Commandant. It is composed of representatives from the Department of State, Royal Air Force, US Army, US Navy, and civilian educational specialists.

The student body of the College is small. The physical facilities are compact. Each class of approximately 166 officers has included 135 Air Force colonels, with the remainder of comparable rank drawn from our other services, the State Department, other government agencies, the Royal Air Force, and the Royal Canadian Air Force. The current class, which entered this fall, contains more than a sprinkling of lieutenant colonels. This grade will comprise most of the student body in the future.

The War College course is no longer strictly bounded by the geographical limitations of the campus at Maxwell. It is currently offered also in the form of an extension correspondence course.

The purpose of the War College extension course is to provide professional military education, similar to that given in the resident War College, for senior officers of the Regular Air Force, the Air Force Reserve, and eligible members of the other armed services, plus certain categories of civilian employees of the US government.

The curriculum of the extension course is broad in scope and must be completed within five years with a grade of "satisfactory." Unlike other ECI courses, the War College course is not self-contained in the listed volumes, which are primarily outlines and study guides containing only a small part of the required readings. Books themselves are obtained through libraries or by purchase.

Statistically, the "average" student in the last class was forty-one years of age, had approximately sixteen years of military service, was married, and had two children. He had considerable combat experience and was a command pilot. Most students in recent classes reported to the War College from Headquarters USAF or SAC, with the area of greatest experience in combat and operations. Most of the students were college graduates with some twenty percent holding masters degrees. There were one Ph.D. and three candidates for doctorates.

Across the board, it was a highly decorated group with an impressive cumulative combat record. A significant figure in relation to the course indicates each student was required to read about 5,100 pages of assigned material and review three books, in addition to the copious research involved in preparation of a thesis.

What happens to graduates of the War College after they move on? Chances for further advancement are exceedingly good. At a time when graduates numbered about 1,300 it was determined that 144 of these had reached general officer rank.

One of the direct benefits to the Air Force, and to the students, is that of having its senior officers associating with and knowing a large number of their peers. Not only is there an immediate personal benefit gained by the sharing of past experiences while at Maxwell, but a matrix is provided for the development of common understandings promoting cohesion and purpose in the higher command.

At present, the War College is grappling with a number of vexing questions. How, in today's rapidly shifting world of technology, can a student best prepare himself for top command?

To what extent should the curriculum be tailored to fit the evolution toward integration of the armed services into a possible single service, or their reorganization in line with mission rather than medium?

What, if any, specific training should an officer have to deal with increasing Air Force responsibilities in the field of global diplomacy?

By placing these and other thorny problems before its unique student body, in an atmosphere of high purpose and intensive academic endeavor, the War College continues to fulfill with distinction the vital mission of making the cream of the Air Force even creamier.—End

The author, Willard A. Hawkins, is an aviation writer, public relations man, and free-lance author. A native of Arkansas and current resident of Little Rock, he served in the AAF in World War II, has written several articles about the Air Force during the decade and a half since leaving the service.

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How the Strategic Air Command trains million-dollar crews for the million-dollar aircraft that make up the world's most powerful strike force . . .

Lt. Col. Warren D. Johnson, USAF

FIGHTING to control his voice, the captain pressed the mike button and replied to the control room: "This is Venice Forty-five. I have seven thousand pounds of fuel remaining and do not yet have the tanker in sight. He is on our scope at thirteen miles. The crew chief is still trying to elge the landing gear down. I still have an intermediate indication on the forward main and a red light on the elge stand."

A moment later he continued. "To save fuel I am going to raise the gear again and leave it up until I hit that tanker . . . there it is . . . have it in sight . . . just above the clouds."

His voice rose perceptibly as he banked the B-47 sharply toward the blinking navigation lights of the KC-97. The officers in the control room looked at one another and the colonel spoke almost inaudibly: "Just get on the boom and get a little fuel . . . then we'll relax."

The gray-haired major holding the microphone thumbed the button and spoke calmly into it: "Okay, Jim. That flying filling station has thirty-five thousand pounds of fuel for you. All you have to do is fly in there and take it. Do it just like you did it for me the

(Continued on following page)

Personal equipment specialist fits parachute on instructor-navigator prior to flying mission at Little Rock AFB, one of command's key training bases.

other night on your stand board check."

"Roger," came the reply.

An interval followed before the officers in the control room heard, "Receiver ready for contact," then the response from the tanker, "Roger, Forty-five. Tanker ready. You are at thirty feet and closing nicely."

The boom operator's voice continued: "Twenty-five feet. Just a little low; up five . . . fifteen feet . . . ten . . . five. Stand by for contact. Tanker contact."

"Receiver disconnect," cracked the captain's voice. "I had you okay and went right through to a disconnect. Have a fuel panel full of red lights. What happened?"

The boom operator replied calmly, "No sweat, sir. You came in just a little too high . . . had an upper limit disconnect. Tanker's ready. Come on back in."

"Receiver's ready."

"Tanker contact."

"Receiver contact."

"Pressure is up; you are getting fuel at four thousand pounds per minute."

"You now have six thousand pounds," the operator said a few moments later. His voice cracked through the control room speaker.

The captain answered, calm and controlled, "That gives me a grand total of about ten thousand five hundred. Keep pumping!"

"Roger, sir. You are in the green and doing fine."

The figures in the control room visibly relaxed.

"That was too damned close," snapped the colonel. "If he is adding right, he only had forty-five hundred pounds left, and that's only about enough for bail-out."

"Right, sir," replied the major. "I launched the strip alert tanker before I called you, but the B-47 only had eighteen thousand when he started down. When he couldn't get his gear down he went back to twenty-five thousand feet to save fuel, but he was still using it pretty fast."

"Well, let's hope he can get that landing gear down after he sucks up some fuel. This is hard on weather-beaten colonels."

In a short while the boom operator's voice came over the loud speaker again. "You have your thirty-five thousand, Forty-five."

"Roger," came the captain's reply. "Disconnect on my count of three. One . . . two . . . three. Disconnect receiver . . . I'm going to back off and cycle this landing gear once more. The handle is down . . . well I'll be! I have a full down indication. That forward main must have been frozen!"

With a sigh of relief, the major spoke into the mike, "Roger, Forty-five. Better land; you've had enough excitement for one night."

Once again training and preparedness had paid rich dividends. Unable to extend his forward main landing gear, the commander of the B-47 had called for the tanker he knew would be ready for immediate takeoff. The tanker had been airborne in exactly nineteen minutes. It had climbed through the clouds and given the multimillion-dollar B-47 the precious JP-4 which allowed him to remain aloft long enough for the landing gear mechanism to thaw and function normally. Without the fuel from the tanker he would have had to crash land or bail out. Possibly the aircraft and crew would have been lost.

The three-member B-47 crew and the tanker crew had reacted perfectly. The aircraft commander of the B-47 had performed a very difficult feat under trying circumstances. Yet he had only reported to the B-47 training base a few months earlier. He had only been flying the B-47 for a short time. But in that short time he had received the most extensive and expert training the Air Force and SAC could give him.

For the past ninety days, the B-47 crew had been subjected to a rigorous training program. They had practiced aerial refueling many times. They had made countless practice bomb runs against various American cities. They had navigated over land and sea. They had flown over 50,000 miles and their aircraft had consumed about 1.5 million pounds of fuel, or about 230,000 gallons. Many hours had been spent in the classroom, many more around the aircraft on the ground. Now they were ready to go on to some Strategic Air Command bomb wing to become a part of the combat-ready force.

This night, they demonstrated the value of that training.

This incident actually took place at Little Rock Air Force Base, twelve miles north of Little Rock, Ark., not long ago. The Air Force officer commanding the B-47, incidentally, was a Negro captain who good-naturedly quipped after he landed:

"That was really an integrated crew. Three white men and a colored man went up and four white men came down."

It was this same captain who a few weeks later submitted a new slogan for the unit that had trained him: "WE TEMPER THE STEEL FOR THE SWORDS OF SAC." This slogan was adopted as particularly appropriate to the training mission assigned to the 70th Strategic Reconnaissance Wing.

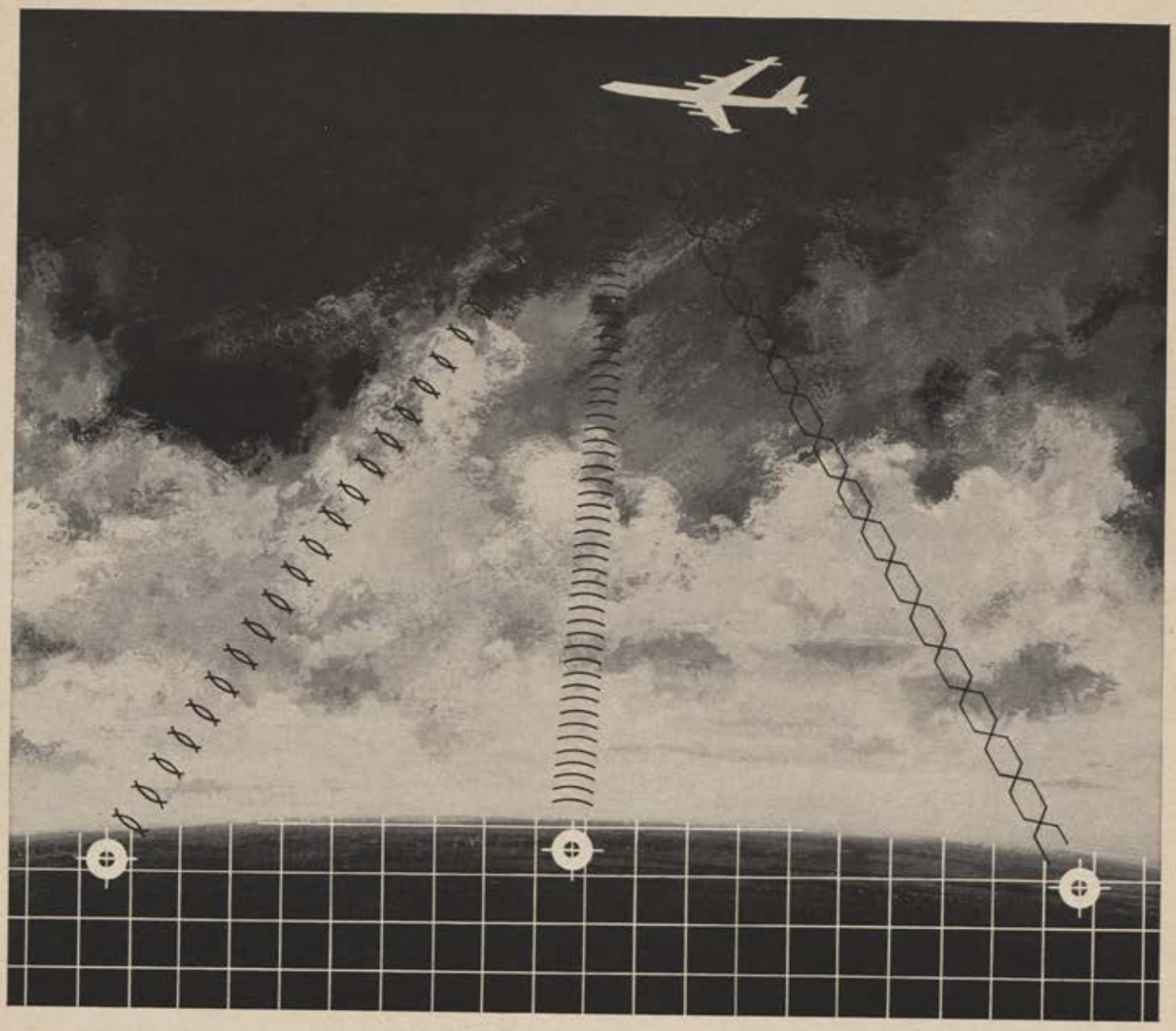
This Strategic Air Command wing, based at Little Rock AFB, in addition to its reconnaissance role, has been directed to train combat crews for other SAC wings. Two other units have been assigned the same mission —the 90th Strategic Reconnaissance Wing at Forbes AFB, Topeka, Kan., and the 3520th Combat Crew Training Wing, McConnell AFB, Wichita, Kan.

At these three air bases in the central United States, SAC will train hundreds of B-47 crews per year. This extensive and costly training program will assist SAC in attaining and maintaining its goal of one-third of its bomber force on the alert. Under the alert program the combat crews literally sleep with their flying boots on. They are able to get their bombers in the air in an incredibly short time.

To maintain this alert, both the crews and the aircraft have to be cocked like a loaded gun, and to maintain such a posture on a sustained basis, more trained crews are required. Moreover, because of the alert com-

(Continued on page 57)

SYLVANIA ELECTRONIC SYSTEMS . . . **IN RECONNAISSANCE**



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Students plan training flight with instructor. Average instructor has logged over 4,000 hours of flight time.

Here students learn emergency procedures in B-47 flight simulator, an indispensable training aid, at Little Rock.

mitments and the need to keep their combat-ready crews proficient, the bomb wings on the alert are unable to commit sufficient airplanes and instructors to train the new crews. Therefore, SAC has concentrated its training at Forbes, McConnell, and Little Rock.

The training problem is compounded by the attrition which eats away at the B-47 crew resource. Last year, normal attrition cost the Strategic Air Command many crews, and the crews to man the B-52 are largely being chosen from the B-47 crews. Each B-47 crew withdrawn must be replaced. SAC officers are liable for worldwide Air Force assignments, and each one reassigned affects a combat crew. Last year SAC netted about one-third of the total number of crews trained.

With the new alert requirement and little increase in number of crews, many presently assigned SAC crews are spending eighty hours or more each week on the base and away from their families. Others are on the alert at our forward bases, away from their homes for several weeks at a time. Some spent nearly half of last year on temporary duty away from home. The new crews trained at Forbes, McConnell, and Little Rock will augment the present alert force and spread the alert duty more equitably.

The new SAC crews will come from Air Force-wide resources. Some of the officers to man these new crews will be recent graduates of the Air Force navigation or pilot schools. Others will be from other Air Force commands. Those who are to become aircraft commanders will be experienced pilots with extensive flying experience. Most of the aircraft commander trainees have been copilots on SAC crews and have demonstrated the maturity required to become aircraft commanders.

The student crews first go through survival training at Stead AFB near Reno, Nev., where they learn to survive if forced down over enemy territory. From Stead they go to McConnell where they receive three months of comprehensive ground training in all phases of the B-47. This course includes a thorough study of the B-47 aircraft systems, navigation and bombing principles, and for the aircraft commander and copilot a twenty-one-hour course in the B-47 flight simulator.

After completion of the ground training course at McConnell, some of the crews go to Forbes and some to Little Rock for flying training. The rest remain at McConnell. Before leaving McConnell for Forbes or Little Rock, crews to be trained there will be assigned to one of the SAC operational units which are strategically located in every part of the United States. They will then go on to Forbes or Little Rock for ninety-day temporary duty.

During the flying phase of training, they are scheduled to fly twenty-one missions in the B-47. The aircraft commander is scheduled to make fifty-eight landings and to spend nine hours practicing aerial refueling. The navigator, also trained in high-speed radar and bombing, is scheduled to fly eight practice navigation legs and make nineteen practice bomb runs.

The copilot (or pilot as he is called in SAC) will be scheduled to land the airplane at least eight times. The three-man crew will be trained to work together as a highly efficient team so that eventually they will be able to navigate, day or night, to any place in the world and bomb, even through clouds, any target with pinpoint accuracy. Such skills are what make USAF a truly global Air Force.

Instructors in the 70th Wing at Little Rock have been selected from all over SAC. They represent the ultimate in experience and skill. Average flying time for instructor pilots is well over 4,000 hours; for instructor navigators, more than 2,700 hours. One instructor pilot has more than 9,000 hours in the air, and over 6,000 hours is not uncommon.

Most of the instructors have flown in the B-47 for more than 1,000 hours and several for more than 2,000 hours. Fifty-eight officers (instructors and staff) are "four-headed monsters" (quadruple rated as pilot, navigator, bombardier, and radar operator). Most have combat experience, and many flew in Korea as well as in World War II.

If statistics are an indication of the ability and skill of these instructors, the trained product should be outstanding. Added together, the flying experience of the instructors and staff of the 70th Wing is 512,109 hours, or the truly extraordinary total of 21,338 days—about fifty-nine and one-half years in the air.

At the end of the ninety days of training, the students will join SAC's combat-ready force. They will become a part of the alert force ready to launch a devastating retaliatory attack against any aggressor. Truly they will be tempered steel for the swords of SAC.—END

The author, Lt. Col. Warren D. Johnson, was scheduled this month to take command of a B-52 squadron, the 340th Bomb Squadron, at Blytheville AFB, Ark. At the time he wrote this article, he was Director of Operations of the 825th Air Division, Little Rock AFB. Since then he has himself taken B-52 training to prepare for his new post.


ARMY
ARMY
ARMY

Vertol selected to build new 2-3 ton transport helicopter

Vertol has been selected by the U.S. Army to develop a new 2-3 ton capacity helicopter, destined to write a new page in the mobility book of today's fast striking forces. This multi-turbine powered vehicle (Army designation the YHC-1B Chinook) is a growth version of the company-developed Vertol 107 family prototype.

The all-weather, day-night YHC-1B will be capable of performing such varied missions as redeployment, reinforcement, attack and pursuit. In a logistical role, the aircraft could transport missiles, nuclear warheads and general cargo, and evacuate casualties. Its unobstructed 30-foot long payload compartment, with a straight-in rear loading ramp that can be left partially or completely open or removed entirely to transport extra-length cargo, speeds the entry and discharge of men and materiel . . . and facilitates in-flight parachute or free-drop delivery for special missions.

The YHC-1B will not only be able to air-lift tactical units capable of completing assigned combat missions, but provide vitally needed mobility within the combat zone. This mobility is requisite in the concept of limited conflicts and, in addition, provides an important offensive and defensive weapon against nuclear attack. In a nuclear situation, the YHC-1B could provide the means for the prompt concentration of troops for attack and their equally rapid dispersion to negate effective retaliation.

All the proved advantages of tandem-rotor helicopters as pioneered by Vertol, will be inherent in this newest Army air vehicle. Large center of gravity range that permits indiscriminate seating and regrouping in flight • Low rotor downwash velocity • Excellent towing characteristics • Rotors high on airframe to permit landing in wooded terrain • Excellent hovering characteristics under varied conditions • Pilot seats low in airframe for ease in judging clearances • Easy maintenance.

Vertol's years of research in the VTOL-STOL field, personified in the YHC-1B, assure our Pentomic army the mobility, speed, flexibility and freedom from terrain that are among the nation's most potent weapons in preventing aggression.

Engineers: *Join Vertol's advanced engineering team*

VERTOL *Aircraft Corporation*

MORTON, PENNSYLVANIA

SUBSIDIARIES: ALLIED RESEARCH ASSOCIATES, INC., BOSTON, MASSACHUSETTS, VERTOL AIRCRAFT CO. (Canada) LTD., ARNPRIOR, ONT.

STRATEGY OF DETERRENCE

The implications of relying solely on conventional weapons

Marshal of the RAF Sir John Slessor

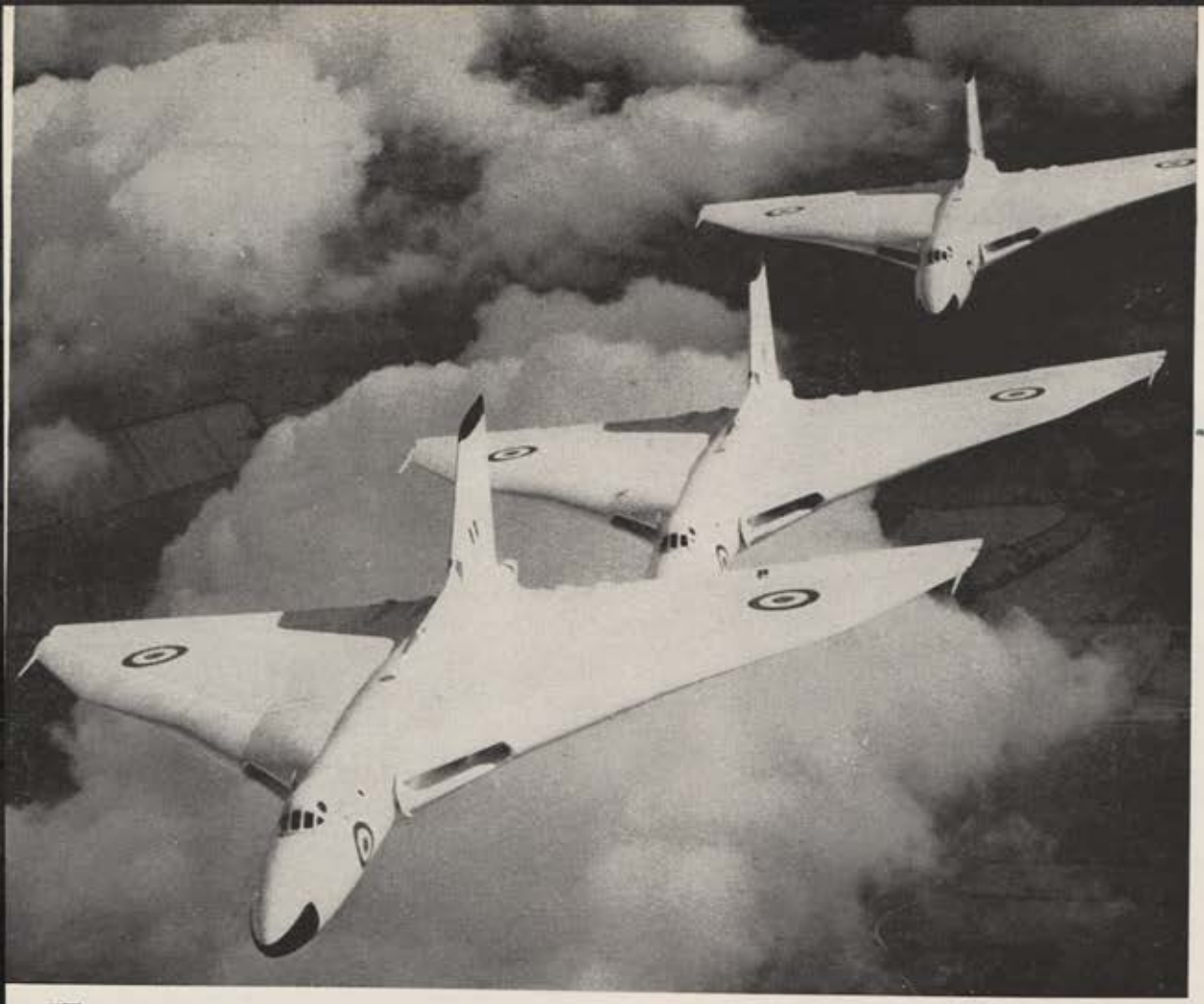
THE AIM to which the existence of the Royal Air Force is dedicated is the prevention of war. It follows that any discussion of the strategic policy governing the composition and organization of the service must be concerned mainly with what Sir Winston Churchill once called the policy of "successful deterrence operated from a foundation of sober, calm, and tireless vigilance."

This does not mean that deterrence is the exclusive responsibility of the air forces of the free world. The term "balanced forces" has become somewhat suspect; it is too often interpreted as meaning that we must all have a little bit of everything. Both in the Commonwealth and in NATO one can see examples of that interpretation being carried beyond the limits of that sound old military principle, economy of force. Nevertheless, if we are to prevent another major war while at the same time evading gradual defeat by the more insidious tactics of the termite—infiltration, subversion, minor probing attacks, and the worldwide exploitation of local unrest—there must be a proper balance between, on the one hand, our capacity for instant retaliation against all-out assault, and on the other, our ability to join with our allies in dealing promptly and effectively with lesser forms of attack, in themselves relatively minor but which cumulatively could lead to the worldwide triumph of communism. Implicit in the latter is the need for forces of the right type which, while not inexpensive when matched by the essential capacity to move them to the right place in time. can in these days be smaller than is commonly supposed.

It remains true, nowever, that the main bastion of deterrence is to be found in the striking commands of the British and American Air Forces. It is permissible to be less than satisfied with the organization and present fighting value of other elements of British military power, without caviling at the proportion of our available resources allotted to the deterrent arm of the RAF. That proportion is often grossly exaggerated, and is far less than that formerly reserved for the fighting fleet when the Royal Navy was our sure shield.

In any event it makes no sense to suggest that Britain could now contract out of a form of military power in which she was a pioneer and has still an immensely valuable contribution to make in experience, scientific ingenuity, and technique—as was shown once more by Bomber Command's success in the United States Strategic Air Command trials last year. The British share in the allied nuclear striking force, more significant than mere numbers suggest, is not only the best, perhaps the sole, means of securing anything like genuine interdependence with the United States; it is also a contribution to the over-all strength of NATO which we could not possibly afford to withdraw, and could only be replaced by something else at quite unacceptable cost in time and money.

To arrive at a reasonable assessment of the right balance of forces required, one must appreciate the true object of the deterrent. It is not a sort of Maginot Line behind which we can sit and do nothing while the real offensive comes around unguarded flanks. It does not exist to impose our will or way of life upon other people by the threat of nuclear devastation. In this second half of the twentieth century no one but a lunatic imagines that major wars can



"The main bastion of deterrence is to be found in the striking arms of the British and American Air Forces." Above, a formation of three Avro Vulcan bombers of RAF Bomber Command. Vulcan is one of "Vee" force of British bombers that complement US SAC in free world's arsenal.

still be won as they were in the centuries before Hiroshima. Those of us who have lived through two great wars can reflect sadly on the truth of Marshal Foch's dictum to the effect that the real object of fighting is to win, not the war, but the peace that follows the war. In other words, winning a war means being successful in creating conditions more favorable than if there had never been a war. That is inconceivable for either side in a nuclear age.

In this day and age, therefore, the risk that a potential aggressor will embark upon total war as an instrument of policy—as Hitler did in 1939 and the Japanese did two years later—is virtually negligible, as long as we maintain effective retaliatory power. Far more practical is the need to deter him from carrying a course of political or military action to an extreme where the risk of it spilling over into total war becomes a real danger, by presenting him with the certainty that the result would be universal catastrophe, to himself as much as to his victim.

The main object of the deterrent is thus to enable us to take such political and, when necessary, limited military action as may be required to protect our really vital interests, anywhere in the world, without being inhibited by the threat or reality of all-out war. That, of course, raises abstruse questions about what are our really vital interests, which fortunately are beyond the scope of this article. All but a very few of us, however, know in our bones that there are some things which would make life not worth living for us and our children, and therefore that we must be prepared in the very last resort to face total war, even at the risk of extinction. The best way of avoiding that risk is to leave no doubt that there are limits beyond which we will not be driven by our devotion to peace.

There are some today who seek refuge from an appalling dilemma by trying to put the clock back. There is discernible nowadays a dangerous tendency to talk about atomic stalemate; to suggest that, in fact, the nuclear striking power of the United States will never be used except in retaliation for the devastation of American cities, and therefore we must find some other way of making war unprofitable.

No one can say with certainty that miracles will not happen. We cannot be absolutely sure that the leaders of Soviet Russia will not abandon their crazy dream of a Communist world dominated by Moscow; or that some day all nuclear weapons will not be destroyed and some practical means discovered of ensuring that nuclear energy can be used only for peaceful purposes. All we can say is that at present the one seems just about as likely as the other in the foreseeable future. But we should be quite clear that, if the second happens and not the first, then indeed we should be faced with a stark alternative—one which, it cannot be said too often, is no clear alternative unless it be known beyond all peradventure that no nuclear weapons remain anywhere in the armories of the world; we should have to rely for the defense of the free world upon so-called conventional arms.

Actually, of course, there is no practical possibility whatever, short of an inconceivable miracle, of any dependable arrangement for the total abolition of nuclear weapons. Talk of prohibition is meaningless twaddle; and unilateral renunciation of nuclear capacity is to court surrender in advance. It may be well to take a passing glance at this business of categorization of weapons. In an age when we are within measurable distance of a kind of atomic machine gun, does it really make sense to go on talking about conventional and atomic weapons? Should we not accustom our minds to a new differentiation based on range and yield

"Vee" force on parade over British countryside. From top to bottom, they are Handley-Page Victor, the Vulcan, Vickers Valiant—a formidable trio with a nuclear punch.

—on the one hand, cannon and below; on the other, missiles and manned aircraft. No nation, however small, can long be expected in these days to deny themselves the former; it may not be too much still to hope that the megaton warheads and the enormously expensive means of long-range delivery may remain in the hands of only a few great powers, with special resources, experience, and qualifications.

A point here is that the former could be used anywhere with some reasonable expectation of the conflict remaining localized, which can hardly be believed of the latter—certainly not in the thickly populated and highly developed areas of Europe.

However that may be, it is urgently necessary that we should be quite clear about all the implications of the suggestion that we should fall back upon a so-called conventional basis of defense for the free world. The claim is that it would be more credible as a deterrent. Maybe it would if it ever materialized. What is totally incredible about it is that it ever would materialize. The advocates of that course point out that the free world has more manpower, money, and material resources than Soviet Russia. That is true—though the picture might look rather different in twenty years' time if the weight of the new China were thrown into the scale. But it is irrelevant. It is not that we could not match the vast military resources of Russia with an adequate defense, if everything else were subordinated to that. The point is that we should not; and indeed to attempt to do so would be political and economic lunacy.

What would it involve? To begin with, the whole strategic concept governing the shape and size of the NATO forces in Europe would have to be scrapped. Instead of twenty divisions on the central front we should need about three times that number, or their equivalent in fighting value. For us in Britain (and the same would apply proportionately to all our NATO allies) that would mean that instead of reducing the BAOR (British Army of the Rhine) from four to three divisions we should have to increase it to eight or more—with a corresponding increase in our tactical air forces.

So, far from making any saving on Bomber Command we should need more bombers, if they were to be denied the ultimate weapon, to support the conventional defenses in Europe and secure for us air superiority in a long war. Similarly, great increases would be essential in our naval strength, to enable us to ensure once more the safe and timely arrival of convoys in a prolonged global war at sea. So, far from abolishing conscription, we should have to restore it—perhaps for a period of three years instead of the former two. And we could say goodby to any economics in the Defense Vote—another £1,000 million [$2.8 billion] a year might well be not very wide of the mark.

As to the effect on our economy, it would not merely be a question of fewer television sets, washing machines, and cheap motor cars on the system of deferred payments—not just a gentle flattening in the upward curve of our standard of living. Unemployment might not rise very much because the men and women surplus to our reduced scale of peaceful industry would all be in the forces or munition factories. But we live and eat on our export trade and of that the core is in our metal-using industries, which would be the first to feel the impact of greatly increased armaments. And finally, what of our capacity to find the sinews of the real cold war, the essential rise in the scale of economic cooperation and capital investment in the uncommitted, underdeveloped countries of Asia and Africa?

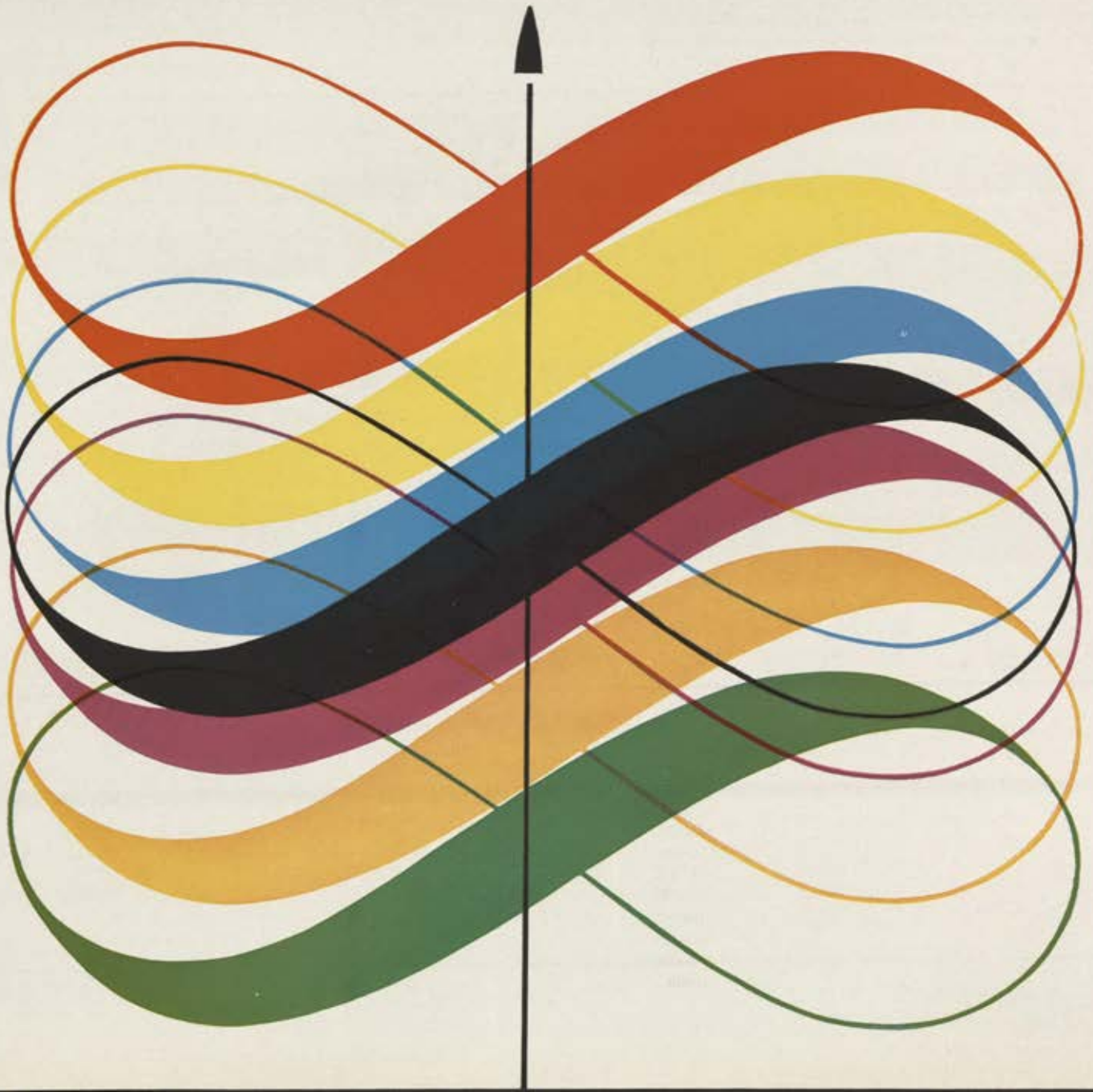
Such a program obviously makes no sense; it would surely be difficult to devise a policy that would more admirably suit the purposes of international communism. In fact, it is not really an alternative at all to the present policy of nuclear deterrence. It may be argued that the Soviets have no intention of overrunning Europe; that is true, but is anyone prepared to guarantee that it would remain so if the shield forces of NATO were not backed by the sword of a more decisive deterrent? So, unless we are to sit back and leave it all to the United States (and there is no reason to assume that they would or could carry the whole burden), the only real alternative to the present strategic concept is to accept surrender in advance. The advocates of that course are at least logical—though that is about all that can be said for them.—END

The author, Marshal of the Royal Air Force Sir John Slessor, is a retired Chief of the British Air Staff. The author of four books on air war strategy, he served in the RAF from 1915 to 1952. The above first appeared in the Times *of London.*

November • 1959

SPACE DIGEST

THE SPACE AGE IN PERSPECTIVE




CONCEIVING THE MEANS
of launching larger payloads in space is one aspect of a vast new program at Martin-Denver. If you know creative persons who should be a part of this program, urge them to communicate with N. M. Pagan, Director of Technical and Scientific Staffing, The Martin Company, P. O. Box 179 (Dept HH 2), Denver 1, Colorado
MARTIN
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VOLUME 2, NUMBER 11 • NOVEMBER 1959

SPACE DIGEST

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From the Editors...

ON PAGE 69 of this month's SPACE DIGEST we have published significant excerpts from the recently issued report of the eleven-member team of US education specialists, headed by Laurence G. Derthick, US Commissioner of Education, who toured some 100 Soviet educational institutions in the summer of 1958, then came home to write a 135-page document that ought to be required reading for anyone who isn't especially concerned about the shortages in our own educational system that have been pointed up by such vocal critics as Vice Adm. Hyman G. Rickover, to cite someone who has spoken out on the subject in no uncertain terms.

It is obvious, even from the excerpts that appear on these pages, that the Soviets believe passionately in total education as a means of outrunning us. Apparently, in the Soviet Union, there is just no question of where the money is to come from for educational plant and personnel. What is needed is provided; there are no parent-teacher groups canvassing the complacent for their pro votes on school bond issues in the suburbs.

Our heritage precludes, happily, Soviet-style educational policy by fiat. Which is all the more of a challenge. In our country, the federal government guides and suggests state and local educational policy, but does not dictate it.

The serious question, more serious all the time, is: Will our free society face up to the need for a national approach to educational policy that will ensure equalized, high standards in every local community, and in an atmosphere of freedom?

It isn't a matter of imitating the Russians. It's a matter of willingness to buy and use the best educational system available for ourselves.

Protectively clad against 400-degree heat whipped up by 3,500-mph wind in tunnel, NASA mechanic checks rocket engine model after a test.

NASA technician works on construction of form-fitting contour couch for Mercury program. Astronauts will have individually molded seats.

A SPACE DIGEST Photo Report

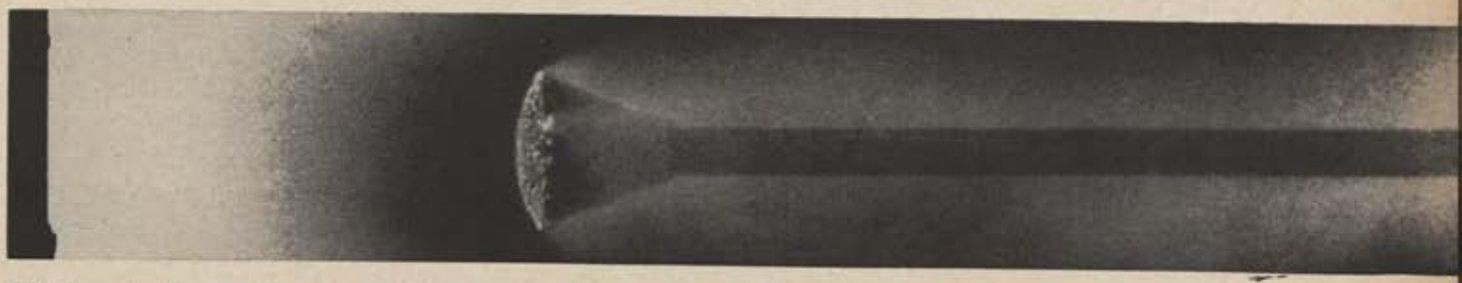
NASA SHOWS ITS SPACE AGE WARES

FOR decades, the scientists and officials of the old National Advisory Committee for Aeronautics proudly unveiled highlights of its research program at the annual NACA Inspection—always a red-letter day for the aeronautical world.

NACA's successor agency—the National Aeronautics and Space Administration, continuing the custom, held its First Annual Inspection at Langley Research Center, Hampton, Va., the week of October 12. Hundreds of aerospace specialists from government, the military, industry, and press attended the series of day-long programs, repeated each day of the Inspection week.

On the tours, the visitors heard lectures and saw demonstrations of aerospace technology ranging from experimental versions of cars that ride inches off the ground to such esoteric studies as magneto-plasmadynamics, the actions of ionized gases, and ion propulsion techniques.

Stressed too, at the Inspection, was NASA's continuing research in aerodynamics. Visitors saw studies in supersonic transport configurations, forecasts of the sort of multi-Mach craft you may dash to Europe in not too many years from now. A fine aerospace show.—END

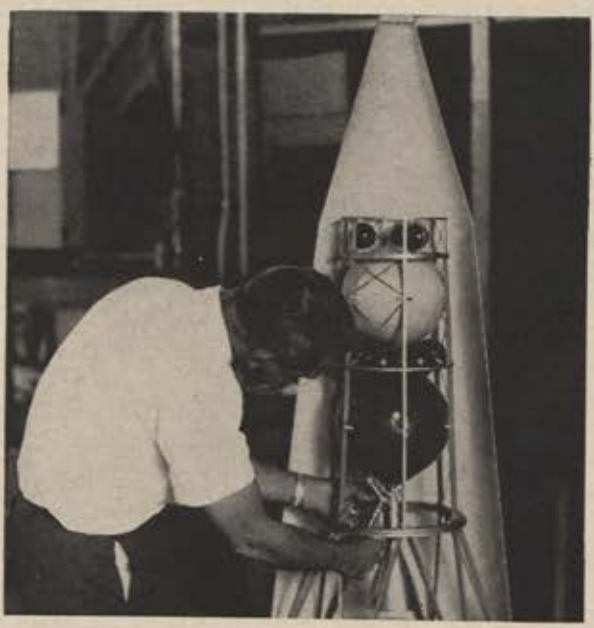


NASA scientists at Langley subject materials to fiery heat blasts in support of Project Mercury.

Ion propulsion research model at Lewis Center is part of continuing NASA space systems work.

Shapes of wings to come? NASA tests models of proposed hypersonic rocket-boosted gliders.

New space age science, magneto-plasmadynamics, actions of ionized gases, under study at NASA.



Jet Propulsion Lab engineer makes measurements on model of stage of NASA's Vega engine system.

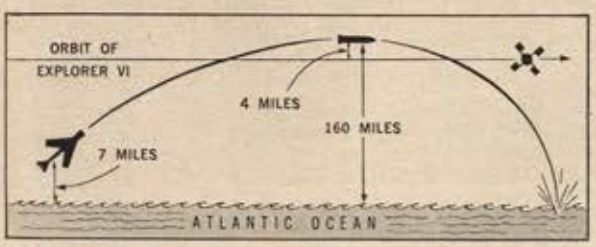
Giant shock tube blasts projectile through high-speed flight in reentry study as camera records.

Lunik III, Bold Orion, Explorer VII, and . . .

THE WAITING GAME

THE SPACE show goes on—on both sides of the Iron Curtain. But somehow, on our side it has evolved into something of a waiting game. With a certain disquiet, we wait for new Soviet "spectaculars" to succeed the unnerving Lunik II moon impact and the Lunik III moon-earth orbiter. At the same time, an increasing number of people wonder if a specific set of goals in the technological war with the Soviets *is* or *is not* going to be agreed on and implemented by the national leadership.

It is a strange spectacle. Quietly, a Congress which had raised a loud furor after Sputnik seems



Newest space weapon? Mid-October air launch of Bold Orion missile by B-47 crew to orbit of Explorer VI satellite encouraged official belief in feasibility of catching and destroying satellites. Bold Orion came close to path of Explorer VI.

to have lapsed back into a budget-cutting mood, with both political parties gearing for a campaign in which the opposition will be accused of the "real" responsibility for penny pinching that already has the National Aeronautics and Space Administration stretching lead times for its projects, the Air Force seriously worried about how it can manage operating its force in being *and* its newly spelled out space missions, and the Army reporting that it hasn't the money to complete the Saturn million-pound-thrust program.

Against this fuzzy background of political indecision, it is pleasant to note the US space progress of the last month, accomplishments of dedicated people who just keep plugging, undaunted by the lack of alarms in Washington.

October saw the highly successful launching from Cape Canaveral, of the Explorer VII satellite for NASA, powered by the Jet Propulsion Laboratory-Army Ballistic Missile Agency-developed Juno II four-stage rocket. Explorer VII's ninety-odd-pound payload is expected to return valuable data on solar radiation, and weather-forming processes from its nearly circular 346-mile perigee, 664-mile apogee orbit.

The same day Explorer VII joined the celestial company, the Air Force successfully air launched a two-stage missile toward the orbit of Explorer VI, getting within a very few miles (reported as about four miles) of the path of the "paddle-wheel" satellite. This was an amazing demonstration of the potential of antimissile and anti-satellite tactics.

Talent is not lacking. Money, decisions, and goals seemingly still are. The increasingly significant question is how long we dare delay our full-scale effort. It is a dangerous waiting game.

—WILLIAM LEAVITT

The 108-megacycle transmitter aboard Explorer VII, fired into orbit October 13 to obtain radiation data. Satellite was powered by a Juno II.

SOVIET EDUCATION—
TARGET: SUPERIORITY

From* Soviet Commitment to Education, *the report of the first US official education mission to the USSR.

THE ONE fact that most impressed us in the USSR was the extent to which the nation is committed to education as a means of national advancement.

Wherever we turned we heard the slogan: "Reach and overreach America." And everywhere, the people seem to respond in the conviction that education is the best means of winning world supremacy.

Education reaches far beyond school-age children and youth and is eagerly sought by hundreds of thousands of full-time workers who are also full-time students; hundreds of thousands of others take correspondence courses.

They have been building schools and universities at a rapid pace. Down on the borders of China where only a half century ago the people were almost one hundred percent illiterate, we saw thriving schools, an impressive scientific academy, and other institutions that have reduced illiteracy and advanced knowledge to an astonishing degree.

Even though education in the USSR is controlled by the government and is therefore standardized and regimented, there is some flexibility of operation. Furthermore, decisions on policy, on textbooks, on teacher training, on curriculum, and on similar matters are not always made arbitrarily. We found fairly widespread evidence that before making decisions on education, the government seeks opinions from specialists at all levels.

The fact that Soviet educational administration is centralized has often been commented upon. In outward form, however, the Soviet school system is decentralized, with fifteen republic Ministries of Education and many regional and local departments of education. The official pattern before one's eyes is therefore diversity, not uniformity; diffusion, not centralization. Uniformity in educational policies and methods is nonetheless real.

Educational policies (including those on science and research) and administration are controlled at three different political centers by appropriate bodies responsible for these fields: by federal governmental agencies (ministries and bureaus), by federal organs of the Communist Party, and by republic bodies of both government and Party.

At the bottom of school organization are the nurseries which serve children up to three years of age and at the top the research institutes. Between these two extremes are the main institutions of the Soviet school system: the kindergarten, serving children between the ages of three and six; the general education school, offering grades from one to ten; and the universities and institutes.

Parallel to the upper three grades of the general schools are varieties of technicums and pedagogical schools, which are increasingly giving post-secondary education, and schools for urban and rural youth which offer a general education course to young workers.

While exact figures on the total cost of education annually in the USSR are difficult to obtain, it is generally conceded that from ten to fifteen percent of the total national income is channeled into education.

The Soviet system of education is built basically around the general school.

The program of general education consists of four elementary school years and six secondary school years. A single unified curriculum is planned for the elementary or four-year school, for seven-year (incomplete secondary), and for the ten-year (secondary).

All general schools are coeducational, attendance is compulsory through the seventh grade, and attendance records are carefully checked. Under a recent Soviet educational reorganization plan for 1959-1963, compulsory education has been increased to eight years.

We were impressed with the abundance of equipment — charts, maps, three-dimensional teaching aids — and by the quality and quantity of laboratory and shop facilities.

The school year begins on September 1 and

How Lockheed-built satellites are

Making space travel safe for man

Before man can be sent into the emptiness of space, we must know how to protect him against the hazards of weightlessness and cosmic radiation—and how to bring him safely back to earth.

The United States is using every scientific means to solve these problems. The satellites in the Discoverer program of the Advanced Research Projects Agency—Lockheed-built Agena vehicles—are one of the means to achieve this end.

ARPA's Discoverer program is being executed by the Air Force's Ballistic Missile Division, ARDC. Lockheed's Missiles and Space Division is prime contractor and system manager of a team that includes Douglas, General Electric and Bell.

The Agena is by far the nation's largest satellite now in orbit—19 feet long, 5 feet in diameter. It weighs almost a ton when in orbit.

It was designed to be put into polar orbit—the most difficult of all to achieve. Four Agena satellites have been placed in completely successful polar orbits; more are on the way.

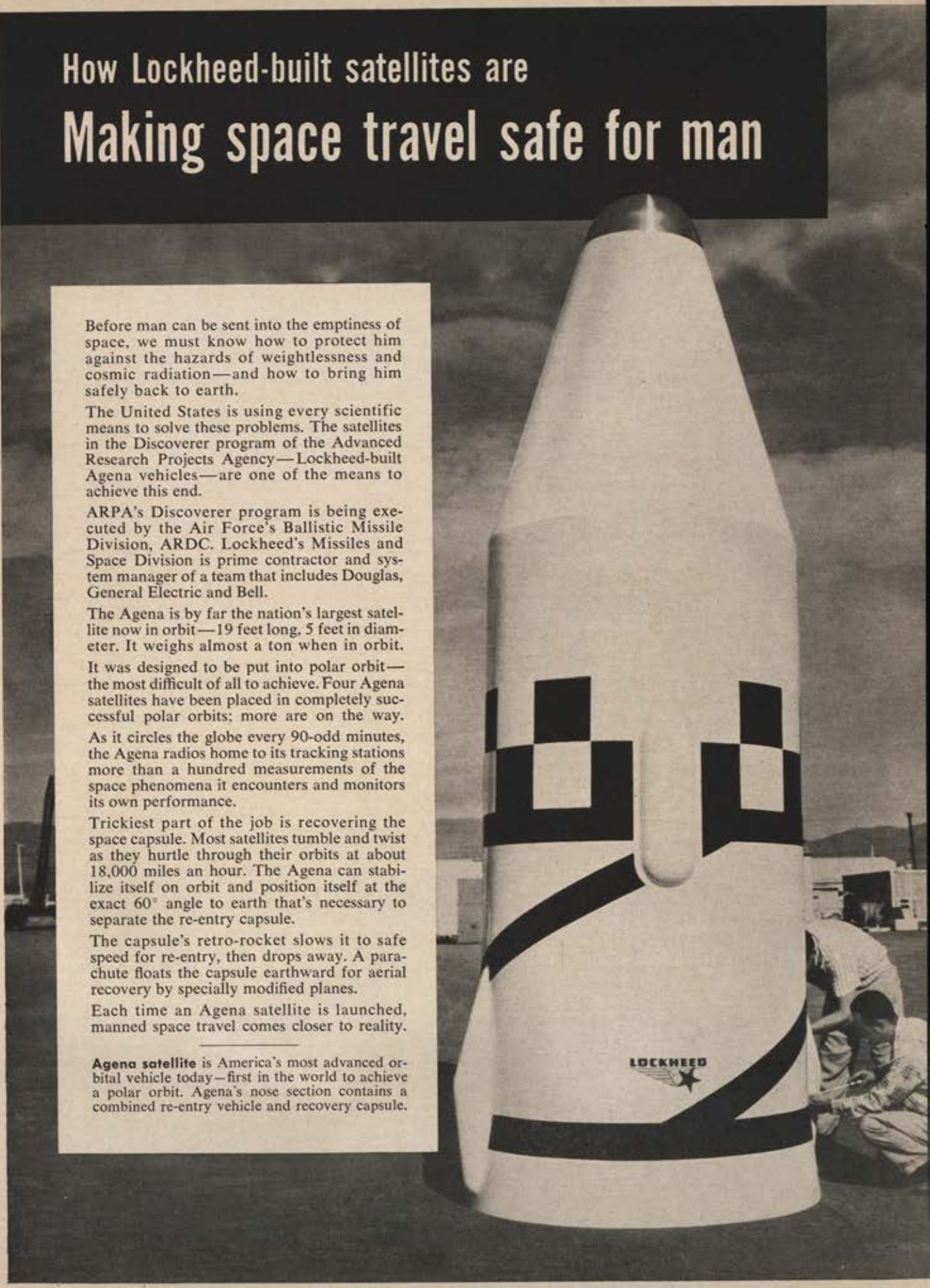
As it circles the globe every 90-odd minutes, the Agena radios home to its tracking stations more than a hundred measurements of the space phenomena it encounters and monitors its own performance.

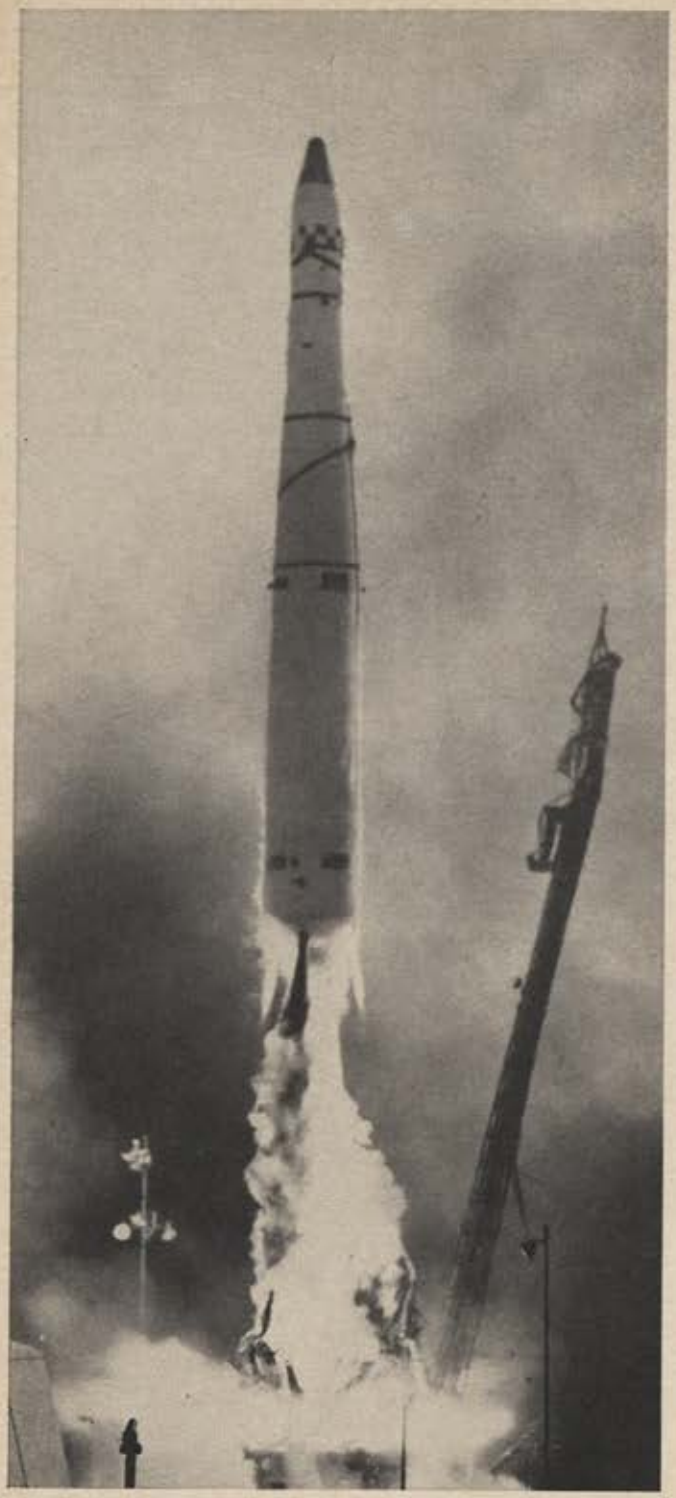
Trickiest part of the job is recovering the space capsule. Most satellites tumble and twist as they hurtle through their orbits at about 18,000 miles an hour. The Agena can stabilize itself on orbit and position itself at the exact 60° angle to earth that's necessary to separate the re-entry capsule.

The capsule's retro-rocket slows it to safe speed for re-entry, then drops away. A parachute floats the capsule earthward for aerial recovery by specially modified planes.

Each time an Agena satellite is launched, manned space travel comes closer to reality.

Agena satellite is America's most advanced orbital vehicle today—first in the world to achieve a polar orbit. Agena's nose section contains a combined re-entry vehicle and recovery capsule.





Boosted into space by the 150,000-pound thrust of an Air Force Thor missile, the second-stage Agena satellite is powered into orbit by its own liquid-fuel rocket engine of 15,000 pounds thrust.

Once in orbit, the Agena satellite radios back to its tracking stations more than a hundred measurements of its performance and of the conditions it encounters as it circles the earth at 18,000 mph.

LOCKHEED

MISSILES AND SPACE DIVISION

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RAMJET PROPULSION TESTING

ends between May 20 and June 20, with a twelve-day winter holiday and a ten-day spring holiday. Since the Soviet pupil puts in six days a week at school, in ten years he spends about the same number of days in school as the US pupil does in twelve years.

The standard curriculum offered in the RSFSR [Russian Republic] schools is shown below:

Grades 1-3: Russian language and literature, arithmetic, drawing, singing, physical education, and introduction to manual training.

Grade 4: History, geography, and elementary biology—largely nature study—are added to subjects taught in grades 1 to 3.

Grades 5-10: Russian language and literature, foreign language, history, arithmetic, algebra, geometry, trigonometry, physics, chemistry, botany, zoology, anatomy, Darwinism, geography, astronomy and drafting, polytechnical training (agricultural and industrial training), drawing, singing, and physical education.

Mathematics, Russian language and literature, and physical education are required in all grades. Mathematics and science are particularly emphasized throughout the general school.

Only one foreign language is required in the basic curriculum (instruction begins in grade 5 and continues through grade 10), and a pupil has a choice. He may study a second language in an extracurricular language club.

In the four-year primary school, the arithmetic curriculum is designed to carry Soviet children through a program covering the four operations of arithmetic, real and imaginary numbers, the metric system, the measurement of time, decimals, and the rudiments of geometry.

The mathematics course, which includes arithmetic (grades 5 to 6), algebra and geometry (6 to 10), and trigonometry (9 to 10), is particularly designed for polytechnical education.

Science education for Soviet children includes scientific training through in-school and out-of-school programs.

Science education for Soviet pupils begins in the kindergarten. There a ground work for scientific habits in the observation of natural phenomena and plant and animal life is laid. In the elementary grades courses in biology, chemistry, and physics are comparable to good elementary science courses in US schools.

Physics — Among the subjects of particular importance is physics, which aims at acquainting the pupil with natural phenomena *and the basic principles of production processes.*

In grades 6 and 7 pupils become acquainted with principles of mechanics and heat and electrical phenomena. In grades 8 to 10 the principles of mechanics, acoustics, molecular physics, as well as heat, electricity, optics, and the atom.

Chemistry—The study of chemistry begins in the seventh grade with elementary instructions on substances and their transformation; on atomic and molecular studies and the principal laws of chemistry; on oxides and the bases of acids and salts; and on the properties of oxygen, hydrogen, the air, and water. After this, pupils prepare for a systematic course in grades 8, 9, and 10, where the work plan calls for a study of chemical elements.

Biology—A systematic course in biology includes the study of botany (grades 5 to 6), zoology (grade 7), human anatomy and physiology (grade 8), and the principles of general biology (grade 9) which stresses the practical aspects of agriculture.

Astronomy—In the tenth grade an introduction to astronomy is given.

Polytechnical influence — The polytechnical emphasis in the general school has modified the content of physics, chemistry, biology, and mathematics. Science subjects, although important in the training of "future" scientists, now have the major function of establishing an educational foundation for a polytechnical system of training which prepares a large number of students for practical industrial work.

During the last few years the Soviets have been planning, experimenting with, and now are gradually adopting what they call a polytechnical program. The polytechnical program was used in twenty-five percent of the Soviet schools in 1957-58 in addition to the general education program, which was reduced slightly. In 1958-59 the plan

will be followed in fifty percent of the schools.

More than 180,000 teachers are employed in schools at all levels in the USSR and all have had some pedagogical training.

Soviet educators are very much concerned with teaching methods; methods are emphasized in teacher-training institutes, in textbooks, in published literature, and in in-service training.

The teaching we observed, the recitations we heard, and the copybooks we saw indicated that there was much rote learning.

Salaries of teachers in general schools are fixed, but the scale varies according to the region and the teacher's position and years of service.

Salaries of beginning teachers are equal in general to those of doctors and engineers, and they can make extra money by increasing their teaching load or serving as group leaders in young pioneer circles. Merit teachers get higher salaries or a bonus. There are periodic increases, according to length of service, after five and ten years. Pensions are granted after twenty-five years, but a teacher with more than twenty-five years of service who continues to work receives both pension and salary.

All teachers work for ten months of the year, with a two-month vacation in the summer at regular pay. They are required, however, to spend two weeks in August preparing for the next school year.

Considerable attention is given to the preparation of semiprofessional technical personnel in the USSR—technicians whose competence lies between that of the skilled worker and the professional specialist. Such workers are trained in special secondary establishments called technicums. Thus there are technicums for training workers for the power industry, the medical profession, light industry, and for others. Technicums have undergone remarkable growth over the years. In 1955 there were 3,757 technicums in 852 cities with a total enrollment of 1,961,000 students and a total staff of 96,000 teachers.

Soviet educators are in the process of achieving two major objectives that have in recent years been the concern of our own teacher educators in the United States: (1) To unify all teacher education, and (2) to bring all teacher education to a college- or university-degree-level status.

In the preparation of both elementary and secondary school teachers, there appeared to be an increasing emphasis on solid subject-matter content, with relatively less emphasis on pedagogy as such.

Soviet teacher educators consider practical work, that is—observation of teaching, student participation in the classroom situation, and student teaching—to be of the highest importance for teachers in training.

The selectivity in teacher education is approximately five to one; that is, out of approximately five students who apply for admission to an institution of teacher education, one is accepted. At this time there appears to be no numerical shortage of teachers in the Soviet Union.

Teachers are not overburdened with extracurricular work. Their clerical duties are minimal. Although schools in the Soviet Union meet six days a week, each teacher has one work day a week completely free.

Perhaps the most important influence in Soviet educational progress is the Academy of Pedagogical Sciences of the RSFSR, an institution which has no counterpart in the United States. The Academy is the research, development, and resource organization that keeps the educational system moving ahead and improves curriculum and methods of teaching. It is a part of the Russian Republic, not the Soviet Union generally, but as none of the other Republics has such an academy its work is used throughout the country.

Although the Academy is only fourteen years old, it is of considerable size and complexity. Its members, who are elected for life, are some of the most distinguished scientists in the USSR. It is presently staffed by thirty-four full members who devote full time to Academy work, fifty-four corresponding members who devote part time to it, and 550 research workers.

It maintains eight research institutes, seven in Moscow and one in Leningrad. Of the many aspects of the work of the Academy of Pedagogical Sciences, three are of particular interest —the development of textbooks, the development of teaching aids, and the work of the department of comparative education which studies education programs in other countries.

Due very largely to the work of the Academy of Pedagogical Sciences, education in the USSR is not static but is constantly changing and improving.—END.

The above is condensed from Science Magazine's *October 9, 1959 excerpts from the 135-page report of the eleven-man US education team which visited 100 Soviet educational institutions in 1958.*

Childhood's end for the race of men could be brought about by astronautics, forecasts a noted British scientist-writer who long before Sputnik wrote confidently of man's ventures into space. But the successful birth of the new era will depend, he says, on our proper choice of . . .

Means and Ends in the Space Age

ARTHUR C. CLARKE

IT HAS sometimes been said that the main obstacles to interplanetary flight are not technical, but political and economic. There is always an immense resistance to any change and a desire to preserve the *status quo*. Protagonists of spaceflight frequently used to meet the remark: "Why go to the moon? What's wrong with this earth anyway?" Although the latter question is seldom encountered these days, it has been succeeded by the query: "Why not devote all this effort to developing our own world before going to others?"

We have already given several answers to this question, pointing out that many of the indirect consequences of space travel will in fact help us to develop our own world—probably in ways at least as unforeseeable as those in which the American oil fields and farm lands assisted the development of Europe.

There is, however, a much more fundamental reply to this question, and one cannot help thinking that those who ask it have overlooked the facts of human nature. One wonders if they would have asked Phidias, when he was starting work on the Parthenon frieze, why he was not engaged on something useful like rebuilding the Athenian slums. If he had kept his temper, the artist would probably have answered that he was doing the only job that interested him. So it is, in the ultimate analysis, with those who want to cross space.

There are, it seems, some people who have definite psychological objections to spaceflight. In certain cases this has a religious basis—it is a new form of the old feeling that, in some mysterious way, there are things that "man was never intended to do." We do not know a better way of demolishing this superstition than by referring to the old lady who remarked that airplanes were undoubtedly an invention of the Devil, "since men should travel in trains as God intended them to."

Others, one suspects, are afraid that the crossing of space, and above all contact with intelligent but nonhuman races, may destroy the foundations of their religious faith. They may be right, but in any event their attitude is one which does not bear logical examination—for a faith which cannot survive collision with the truth is not worth many regrets.

In the long run, the prospect of meeting other forms of intelligence is perhaps the most exciting of all the possibilities revealed by astronautics. Whether or not man is alone in the universe is one

Impossible or Elementary?

Even its most enthusiastic supporters do not deny that the conquest of space is going to be a very difficult, dangerous, and expensive task. The difficulties must not, however, be exaggerated, for the steadily rising tide of technical knowledge has a way of obliterating obstacles so effectively that what seemed impossible to one generation becomes elementary to the next. Once again the history of aeronautics provides a useful parallel. If the Wright brothers had ever sat down and considered just what would be needed to run a world air-transport system, they would have been appalled at the total requirements—despite the fact that these could not have included all the radio and radar aids which were undreamed of fifty years ago. Yet all these things—and the vast new industries and the armies of technicians that lie behind them—have now become so much a part of our lives that we scarcely ever realize their presence.

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of the supreme questions of philosophy. It is difficult to imagine that anyone could fail to be interested in knowing the answer—and only through space travel can we be sure of obtaining it.

There is little likelihood of encountering intelligence elsewhere in the solar system. That contact may have to wait for the day, perhaps ages hence, when we can reach the stars. But sooner or later it must come.

There have been many portrayals in literature of these fateful meetings. Most science-fiction writers, with characteristic lack of imagination, have used them as an excuse for stories of conflict and violence indistinguishable from those which stain the pages of our own history. Such an attitude shows a complete misunderstanding of the factors involved.

It has already been pointed out that ours must be one of the youngest cultures in the universe. An analogy due to Sir James Jeans may help to emphasize this point. Take a penny, lay a postage stamp on it, and put both on top of Cleopatra's needle. (For the benefit of those unfamiliar with the Victoria Embankment or Central Park, these obelisks are about seventy feet high.) The column then represents the age of the world, the coin the whole period of man's existence, and the stamp the length of time during which he has been slightly civilized. The period during which life will be possible on earth corresponds to a further column of stamps certainly hundreds of yards, and perhaps a mile, in height.

Thinking of this picture, we see how very improbable it is that the question of interplanetary warfare can ever arise. Any races we encounter will almost certainly be superhuman or subhuman —more likely the former. Only if we score a bull's eye on that one stamp—indeed on a fractional thickness of that stamp—in the mile-high column will we meet a race at a level of technical development sufficiently near our own for warfare to be possible. If ships from earth ever set out to conquer other worlds they may find themselves, at the end of their journeys, in the position of painted war canoes drawing slowly into the New York harbor.

What, then, if we ever encounter races which are scientifically advanced yet malevolent—the stock villains, in fact, of that type of fiction neatly categorized as "space-opera"? In that event, astronautics might well open a Pandora's Box which could destroy humanity.

This prospect, though it cannot be ruled out, appears highly improbable. It seems unlikely that any culture can advance, for more than a few centuries at a time, on a technological front alone. Morals and ethics must not lag behind science, otherwise (as our own recent history has shown) the social system will breed poisons which will cause its certain destruction. With superhuman knowledge there must go equally great compassion and tolerance. When we meet our peers among the stars, we need have nothing to fear save our own shortcomings.

Just how great these are is something we seldom stop to consider. Our impressions of reality are determined, far more than we imagine, by the senses through which we make contact with the external world. How utterly different our philosophies would have been had nature economized with us, as she has done with other creatures, and given us eyes incapable of seeing the stars! Yet how pitiably limited are the eyes we do possess, tuned as they are to but a single octave in the spectrum! The world in which we live is drenched with invisible radiations, from the radio waves which we have just discovered coming from sun and stars, to the cosmic rays whose origin is still one of the prime mysteries of modern physics. These things we have discovered within the last generation, and we cannot guess what still lies beyond the threshold

of the senses—though recent discoveries in paranormal psychology hint that the search may be only beginning.

The races of other worlds will have senses and philosophies very different from our own. To recall Plato's famous analogy, we are prisoners in a cave, gathering our impressions of the outside world from shadows thrown upon the walls. We may never escape to reach that outer reality, but one day we may hope to reach other prisoners in adjoining caves, where we may learn far more than we could ever do by our own unaided efforts.

Yet space travel will not, as some fear, destroy the mystery of the universe. On the contrary, it may indeed increase it. Although many specific problems will be solved, and many doubts settled our area of contact with the unknown will be enormously magnified. This has always been the case with scientific research: It should never be forgotten that, despite all our knowledge, we live in a far more wonderful and even more mysterious world than did our ancestors. We will not exhaust the marvels of the physical universe until we have explored the whole cosmos—and *that* prospect is still, to say the least, satisfyingly remote, if indeed it is theoretically possible. We have scarcely begun a voyage of discovery which may never have an end.

Somewhere on that journey we may at least learn what purpose, if any, life plays in the universe of matter: Certainly we can never learn it on this earth alone. Among the stars lies the proper study of mankind: Pope's aphorism gave only part of the truth. For the proper study of mankind is not merely man, but intelligence.

I am not unmindful of the fact that fifty years from now, instead of preparing for the conquest of the planets, our grandchildren may be dispossessed savages clinging to the fertile oases in a radioactive wilderness. We must keep the problems of today in their true proportions: They are of vital—indeed of supreme—importance, since they can destroy our civilization and slay the future before its birth. But if we survive them, they will pass into history and the time will come when they will be as little remembered as the causes of the Punic Wars. The crossing of space—even the sense of its imminent achievement in the years before it comes—may do much to turn men's minds outward and away from the present tribal squabbles. In this sense the rocket, far from being one of the destroyers of civilization, may provide the safety valve that is needed to preserve it. Spaceflight does not even have to be achieved for this to happen. As soon as there is a general belief in its possibility, that belief will begin to color man's psychological outlook.

We stand now at the turning point between two eras. Behind us is a past to which we can never return, even if we wish. Dividing us now from all the ages that have ever been is that moment when the heat of many suns bursts from the night sky above the New Mexico desert—the same desert over which, a few years later, was to echo the thunder of the first rockets climbing toward space. The power that was released on that day can take us to the stars, or it can send us to join the great reptiles and nature's other unsuccessful experiments.

The choice is ours. One would give much to know what verdict a historian of the year 3000—as detached from us as we are from the Crusaders—would pass upon our age, as he looks back at us down the long perspective of time. Let us hope that this will be his judgment:

"The twentieth century was, without question, the most momentous hundred years in the history of mankind. It opened with the conquest of the air, and before it had run half its course had presented civilization with its supreme challenge—the control of atomic energy. Yet even these events, each of which changed the world, were soon to be eclipsed. To us a thousand years later, the whole story of mankind before the twentieth century seems like the prelude to some great drama, played on the narrow strip of stage before the curtain has risen and revealed the scenery. For countless generations of men, that tiny, crowded stage—the planet earth—was the whole of creation, and they the only actors. Yet toward the close of that fabulous century, the curtain began slowly, inexorably to rise, and man realized that the earth was only one of many worlds; the sun only one among many stars. The coming of the rocket brought to an end a million years of isolation. With the landing of the first spaceship on Mars and Venus, the childhood of our race was over and history as we know it began."—END

The author, Arthur C. Clarke, is one of the world's outstanding writers on space exploration. Mr. Clarke's books include The Exploration of Space, The Making of a Moon, Exploration of the Moon, *and* Interplanetary Fight. *The above is from* Exploration of Space, *Revised Edition, Copyright 1951, 1959 by Arthur Charles Clarke. Reprinted with the permission of Harper & Bros.*

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The Army's AN/USD-2 is today's most advanced drone system for gathering information on enemy battlefields. This high-priority Army program is a major part of Aerojet's acquisition of the Rheem Defense and Technical Products Division at Downey, California. Under the cognizance of Aerojet's Aeronautical Division, the SD-2 project is receiving increased emphasis during its advanced system development stages.

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THE CHALLENGE of the space age is unique to human history. For once we have an opportunity to lay the educational, philosophical, and moral groundwork for a revolutionary period of technology *before* the fact rather than after; to attempt to *avoid* problems rather than waiting to solve them after they have occurred; to *anticipate* crises. . . ."

"In this great effort, technical societies are doing all they can to advance the state of the art in missiles, rockets, and space technology in general. Specialized magazines find their niche in reporting technical progress. But someone, we submit, should worry about fitting the pieces together, keeping them in perspective, recognizing that we are living in the jet age, the missile age, and the space age all at once, with grave problems of national security coloring our effort in all three fields. Through proper understanding of these factors, we can achieve economic growth on a scale hitherto unknown to mankind. . . ."

The above quotations are from our October 1958 announcement of the addition of SPACE DIGEST as a magazine-within-a-magazine bonus to the 70,000 readers of AIR FORCE Magazine.

"We will continue to bear in mind, as we discuss outer space, the imperative need to maintain a free world to take off from and return to. In short, we wish to invite our readers to enter the space age in an editorial environment that applies calm reason and broad perspective to the greatest adventure in history. We look forward to an eventful journey."

Those were the concluding words of our announcement of SPACE DIGEST.

This month marks the first anniversary of SPACE DIGEST.

Our first year has been indeed an eventful journey, a stimulating intellectual experience, we believe, for our readers, and we hasten to add, ourselves.

Life on other worlds . . . bringing up children in the space age . . . staying young by traveling at nearly the speed of light . . . the state of the art in human space travel . . . when did time begin? . . . can there be such a thing as space control?

These are just a few of the significant subjects that have been explored by some of the world's leading thinkers on the pages of SPACE DIGEST.

SPACE DIGEST

In the past twelve months, SPACE DIGEST has carried articles by such leading authorities as A. C. B. Lovell of the famed Jodrell Bank Observatory in Britain; anthropologist Margaret Mead; space-age prophet Arthur C. Clarke, who years before Sputnik forecast many of today's astronautical commonplaces; Harlow Shapley, noted US astronomer; Dr. Hubertus Strughold, the US Air Force's "father of space medicine"; T. Keith Glennan, Administrator of the National Aeronautics and Space Administration, on whose shoulders rests the heavy burden of the US civil space effort; Lt. Gen. Bernard A. Schriever, the Commander of the Air Force's Air Research and Development Command; Edward Teller, father of the H-bomb; and many others.

Also, SPACE DIGEST has presented a month-by-month report—in nontechnical terms—of the big space stories, the launchings, successes, and failures and what they have meant in our country's race to keep pace with burgeoning Soviet technological power. As an extra feature, designed to keep readers informed of the "less glamorous" space-age stories, SPACE DIGEST's "Speaking of Space" column has been a valuable compendium.

In addition, SPACE DIGEST's series on the US National Space Effort has told the story of the multiplicity of effort in US astronautics and raised questions that have been discussed searchingly on the highest levels. In succeeding articles the series has described the contributions of the military services, and other agencies, as part of a total effort to keep readers informed of the ebbs and flows of US astronautical tides.

In the year since SPACE DIGEST's inception, its editors have culled hundreds of publications, speeches, and published reports, to select the cream of today's writing on the space age in perspective. Sources have ranged as far afield as *Playboy* Magazine on one extreme and Russian technical journals on the other. In addition to specifically "space" articles we have published material on general scientific advance, in the belief that the space age transcends rocketry.

It has been a worthy experiment—unique in the aerospace publishing field. And as we enter our second year of publication, it is our intent to provide our readers with more of the best in space-age ideas to help them and us understand more clearly the new era.—THE EDITORS

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UFOs remain a mystery, but their color, movement, and disappearances may be explained by a new theory that suggests "saucers" may be the remnants of space-born icebergs which many scientists now believe are the stuff of those eerie visitors from the void—comets . . .

A THEORY ABOUT FLYING

DONALD H. ROBEY

IT IS widely known that in the year 1947 many people in many places began to report "flying saucers" and other strange objects in the sky. It is not so well known —only astronomers are, in fact, aware—that in the year 1947 earth's neighborhood of interplanetary space was visited by more comets than ever before.

I intend here to suggest a relationship between these two phenomena.

Comets are one of the great historical mysteries of the cosmos. In ancient times they were greeted as heralds of disaster: fire, flood, pestilence, war. The first question early astronomers asked about comets was whether these visitors came from within the solar system or originated among the stars beyond. Isaac Newton answered that one in his *Principia* by describing a method of delineating cometary orbits. Comets, he found, obey the same laws of motion that Johannes Kepler discovered were applicable to the travels of earth and other planets of the sun.

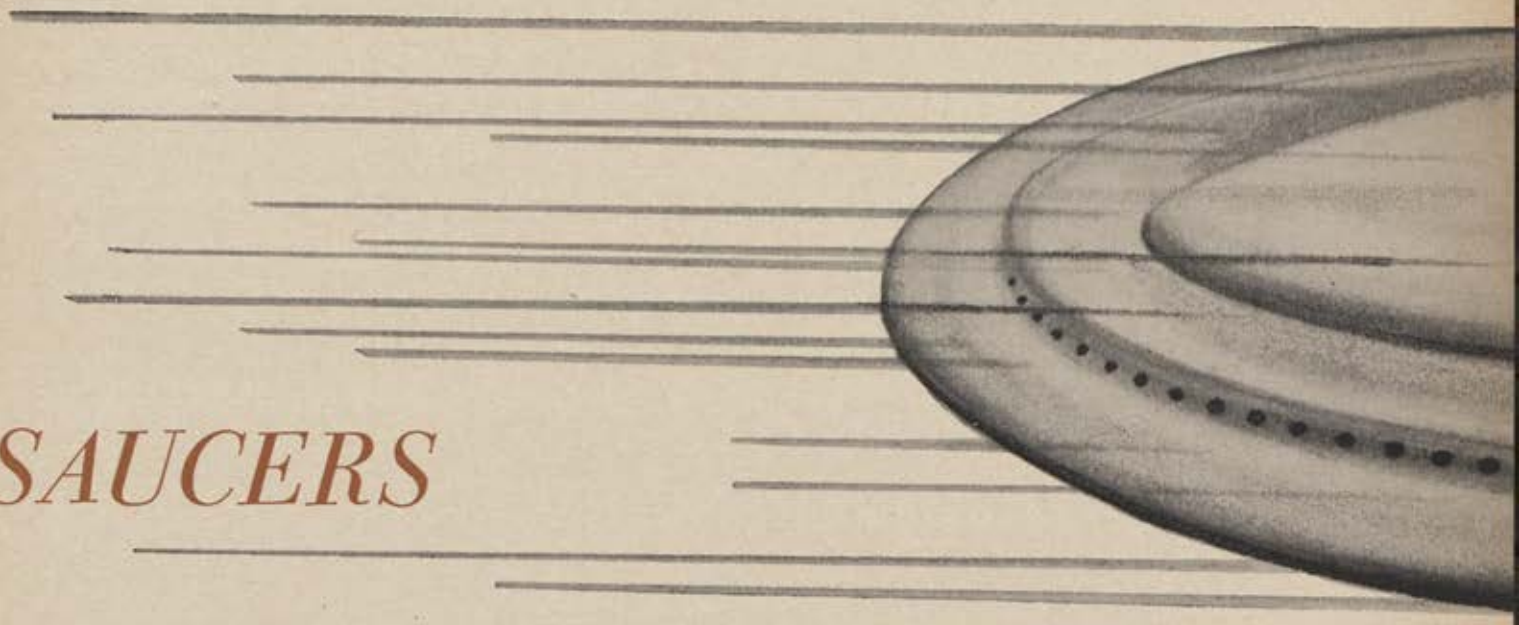
Edmund Halley followed up Newton's mathematical feat by tracking backward through time a brilliant comet he personally observed in 1682. Convinced by his calculations that this was the same comet that had appeared in 1305 and 1456 and 1531 and 1607, Halley accurately predicted its reappearance in 1758. Since Halley's day, the identical comet has been confirmed as a regular visitor to earth's vicinity since 240 B.C. Thus we know that some comets live for thousands of years.

Once comets were definitely established as members of the solar system, the next logical question was: What are they made of?

It was believed quite generally, until the last decade, that comets were flying gravel banks. However, if comets were flying gravel banks, many of them which have passed close to the sun or to Jupiter in the past (and have remained intact) would have fallen apart or been disrupted by the pull of gravitational tides. Also gases released during passages close to the sun would have tended to disperse the gravel.

Actually, all the strange characteristics of comets can be explained if the nuclei of comets are assumed to be gases frozen into icebergs adrift in space. This notion was first analyzed by Dr. Fred Whipple of the Harvard Observatory. The Whipple theory now commands widespread acceptance among astronomers. It is in harmony with the idea of a cloud of comets surrounding the solar system.

Professor J. H. Oort, Director of the Leyden Observatory in Holland, has adopted it as a foundation for further premises. He visions a hundred billion of these frozen monsters drifting around the sun in a sea shaped like a spherical shell 100,000 times as deep as the distance between the earth and the sun. The closer edge of this sea is 50,000 times farther from the sun than is the earth, and the last of the icebergs is three



SAUCERS

times farther out than that. The ice sea as a whole lies roughly halfway between the sun and the sun's nearest neighbor star. This neighbor star and other passing stars occasionally draw some of the comets out of the sea in much the same fashion that water currents southbound from the Arctic sweep terrestrial icebergs into the North Atlantic Ocean.

This disturbance of their accustomed motion throws some of the affected icebergs out among the stars while others race with ever-accelerating speed toward the sun. On their way in, a certain number sweep close enough to Jupiter, giant of the solar planets, to be caught by its gravitational attraction. Thereafter the icebergs travel a shorter orbit, with increased likelihood of breaking into fragments which brush past or into earth's atmosphere.

A few comets accessible to observations have been seen to disintegrate or break up when near the sun or after having passed close to Jupiter. A number of such disruptions, possibly a dozen per century, may occur near Jupiter.

I shall introduce the word "cometoid" at this point to give a name to what I believe is the next phase in a comet's decline. I define cometoid as a chunk of ice too small to be observed as a comet but too large to be entirely melted before it glides into the last few miles of air above earth.

There are no eye-witness accounts of a confirmed cometoid. But there is a thrilling report of an event whose description fits what might be expected to happen if a really large fragment of a spaceberg hit the earth. This event, which took place in Central Siberia in the morning of June 30, 1908 and wrought devastation far exceeding that of any other known heavenly visitor in recorded history, has often been called the most remarkable astronomical event of the twentieth century.

Earthquakes were registered at Irkutsk, Chita, and Kabansk in the USSR and in microbarograms in England. Sound similar to thunder was heard up to distances of 600 miles for several minutes. This was followed by noises similar to the firing of large cannon which shook buildings for two minutes. An immense dust cloud associated with the event passed over England on June 30 and July 1, 1908, reflecting enough light to enable harvesting throughout the night.

No iron or stony meteorite fragments of any size have ever been found at the site of the explosion. Yet when Professor Leonid A. Kulik, of the USSR Academy of Sciences, finally penetrated to the place to undertake a scientific examination nineteen years later, the area was still bare of trees, except for a few sheltered islands, over a radius of nineteen to twenty-two miles. In the midst of this barren circle was a shallow depression two miles wide, pocked with about 200 steep-sided, shallow craters, each from one to fifty yards across, most filled with mud, some with raised centers like the craters of the moon. After almost two decades of natural recuperation, mosses, bushes, and trees

as far as six to ten miles out from the center bore signs of scorching by intensely hot gases.

A flying iceberg of the size indicated by the Siberian craters (a mass in the neighborhood of 100 to 10,000 tons) would have been vaporized upon impact, suddenly freeing the gases frozen inside it and heating them enormously to generate a violent but short-lived hurricane of carbon dioxide, water, methane, and ammonia in addition to deadly poisons such as hydrogen cyanide and cyanogen.

But is it possible for ice to survive the friction of passage into earth's lower atmosphere? This question has been answered conclusively in the computing laboratory of the Convair Astronautics Division of General Dynamics, at least so far as frozen water is concerned.

The calculations show that a solid sphere of frozen water, entering the atmosphere at speed of at least 6.9 miles per second, can survive and slow down to terminal velocities without completely ablating. If the sphere has a radius of one foot, and enters the atmosphere at an angle of six degrees above the horizon, it loses only half of its radius; by the time it descends to an altitude of 100,000 feet, the speed is only 1,700 miles per hour and the frictional heating is negligible. A sphere with a radius of five feet, under the same conditions, loses about 7.8 inches; the ablation stops at an altitude of roughly 50,000 feet, where the globe is still traveling 2,000 miles per hour.

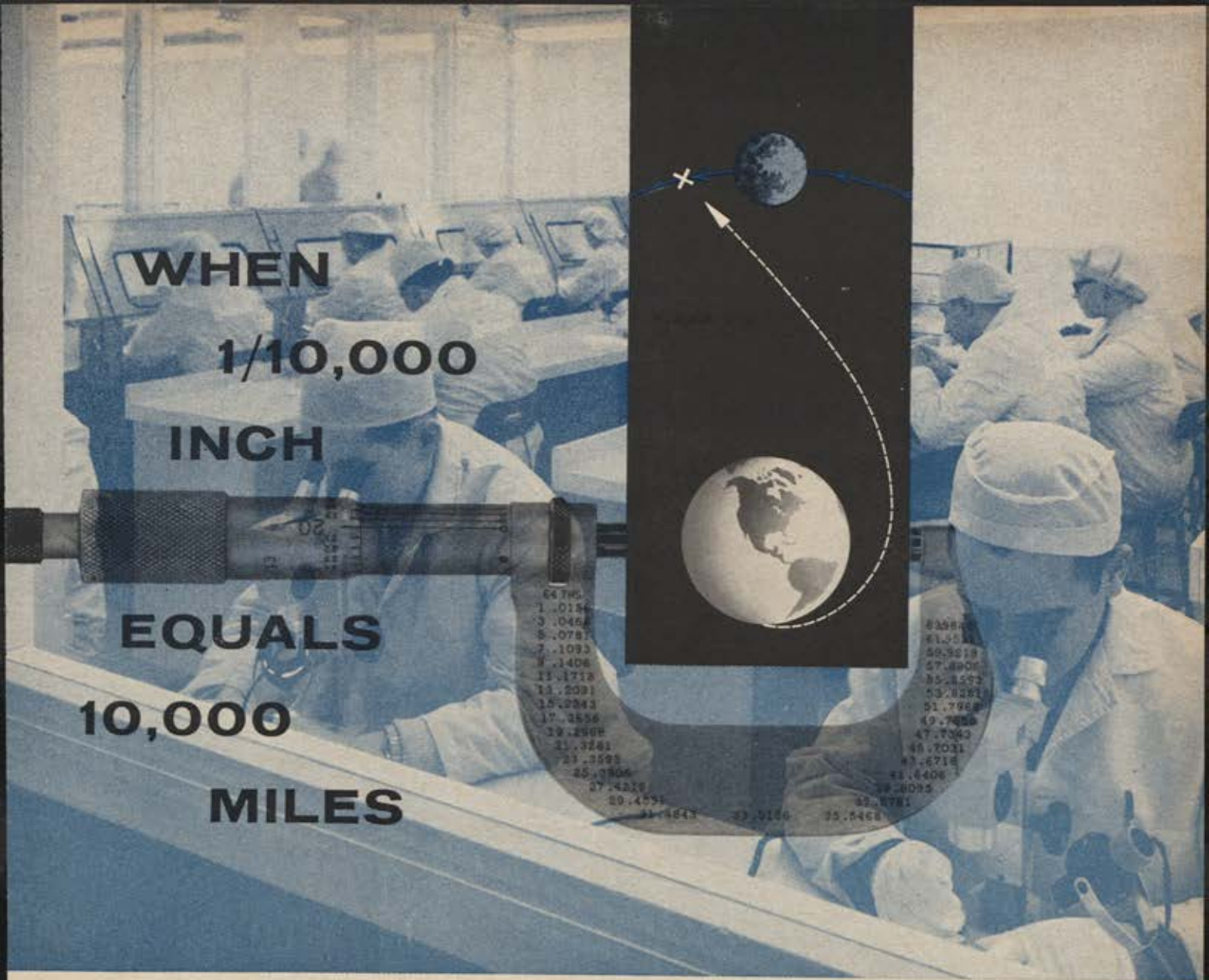
Suppose a small faint comet with a nucleus a little over a mile wide were to disintegrate into small spheres, each having a radius of one meter (3.28 feet). There would be a billion spheres. A more realistic distribution might be obtained by assuming that the breakup would follow the distribution of meteoroids. Then the cometoids would range from one yard to more than half a mile across. The lifetimes of these ice chunks in short-period orbits would vary considerably. The billion smaller spheres would survive between six months and about five years. A hundred million cometoids with an initial diameter of 6.6 feet each would melt away to empty dust balls in one to ten years. The largest chunk of ice hypothecated here should last from 500 to 1,000 years. Thus, with the passage of time following disruption of a comet, larger cometoids would gradually become numerically predominant. After four and a half years, the most numerous would span at least thirty-five feet. But in the first year or two after the earth intersected a new stream of cometoids, the numerous small ice chunks, of the order of a few feet, would be combed out by the sun's heat.

Cometoids of these dimensions could explain the strange stories that are heard from time to time about cakes of ice falling from the sky through the roofs of houses, or found half-buried in open fields.

Now if comets are indeed icebergs vagrant from the deep-freeze surrounding the solar system, and if the fragments of them which I have called cometoids can enter the atmosphere intact, then the appearance of cometoids surely must have been observed at some time in the past.

I believe cometoids may have been seen. Such observations have been seriously questioned and generally omitted from scientific journals in recent years because the atmosphere was not deemed capable of slowing such large objects down to the speed reported—a few hundred miles per hour —without incinerating the objects. Many older sightings of unusual meteoric phenomena can be found in the scientific literature, however. For example, in *Monthly Notices* of the Royal Astronomical Society for December 1880, W. F. Denning describes a slow meteor which took at least fifteen seconds to cross the sky. A textbook written in 1869 and used in colleges for half a century still retained mention of a fireball observation in the eighth edition, printed in 1920. The sighting occurred during the great Leonid shower of November 12, 1833, when meteors fell like fiery snow. "Large fireballs with luminous trains were also seen," wrote the textbook authors White and Blackburn. "Some . . . remained visible for several minutes. Even stationary masses of luminous matter are said to have been seen. . . ."

This brings me back to the point of my beginning: the relationship between comets and the so-called flying saucers. Those familiar with unidentified flying objects will already have noted the resemblance between the hovering meteors just described and the slow-moving green fireballs seen above the deserts of the southwestern United States during recent years. There is a further small but perhaps significant link between the southwestern phenomena and the cometoids whose existence I have postulated. Drops of water have



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been observed falling from a clear sky coincidental with the passage of the fireballs.

Mathematical documentation for belief that spheres of frozen water could successfully enter earth's atmosphere from without and survive to reach earth's surface has already been given in this paper. Once the parent body is broken into numerous fragments, the heat affects each piece individually. Thus a homogenous spherical fragment with a radius of one inch decreases in radius ten times as fast as a body with a radius of 100 inches. It follows that if a large cometoid can stay in one piece while descending to low altitudes, its speed may drop to a few miles an hour or even to zero, and it may luminesce.

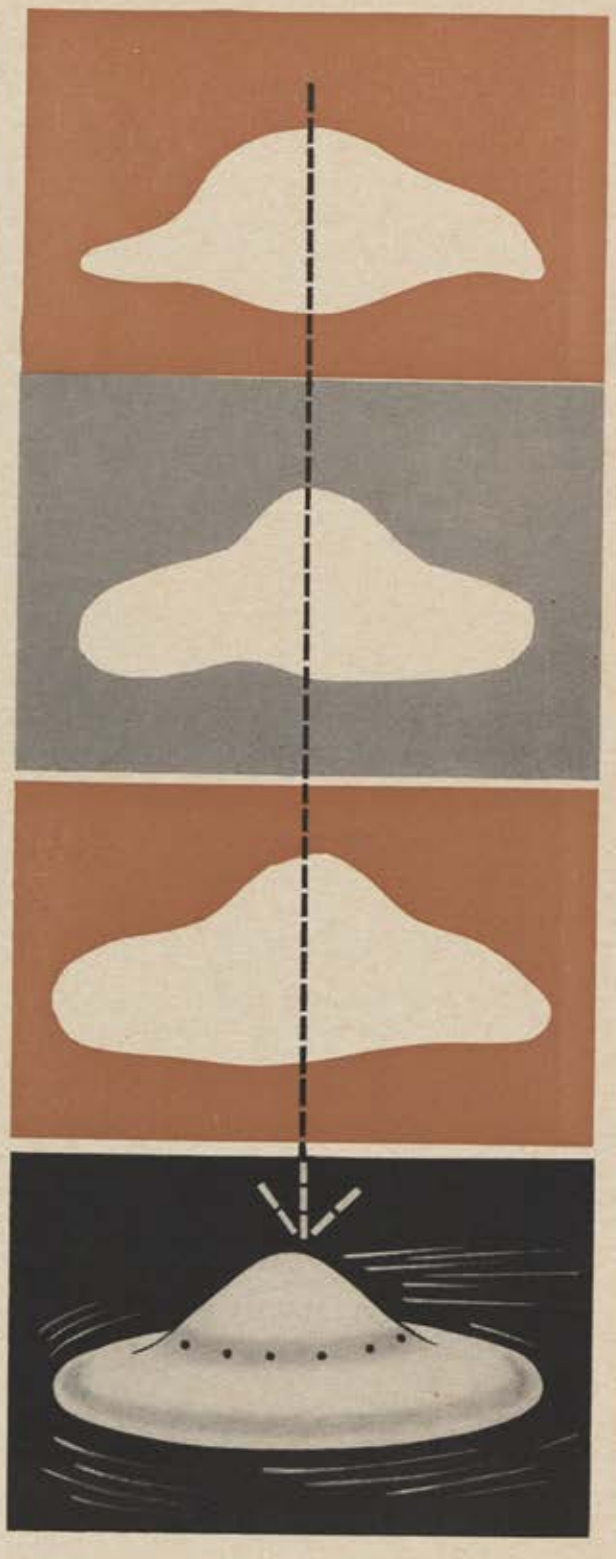
The entry of a cometoid into the atmosphere would be more complicated than the entry of a sphere of frozen water would be. However, as the object arrived within the atmosphere, the outer covering would consist only of dust and of ices which have low-vapor pressures, such as water and possibly materials of resinous or waxlike character. Within, the cometoid would contain a frozen mixture of terrestrial commonplaces like water and gases which would be very volatile in the earth's atmosphere, e.g., methane or ethylene. These vastly different components of the interior would have differing vapor pressures, hence would volatilize at different speeds. A gas that departed early in the course of the cometoid's flight would leave a hollow in other gases still in the frozen state.

Soon after entering the atmosphere, a cometoid would lose its protective dust cover. Erosion would then set in, due to break up and recombination in the surface of chemically active fragments of molecules called radicals.

During this period of its travel, when the pressure would be inadequate to produce melting, the cometoid would undergo a preliminary shaping by ablation processes. Corners would be removed, sharp edges dulled and rounded, and the surface pitted.

The inhomogenous nature of the internal ices would keep the entity turning. It would not matter whether the cometoid always turned in one direction or rocked back and forth; as long as it kept exposing different parts of the surface alternately, the rounding and forming would continue.

As the cometoid drifted into lower altitudes, the pressure would rise and cause melting. Substances like water, which expand on freezing, can melt under pressure and refreeze when the pressure is removed, provided the temperature is not too low. Liquids which ooze into the substrata would tend to sublimate the more volatile ma-



Evolution of a "flying saucer?" Cometoid travels along in space, top sketch. In second panel, ablation begins high in atmosphere. Third panel depicts melting stages, lower down in atmosphere, with concurrent shaping process due to spin. Bottom cometoid has attained saucerlike shape. (Drawings after sketches by Doug Anderson).

terials while freezing themselves. By this process a shell of low-vapor pressure ice would be expected to form around the cometoid. If it could be broken up and examined, it might have a shiny, glassy appearance like that reported for many "flying saucers." Grains of dust in the pitted surface might form bands around the sphere. A spinning disc could thus acquire concentric stripes, or a cigar-shaped object might have a series of bands.

In order to remain in existence, cometoids must be quite cold. During the disintegration period, they may have frigid shells filled with hot gases. These gases, being in a state of flux, will shoot out through the various openings in the shell to produce a miniature glowing cloud around it. The cometoids will then become more like hot-air balloons.

Also, because of recombinations of the radicals and melting of the foreward face of the shell, small jets tending to oppose the body's motion would occur. The reactions would not be instantaneous, so that a sphere, tumbling randomly, would have a slightly erratic path. A disc-shaped body, spinning clockwise about a vertical axis, would make a gradual counterclockwise turn. If a jet emerged from the interior through just one opening in the shell or if one of several jets predominated, a sphere or a disc would wobble in flight.

A sphere, per se, has no lift, but one that is spinning and blowing out gas jets can have a lift. If the sphere is spinning counterclockwise because of a tangential gas jet, then the jet will oppose the air stream underneath so as to build up an excess pressure relative to the jets on top. If the sphere was spinning in the opposite direction it would tend to dive.

Another lift mechanism might be present in a cometoid. If some of the internal ices were melting there would be a tendency for the liquid to extrude the bottom through any holes that were available. The instant the liquid touched the atmosphere (which would be relatively hot) it might expand to create a pressure underneath.

When cometoids descend to altitudes of a few miles their velocities fall to a few hundred miles per hour. Jet planes, which sometimes travel at higher speeds than that, are not luminous. Light emission must therefore result from changes of state within the cometoid. It is suggested that cometoids which are fresh from the very cold subsurface regions of comets may at times contain dormant atoms or combinations of atoms capable of emitting light when sufficiently warm. Since comets in general consist principally of unknown combinations of hydrogen, nitrogen, oxygen, and carbon, the light emitters would have to be of one or more of these elements. One element has been known for forty years for its exceptional phosphorescence on warm-up. This is frozen nitrogen, quite abundant in comets. It glows a brilliant green following excitation and can be seen in daylight.

If a cometoid were twenty feet in diameter, and aglow from the sudden warming of frozen nitrogen inside a thin, glasslike shell, the object would appear as bright as the sun at a distance of 105 feet or as bright as the moon at a distance of approximately 23,000 feet.

It might be pointed out, in this connection, that brightness of objects seen visually is associated with the wave length of light. That is, the eye is not equally sensitive to the different wave lengths in the visible spectrum. In dim light, the eye becomes more sensitive to green or blue-green light. It is not surprising, therefore, that many bright green fireballs have been seen. For the most favorable time for such objects to survive entry of the atmosphere is after sunset.

Although the explanations offered here cover most of the unknowns of "flying saucers," a few mysteries remain untouched. These include the apparent alternation of evasive and pursuit tactics by UFOs kept under simultaneous observation by experienced airplane pilots and by radar, reports of radiation accompanying the appearance of some UFOs, and alleged UFO effects on electrically controlled vehicles such as motor cars.

It has been noted by many scientists that electromagnetic bursts from the sun may influence comets in certain ways. The author is now refining mathematical formulae which could elucidate the transfer of these effects from comets to cometoids and thus explain yet unexplained enigma.—END

Donald H. Robey is a young physicist who is associated with the Convair-Astronautics Division of General Dynamics in San Diego, Calif. He has previously reported his cometoid theory to the American Meteorological Society. This article is condensed from the Saturday Review, Science and Humanity *section, September 5, 1959, and reprinted with permission of the* Saturday Review.

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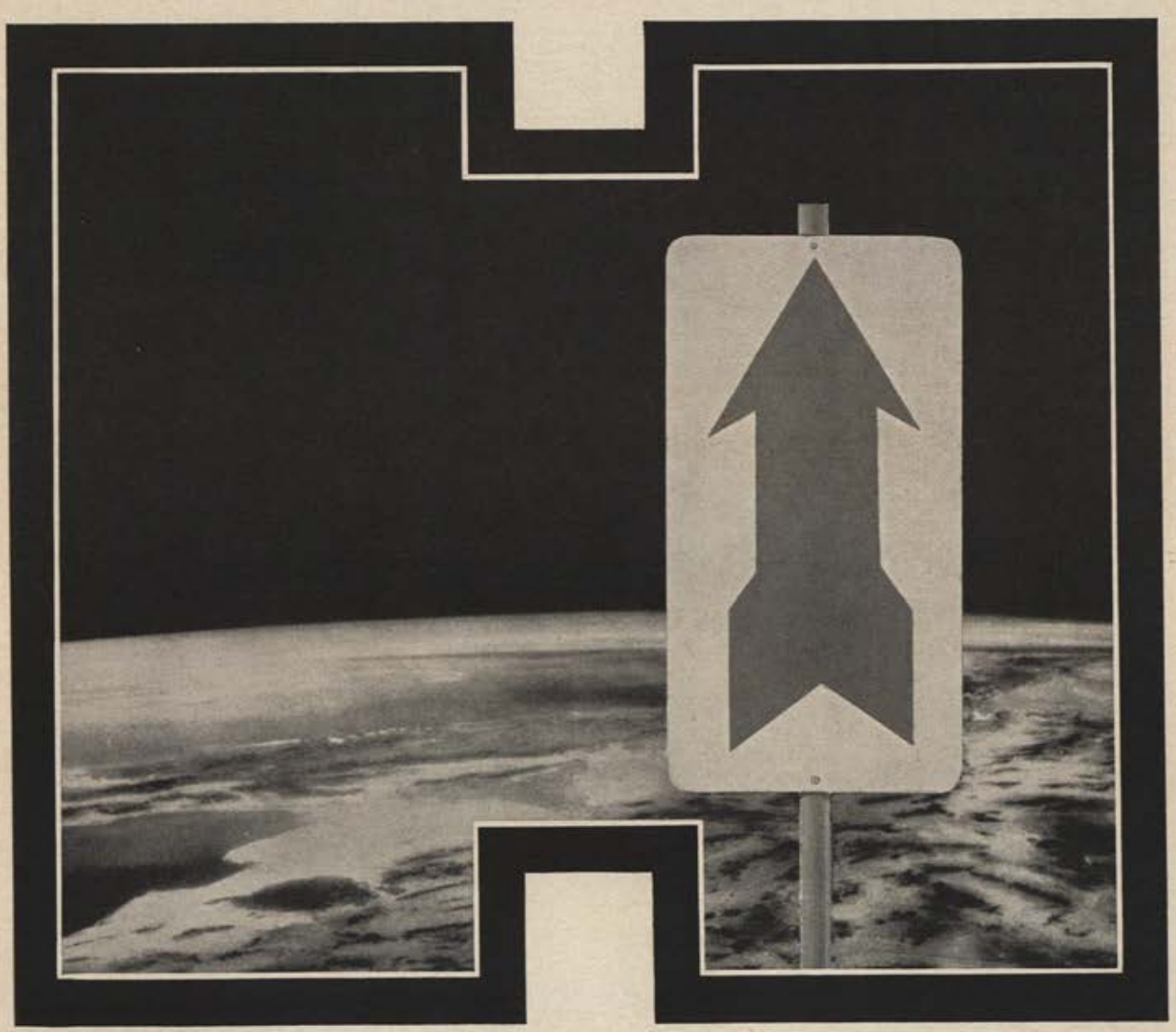

Southern California and Arizona from 143 miles up, *photographed from a Navy Viking 12 rocket, fired from White Sands, N. M. Dark patch at lower left is the Gulf of California.*

times

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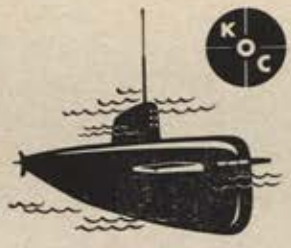

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Speaking of SPACE

First photo of the earth from 19,500 miles in space was taken from Explorer VI, the "paddle-wheel" satellite launched on August 7. Picture at far left shows area of the Pacific Ocean that the Explorer VI television scanner saw on August 14. The lined areas at the left are NASA's interpretation of the signals, a cloud-cover map superimposed upon a globe. Part of the Explorer's payload was a two-pound scanning camera made by Space Technology Laboratories.

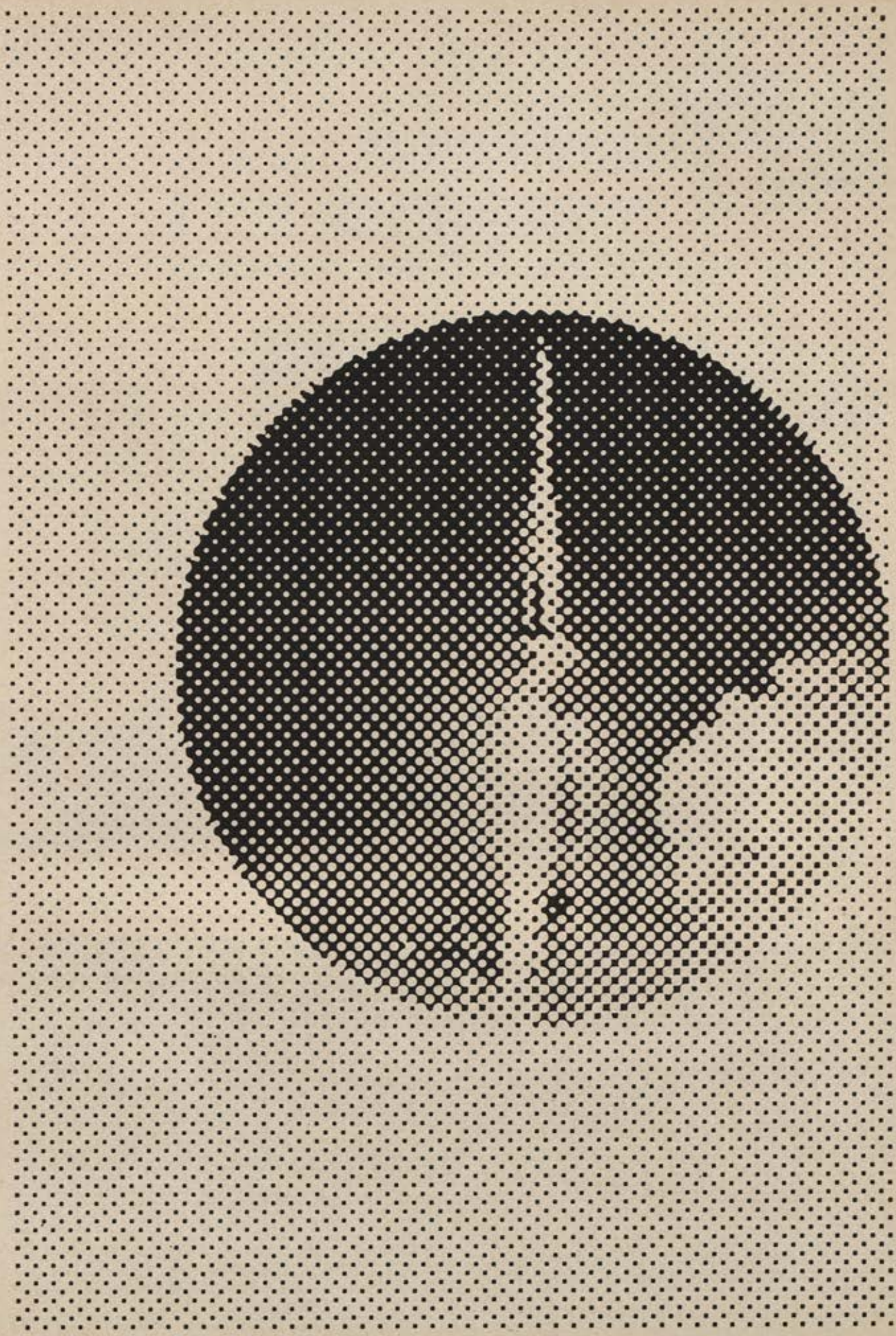
Science—a Dark Horse

Science and technology seem to be edging forward to take their place beside motherhood and religion on our political platforms. The Task Force of the Republican Committee on Program and Progress, drafting the long-range policies and goals of the Republican party in a report, "The Impact of Science and Technology," urges a strong science and technology . . . "to maintain the peace, to protect individual freedom, to advance our standard of living, and expand our opportunities for personal economic progress and security. . . ." The eight-man committee, headed by Charles E. Ducommun of California, endorses the federal government's role in science, especially in basic research, but suggests applied research should be left increasingly to private organizations. The Republicans warned of over-concentration of science in federal areas, and came out against the proposed federal department of science.

A few days after the release of the Republican report, fifteen members of the Science and Technology Committee of the Democratic Advisory Council, including former Assistant AF Secretary for R&D Trevor Gardner, Nobel Prize winner Harold C. Urey of the University of California, and

GEORGE "MOON" MEYERS—By Jack Tippit

"Babes on the moon? Oh, sure, Tony, I met dozens of them . . . but even with their two heads none of them understood me."



SPEAKING OF SPACE

Ernest C. Pollard, chairman of the biophysics department of Yale, met in Washington. The seventeen-man group proposed a national laboratory to work on the problems of waging peace—possibly to expand into an international agency.

In the News:

Dr. Hans A. Bethe, theoretical physicist now at Cornell, received the 1958 Franklin Medal for his contributions to "our understanding of the physical universe from nuclei of atoms to the interior of the stars."

Maj. Gen. Donald N. Yates, Commander of the AF Missile Test Center at Cape Canaveral, Fla., is now also the Department of Defense representative for Project Mercury support operations.

Dr. James Rhyne Killian, Jr., who was the President's Special Assistant for Science and Technology, has been elected a director of the International Business Machines Corp.

Sir Henry Tizzard, the British scientist credited with the development of radar, died in Hampshire, England, on October 9. As Rector of the Imperial College of Science and Technology, Sir Henry pressed for the development of England's air defense, and aided in the development of the jet engine and the atom bomb.

Russian Space Law

Two Soviet articles on the legal and political stand to be taken by the Soviets in international discussions of space law have been translated by F. J. Kreiger and J. R. Thomas. "On the Question of Interplanetary Law" and "For Equal Collaboration in the Peaceful Use of Cosmic Space," taken from *Sovetskoye Gosudarstvo i Pravo* and *Izvestiya*, discuss Soviet proposals for reasonable collaboration, but also suggest a possible Soviet agreement for mutual exploration as a *quid pro quo* for US concession in liquidating its overseas bases. Translations available from the Library of Congress, Washington 25, D. C., in microfilm, $2.70, or photocopy, $4.80—59-10511.

In early October the Soviet Union announced that it would ask the General Assembly of the United Nations

First US steerable radio telescope, built near Ann Arbor, by the University of Michigan and the Navy will study solar and galactic radio sources.

to call an international scientific conference on exchange of experience in exploring outer space. While maintaining its boycott of the present UN Committee on the Peaceful Uses of Outer Space, the Soviets proposed the organization of a group similar to the conferences on the peaceful uses of atomic energy that met, somewhat fruitlessly, in Geneva in 1955 and 1958.

Little Joe Launched

The fifty-five-foot booster rocket designed to carry the first man into space was successfully launched from NASA's Wallops Island test station last October 4. The rocket contained a boiler plate steel model of the Project Mercury capsule. Little Joe was purposely destroyed after about two and one-half minutes of flight, at an altitude forty miles above the Atlantic, in an initial test of the rocket's booster launching and destruct systems.

Vitrifying Congealment— Next Phase

From various areas and segments of the scientific community come reports that suggest that cells can support life at extremely low temperatures, and that freezing the body, or temporarily deanimating it, may be one of the steps in man's uncertain path to space.

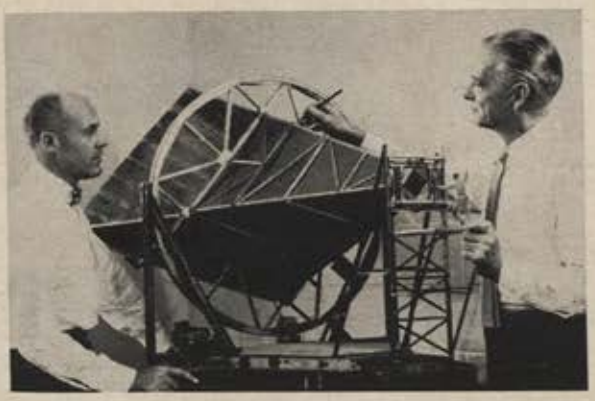
A whole body organ, a puppy's heart, has been frozen, partially dehydrated, allowed to absorb an antifreeze in the form of glycerol, and supercooled. Dr. Ernest M. Barsamian of Harvard Medical School described his technique at a recent meeting of the American College of Surgeons. After the solidified animal heart was planted inside the neck of another puppy, it resumed its natural rhythms.

Dr. Harold T. Meryman, a biophysicist at the Naval Medical Research Institute at Bethesda, Md., reported to a New York Academy of Sciences conference on freezing and drying materials that a pregnant cow at the University of Maryland was artificially inseminated with diluted semen that had been frozen, dried, then reconstituted. Dr. Meryman has named the unborn calf Dessica.

These experiments in lowering the cell temperature take us back to that gold mine for science-fiction writers, Jean Rostand's book, *Can Man Be Modified?* (Basic Books, 1959.) Considering such varied problems as biological mutations, heredity, and the future of man as a moral animal, Dr. Rostand, son of *Cyrano de Bergerac* creator Edmond Rostand, postulates, "If semen endures a condition of vitrifying congealment for several months, could it perhaps do so for several years, several centuries? If so, we can, by only a slight extension envisage the possibility of human reproduction a very long time after death. Now, like space, time is ceasing to be an obstacle to genetic mingling. Here, after telegenesis, comes paleogenesis. One cannot help thinking of Diderot's prophecy, in *Le Reve de d'Alembert:* 'A warm room with the floor covered with little pots, and on each of these pots a label: soldiers, magistrators, potted courtesans, potted kings. . . .' The only difference is that, instead of a warm room, we must provide a cold one."

And perhaps instead of mutations formed here for adjustment to slowly changing conditions on earth, we can mutate space man to adjust to conditions as they prevail at his destination.

—MICHAEL B. MILLER



Bell Lab engineers check model of large horn antenna under construction as part of experimental ground station for relaying messages via satellites.

Space Technology Laboratories' new corporate symbol represents a bright history in a stimulating age. ✶ STL *has provided the over-all systems engineering and technical direction for the Air Force Ballistic Missile Program since it was assigned the highest national priority in* 1954. *Five years of accelerated effort produced epic advances in science and technology, and propelled the art of missilery through three distinct generations of progress.* STL *contributed technical leadership to the science/government/industry team which has built this solid, expandable foundation for future advances in space, and is daily adding new strength to our national security.* ✶ *In addition to its major management functions,* STL *also conducts advanced space probe experiments for the Air Force at the direction of such agencies as* NASA *and* ARPA. ✶

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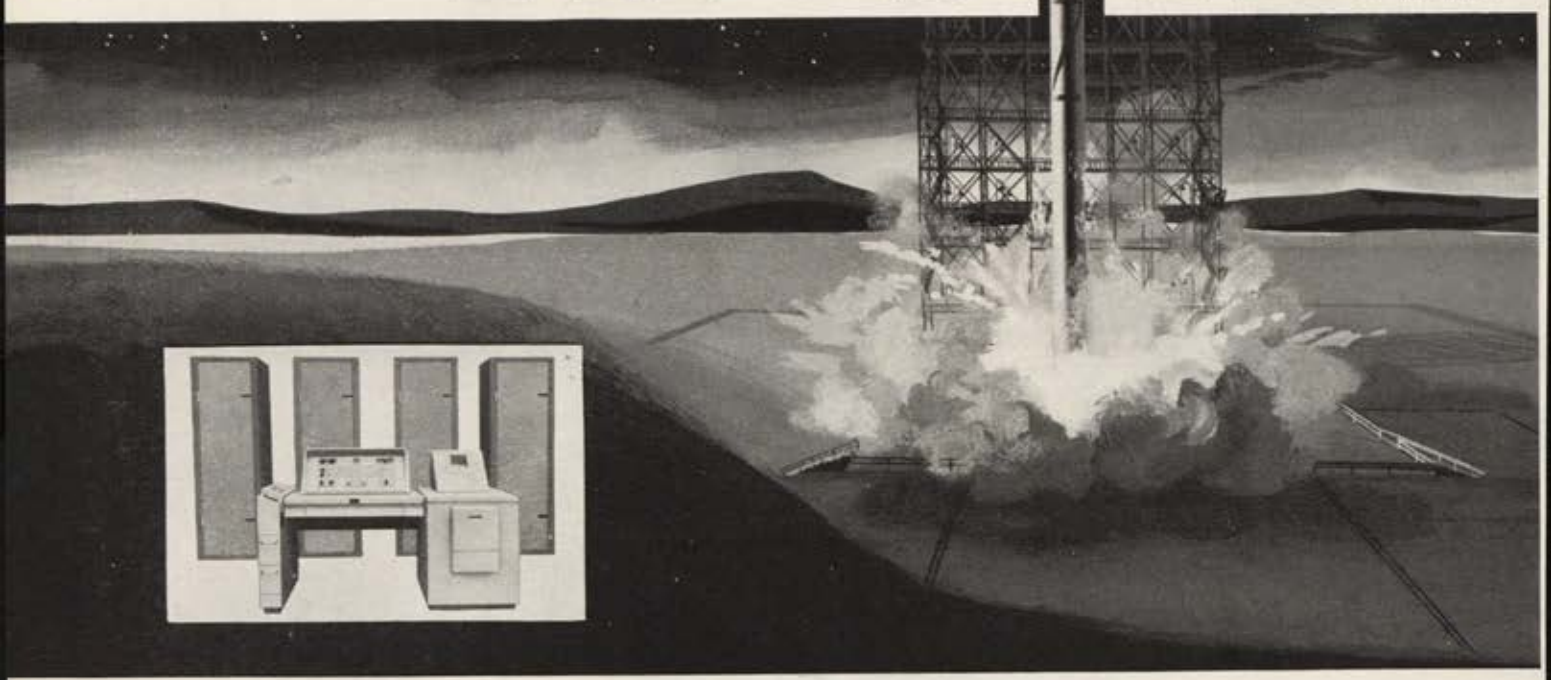

APCHE (Automatic Programmed Checkout Equipment) is a solid-state, universal, high-speed, highly reliable, compact general-purpose tester designed especially for automatic checkout of aircraft, missile and space systems and their supporting systems. In its various versions (differing in input media, size and weight) APCHE installations may be fixed, mobile, airborne or submarineborne. APCHE was designed and is being produced as a part of RCA's ground support electronics subcontract from the Convair (Astronautics) Division of General Dynamics Corporation, prime contractor for the ATLAS Intercontinental Ballistic Missile.

The system being supplied to Convair for the ATLAS Program includes a console and four rack cabinets providing both analog and discrete test functions with a resulting printed and GO-NO GO indication. As a product of RCA's Missile Electronics and Controls Department, Burlington, Massachusetts, APCHE is one of the latest RCA developments in the field of military weapon readiness equipments.

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At the Air Force Association Convention in Miami Beach . . .

OUTLINE for National Security

Hon. James H. Douglas
SECRETARY OF THE AIR FORCE

A YEAR ago I expressed confidence that we could build a missile force to maintain our deterrent power without any gap between today's effective bomber force and tomorrow's effective force of missiles and bombers. Today I am still confident that we can and will build such a missile force. To do so, however, in the sharp competition of missile, aircraft, and other projects for Air Force and defense resources, will almost inevitably cause the postponement, even the elimination, of desirable projects. This calls for careful selection in the light of over-all defense needs. In the Air Force top priorities will continue on our long-range striking force, both ballistic missiles and manned aircraft, their instant readiness and provision for warning against attack.

Besides the weapon system needs, the fundamental and continuing Air Force need will be for officers and airmen of character and ability trained to the skills of combat, supply, and maintenance of an Air Force for the aerospace age. . . .

Clearly the Air Force can play its part in meeting our national needs for military power only so long as it develops high qualities of leadership in officers and airmen committed to careers of service in the Air Force. Fortunately, for years to come our top leadership will carry with it experience of World War II and the Korean War; and for the future our Air Force Academy provides a new assurance of strong trained leadership.

Also, let us recognize our debt for present and future Air Force leadership to the great academies of our sister services. A great strength of the Air Force lies in its having received a most generous contribution of talent from both

(Continued on following page)

Talking it over at the Awards Luncheon, at left, the outgoing president of Air Force Association, Peter J. Schenk, right, Secretary of the Air Force James H. Douglas.

West Point and Annapolis in the past decade. The Army and Navy training of Air Force officers will contribute increasingly to effective integration of the services in the unified commands and the over-all defense effort. And the unified commands give strong emphasis to the broad character of top leadership required in each of the services.

Basic to meeting our needs for leadership and skill in officers and airmen is the old problem; that of making it truly rewarding to the officers and airmen of our Air Force.

Clearly our Air Force is more attractive to our officers and airmen today than it was a few years ago. The pay bill, better housing, and better facilities of all kinds, in fact generous assistance from the Congress have helped make military service more rewarding. The results in reenlistments and retention are extraordinary. The reenlistment rate for first-term airmen is close to fifty percent of those regarded eligible for reenlistment. This permits us to be selective to a degree never before possible, both in first-term enlistments and in reenlistments. Nine out of ten of our airmen who have gone beyond their first enlistment are staying in. Proficiency pay now drawn by some 20,000 airmen in seventy-five designated skills is no doubt a major factor in this retention record.

Among officers, recent surveys indicate an increasing number have decided to make a career of the Air Force, and this attitude is reflected in their greater interest in the regular officer augmentation program. We now plan to retain sixty-five percent of rated officers, including ROTC graduates, a group in which retention has been a serious problem in the past. Our most difficult retention problem today is in research and development type personnel, particularly nonrated officers with highly technical skills. . . .

Let me say a word about the unsung achievements of our Air Force in meeting its ever more demanding supply and maintenance requirements. A ready force demands that aircraft and missiles be ready to go on short notice. Supply and maintenance procedures must keep our weapons operationally ready, and are today very effective. For example, during the past six months, only one percent of our B-52s and one and a half percent of our jet tankers were at any time out of commission for want of parts. Improvement in our supply and maintenance has more than overcome the increased complexity of weapon systems.

We aim to build a logistic system as fast in response as the weapons it supports. We have eliminated depots in Europe, and are now supplying our bases there directly from central points in the United States using an electronic system for requisition of items and airlift to deliver them. The result has been not only faster and more flexible support but a reduction in the over-all cost. The elimination of depots overseas was made possible in part by increased use of airlift for the delivery of engines and parts and for the return of engines for overhaul. And this has permitted a reduction in high-value inventory items.

Basic to our logistic support of the Air Force overseas is the Military Air Transport Service, which provides airlift both by military aircraft and by civil carrier. Concern has been expressed by some that the Air Force will increase its military air transport operation in peacetime. This is not the case. Plans for the movement of military cargo on MATS for the current fiscal year show a decrease in ton miles of something over ten percent as against 1959, and this estimated reduction is reflected in reduced military operations. Civil contract operations for 1960 are scheduled at the same level as 1959.

MATS exists to meet military airlift requirements in the event of war or the threat of war. It must be ready at all times, and thus makes lift available to the Defense Department. Not to make reasonable use of such existing lift before looking to civil carriers would be to pay twice for the same service and thus put a double charge on the taxpayer. For expanded wartime operations MATS relies on the Civil Reserve Air Fleet for as much as eighty percent of the passenger lift, and a substantial part of the cargo lift. There will always be a need for ready military airlift, but the Defense Department will continue to depend on the civil carriers to meet a very large part of its air transport needs. For the year ending last June 30 the Defense Department paid civil carriers for air transport services some $230 million. The Air Force will always have a vital interest in the development of civil air transport. In planning the replacement of obsolescent MATS cargo aircraft the Air Force seeks a turbine-powered cargo transport which will not only meet Army, Navy, and Air Force needs, but will provide an economic cargo aircraft for civil carriers.

". . . we must remember that the threat of Soviet communism is many pronged. It is economic, political, and ideological. . . . It seeks to control the minds of men. We cannot meet it with military power alone . . . we must be strong in our faith. . . ."—Secretary Douglas, addressing assemblage at the AFA Awards Luncheon at Miami Beach.

The prime mission of our military forces is to protect our peaceful existence and that of our allies in the face of the Communist threat, and to assure our survival and theirs in the event of war. Our military power today is strong. Our first need is to keep it strong for the future, but we must remember that the threat of Soviet communism is many pronged. It is economic, political, and ideological. It is active in all parts of the world, and it seeks to control the minds of men. We cannot meet it with military power alone. To meet its challenge we must be strong economically, strong in determination to preserve justice under law, and strong in our faith in the American way.—END

An Air Force veteran of World War II, James H. Douglas became Secretary of the Air Force in 1957 after serving a tour as Undersecretary. A distinguished lawyer, the Secretary received his baccalaureate degree from Princeton in 1920 and was graduated from the Harvard Law School in 1924.

At the Air Force Association Convention in Miami Beach the Air Force Chief of Staff spelled out USAF's . . .

'TEN MOST NEEDED'

Gen. Thomas D. White, USAF
CHIEF OF STAFF, USAF

THE Federal Bureau of Investigation has its "Ten Most Wanted." I want to examine the Air Force's "Ten Most Needed." These are ten essentials which I feel are required to achieve preëminence in aerospace—which is a must for national survival.

In this era of swiftly advancing missile and space technology, attainment of such an objective is a tremendous and expensive task. Its realization demands hard work, the best in talent, superior equipment—and vision. Beyond this, it requires proper evaluation and understanding of the possible threats against our security, and the accurate appraisal of the necessary means to meet these threats. And here is where differences of opinion arise—just how should we go about achieving the security we seek?

For example, some authorities have stated their opinions that this country has concentrated excessively on the development of strategic weapons—to the detriment of so-called small war capabilities. Statements have also been made to the effect that we are reaching a point of nuclear deterrent stalemate vis-à-vis the Soviets.

I cannot agree with either of these viewpoints. I feel that our current and programmed strategic capabilities are not excessive. Further, I think it most dangerous to assume a stalemate in any type of military situation as a long-continuing probability. Sooner or later something always gives way—oftentimes because of a technological breakthrough or a new discovery. Thus, we cannot lull ourselves into a feeling of security in the complacent belief that there is or could be such a thing as a complete standoff. We must possess sufficient force to meet and defeat the main military danger if we are forced to it. And, unquestionably, the main danger to the forces of freedom is the strong and growing Soviet aerospace power.

To counter this main threat, we must continue to dominate in the field in which we have excelled over the last decade—nuclear striking power. Should we close our eyes to the main danger and diffuse our resources in an attempt to meet specifically an infinite number of lesser possibilities, our over-all position could be fearfully weakened. It would be analogous, in my opinion, to the purchase of 100 percent insurance coverage on the windows of one's automobile at the risk of reducing one's over-all collision insurance. What we need—and have had to date—is a comprehensive insurance policy with heavy emphasis on total coverage!

The Air Force certainly recognizes the threat of minor conflicts and the ever present possibility that such a conflict could lead to World War III. And that is exactly why the Air Force maintains the capability to engage in minor conflicts within its over-all capability to successfully wage a general war if this becomes necessary. The Tactical Air Command's Composite Air Strike Force is but one example of action we have taken in recognition of the threat of minor conflicts.

But neither this force nor others can successfully contain lesser threats if they are not backed by an over-all capability to meet the main danger. The Ten Most Needed I will discuss have been chosen with the main danger foremost in mind. At the same time, their realization will most economically provide a built-in Air Force capability to meet lesser contingencies. . . .

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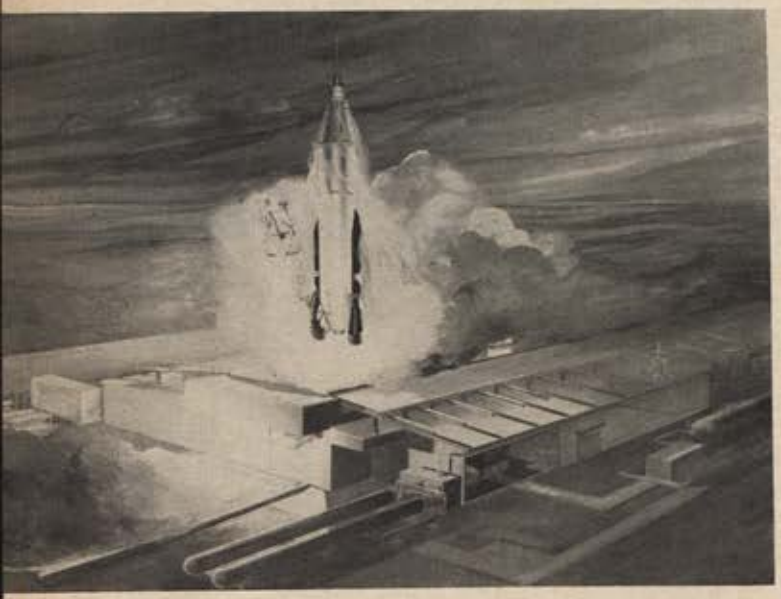

At left, artist's conception of blast-off of Atlas ICBM from launch complex at Warren AFB, Wyo. Hardening of sites, plus possible rail launch methods, will add to nation's retaliatory capabilities.

Model shows proposed railroad car launching system for missiles from railroad sidings or "stop-and-launch" sites. This model, by ACF Industries, was shown at Aerospace Panorama at Miami Beach AFA Convention.

1 First on the list are **intercontinental ballistic missiles.** The hypersonic speed of such missiles, their long range, and the fact that they can be married to nuclear warheads add up to one of the most formidable weapons in the history of warfare. The first of this country's ICBMs, the Atlas, is now in the hands of Strategic Air Command Atlas crews at Vandenberg Air Force Base.

The next ICBM to come along will be the Titan, which is showing great promise even in the early phases of its development. Our batting average on the first four test flights was one thousand. The fifth flight was unsuccessful and, needless to say, we were disappointed. However, in a fast-moving, complex program such as this, we must expect some failures.

The third ICBM the Air Force has under development is the Minuteman solid-propellant missile. We are most enthusiastic about the operational potential of this weapon system. It will be smaller in size and lighter in weight than the liquid-fuel ICBMs. It also will have a faster reaction time, be easier to disperse and will lend itself more readily to hardening. Another important feature of the Minuteman is the fact that we will be able to incorporate real mobility into a portion of our ICBM force.

Studies show that it is entirely feasible to deploy Minuteman missiles on railroad cars and trucks—which would constantly move at random from place to place over the nation's vast rail network and highway system. The addition of mobility to the many other operational attributes of the Minuteman will enhance its deterrent value by compounding an enemy's targeting problems—thus further increasing its ability to survive an enemy surprise attack. We expect the Minuteman to be the backbone of our future strategic missile force. Of particular interest to the American taxpayer is that it will provide a most economical backbone—it is really a reduced cost item. In quantity production, the unit cost per operational Minuteman on site will run less than one-quarter of that of the Atlas or Titan.

Substantial progress has been achieved in the Minuteman program thus far. Firings of large-scale engines simulating the Minuteman engines have been accomplished; small-scale silo launcher static firings have been made; reentry vehicle components and rocket sled tests of prototype guidance systems have been successful. These significant milestones indicate that the Minuteman is progressing steadily toward the objectives and early operational dates presently programmed.

2 Next on my list are **air-to-surface missiles.** We have in the late stages of development an air-to-surface missile called the Hound Dog. We are most enthusiastic about this weapon and its significant growth potential. The current Hound Dog is a supersonic missile that can be launched by a bomber several hundred miles from the target. The first of these missiles will be in operational units with B-52s next year.

USAF's North American Hound Dog air-to-surface missile, which can fly supersonically to target after air-launch, will increase SAC B-52's striking power in years to come.

We also are studying the possibilities of air-launched ballistic missiles—which will, of course, be hypersonic. We already have successfully launched ballistic missile test vehicles from bomber aircraft at both subsonic and supersonic speeds. We have proved that such missiles possess adequate stability to accomplish the required trajectory and that the necessary flight control techniques exist. We also know that inertial guidance can function properly in such a system.

The operational possibilities inherent in air-to-surface missiles are many. The flexibility and versatility of our bomber aircraft will be increased and the ability of our bombers to penetrate enemy defenses will be improved. Long-ranging aircraft armed with such weapons will provide our country with its most highly mobile weapon carrier—mobility measured in hundreds of miles per hour, not per day. Especially significant is that these aircraft could operate overtly and safely over the high seas or friendly land masses with an on-target time measured in minutes.

3 The third category of weapon systems we need is **follow-on long-range aircraft.** Manned aircraft will continue to be a military requirement in the foreseeable future. Ballistic missiles and other unmanned vehicles are not as yet, and may never be, the solution to all military problems.

Improved manned bombing vehicles used in combination with air-to-surface missiles would provide our country with an offensive flexibility unchallenged by any other system in the foreseen state of the art. Longer-range manned systems employing air-to-air missiles also are needed in a defensive role. They would be able to do a job which cannot now be done by current fighter interceptors or current and programmed surface-to-air missiles. There is also a requirement for follow-on manned aircraft in other combatant roles—such as prestrike and poststrike reconnaissance.

Because of the high cost of modern aircraft and missile systems and for other reasons, it is mandatory that we find the means to reduce quantities and types of weapon systems as rapidly as possible—without degrading our combat effectiveness. This is a primary concern of the Air Force.

One action we are taking is to seriously examine the possibilities of multipurpose long-range aircraft which would be capable, in varied configurations, of accomplishing numerous tasks. Ideally, we would like to have an aircraft possessing long-range, supersonic speed, high-altitude capabilities, great endurance, and a large load capacity with the ability to perform many combat roles—offense, defense, reconnaissance, and special high-speed combat airlift.

A multipurpose aircraft would certainly be a sweeping new approach to a most complex and expensive problem. It may well be one answer to the manned aircraft requirement in the missile and space age. Such an aircraft appears to be much more feasible today than it has been in the past. This is true because airborne armament capabilities have increased tremendously and potential flight performance is so great. The advent of nuclear explosives and air-launched missiles means that the weapons themselves can perform part of the job formerly done by the weapon carrier. Aircraft will not always have to conduct a bomb run in the target area—nor will interceptors invariably be required to close with an enemy. The expanded capabilities of their air-launched weapons, both in range and firepower, can accomplish the final task under many circumstances. Supersonic cruising speeds plus sizable increases in range and lift also open the door wide to other operational possibilities never before envisioned. For example, a large basic aircraft such as the B-70 might be employed to airlift several Army Honest John missiles and their crews to any place on the globe in five hours. Development of airborne nuclear power would further widen the vista of this concept.

4 **Advanced tactical systems** are next on my list. We need a tactical all-weather capability that can react quickly and selectively with either conventional or nuclear weapons. We look forward to tactical missiles with longer range, better survivability, increased mobility, more reliably integral guidance, and greater accuracy. These weapons must be backed up with an improved tactical air-control system to include better tactical radar, communications, and data transmission and display. A vertical or short takeoff and landing aircraft which can survive in an aerospace battle is another objective. Its value for use in overseas areas, as distinct from the multipurpose aircraft I have just discussed, is apparent. This objective is more than just wishful thinking. A supersonic F-100 already has been blasted into flight in a takeoff distance of less than one inch. It was launched from an atomic-blast-proof shelter at the Air Force Missile Development

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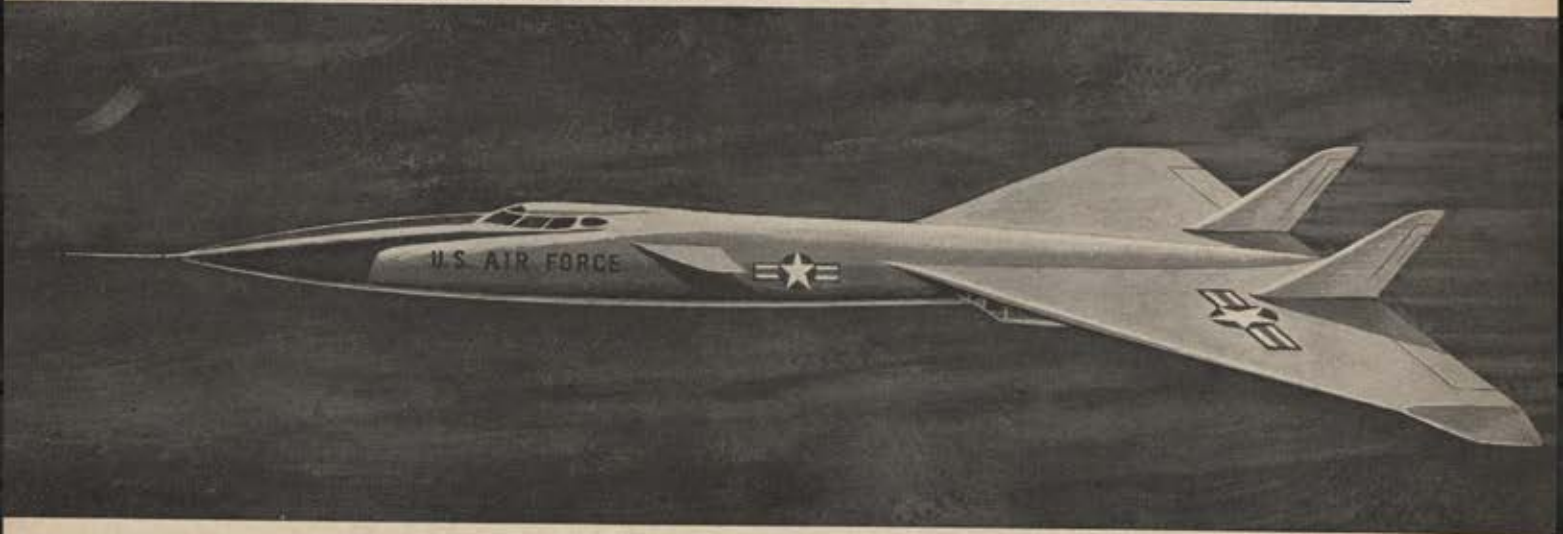
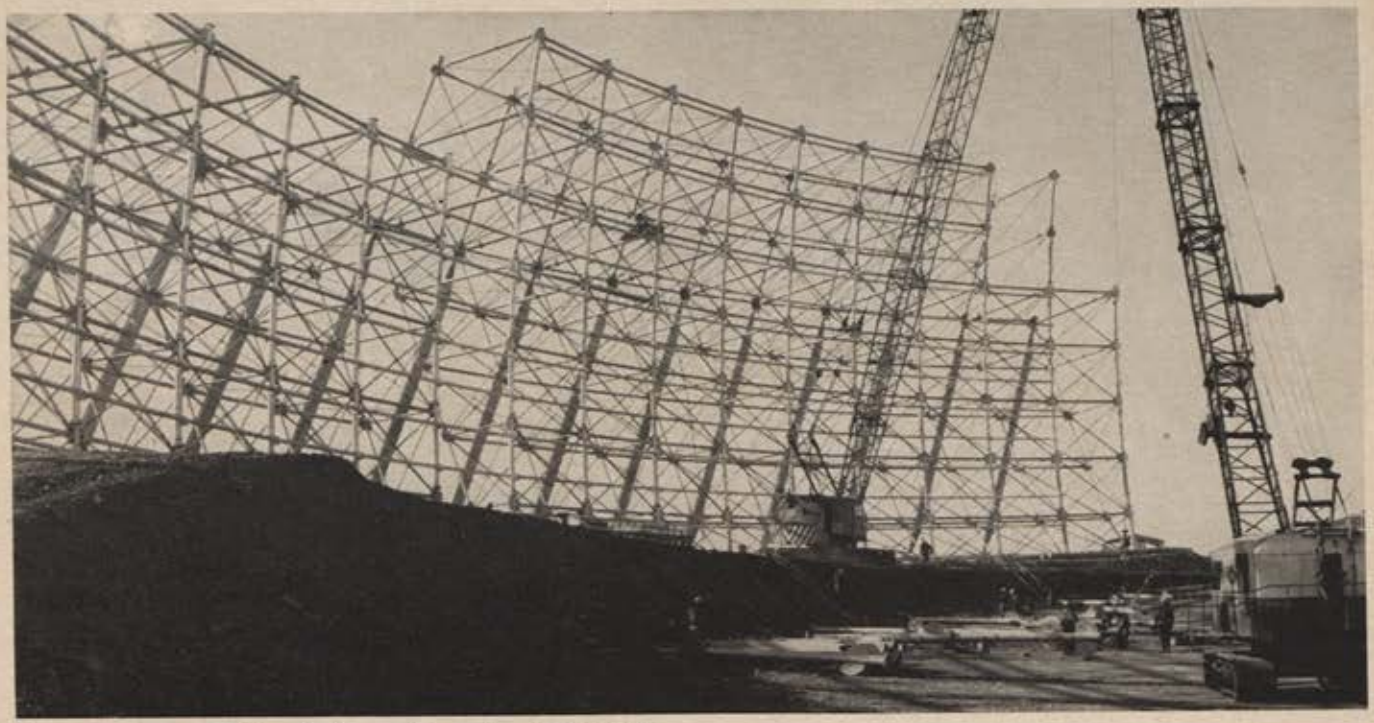
Vertical, short takeoff capabilities are among USAF needs. Here a North American F-100 leaps off from zero-length launch site, could do same if runway were destroyed.

Artist's conception of the B-70, USAF craft now under study, which may be the forerunner of the all-purpose aircraft which could do jobs ranging from airlift to attack.





Top space age need is missile warning network. Ballistic Missile Early Warning System is being built in Arctic.

Center at Holloman Air Force Base. This test proves the feasibility of our approach to a difficult problem.

5 My fifth item is a **ballistic missile warning system.** The critical need for the best possible missile warning system is apparent to everyone—we need a system or combination of systems which will give us "positive" warning. The feasibility of using high-powered radar to detect missiles has been verified, and the Air Force has been charged with the responsibility of constructing such a system. Three ballistic missile early-warning radar stations are planned, two of which are now under construction. Negotiations for the third site are under way. Completion of this radar network will provide a basic missile warning capability. However, we are also investigating other approaches to the problem. One of these is a very promising Air Force development project called Midas—a satellite system employing infrared sensors.

6 Next on my list are **long-range defenses.** The Air Force objective in all its air defense planning is to establish a defense in depth ranging as far out in front of us as possible. We have learned from experience in fighting the air battle that heavy target defenses did not prevent us from destroying enemy targets. We also learned that the most effective way to stop enemy attacks against us was to destroy him in the air and on the ground before he could get near his objective.

To counter the current aircraft and air-breathing missile threat we conclude that long-range, surface-to-air missiles and far-ranging manned interceptors are needed. As far as the ballistic missile threat is concerned, the hypersonic speed of such missiles and the wide area of potential destruction contained in their warheads emphasize, more than ever, the desirability of destroying such weapons as soon as possible after launch. In recognition of this important problem, the Advanced Research Projects Agency is investigating various possibilities in an effort to find the most practical solution.

7 Another system I consider one of our ten most needed is a **modern network of instantaneous, reliable, and secure communications.** There is a vital need for imaginative thinking and accelerated development of new equipments to meet our growing demands in this area. For example, our tropospheric-scatter systems must be extended and more channels must be quickly added. We also must attain improved reliability and security in our cryptographic devices for voice, data, and pictures; and certainly one of our most critical requirements is the need for a reliable worldwide voice capability. The communications satellites we call NOTUS, now under development, are encouraging possibilities.

Our communications modernizing programs now under way are not unilateral exercises. We are working with the other services so that all may profit by any technical progress made. Service partnership in joint strategic communications developments and operations is essential if vital traffic is to continue to flow unimpeded between the networks of all services. On the other hand, the Air Force's highly specialized requirements demand that our portion of this nation's strategic communications network be undeniably responsive to the needs of those who control and operate aerospace weapon systems.

8 Next on my list are **advanced reconnaissance systems.** I don't think I need to go into all the reasons we need such systems. They obviously provide a vital military capability. . . . One such system is called SAMOS. There are, of course, many ways in which this problem can be approached and we will examine every one.

9 **A modernized cargo fleet** is another requirement. Here I am talking about the early availability of aircraft with the capacity to move large loads swiftly when required. We need more efficient, big payload, and faster long-range cargo aircraft. Speed combined with fast turn-around times, for example, would substantially improve our airlift support capabilities—for all the services. Having such aircraft also available in the Civil Reserve

Air Fleet would be of untold value in meeting military requirements during a national emergency.

We demonstrated in the Lebanese and Formosan situations that our supersonic tactical fighters, with air refueling, can reach trouble spots in a matter of hours. Their support and the support needed for the other services must be provided in the same manner by higher-performance cargo aircraft. In this connection, we are optimistic about the development of the turbofan as well as the turboprop. The turbofan will give us approximately fifteen percent increase in operating efficiency over turbojets—which means more thrust and greater range.

Artist's sketch of proposed cargo version of Convair 600 with tail aside for loading. High-priority USAF need is high-performance air logistic support for missions.

10 The tenth item on my list is the **requirement for advanced manned space systems.** Our future offensive and defensive missions, as we reach farther out in aerospace, will be analogous in principle to those missions we now conduct at the lower altitudes. To achieve the greatest effectiveness, man's judgment and skills will be needed. Therefore, I see man in space as a positive military requirement.

One of our early efforts to get him there is the X-15, which is in the process of flight testing. Eventually, this rocket craft will be piloted to altitudes of 100 miles above the earth and speeds on the order of 3,600 miles per hour.

USAF prelude to manned space systems, the X-15, with North American Aviation's Scott Crossfield at controls, readies for its recent free flight test at Edwards AFB, Calif.

As a follow-on to the X-15, we are developing the Dyna-Soar—a manned, ground-launched, boost glide vehicle with a global range capability. The Dyna-Soar is a development project designed to fill the gap between the X-15 and the speeds and altitudes of orbiting satellites. It will combine certain of the advantages of missiles and aircraft into one system—and it will provide control, return, and precise landings to make piloted spaceflight practical.

There they are—our Ten Most Needed—ten essentials the Air Force requires to do its job in the immediate years ahead. The systems listed are based on concepts developed after years of experience in aerial warfare and as a result of our best professional judgment as to what the future holds. Obviously, individual items within these categories could change as a result of technological breakthroughs or other considerations.

The Air Force certainly recognizes that if we are to succeed we must remain open-minded—that we must seek and accept new ideas and approaches. Nevertheless, we feel that our past experience in the conduct of aerial warfare is a valuable guide and serves as a realistic point of departure for the future.

Like the over-all defense mission, the Air Force's "aerospace" portion thereof is huge and many sided. Even our Ten Most Needed are not the whole answer. It also consists of strong industrial base, the proper operational facilities, an adequate command and control system, sufficient supply support—and well trained people.

Equally important is the concentrated research and development activity—on a national scale—which serves as the foundation for the future. In this respect, the Air Force has been working with the Advanced Research Projects Agency and the National Aeronautics and Space Administration on many important projects. Among these projects have been the launchings of several satellites. Air Force systems have boosted six payloads into orbit—three are still in space and furnishing valuable scientific information.

The other services, one can be certain, also have their "most needed"—things they require to perform their assigned missions. We have examined what the Air Force requires to assure maximum ability to perform our missions in aerospace. Given the tools, I am confident that the Air Force can continue to perform its share of the over-all defense task. With the proper teamwork between the services and with the help of public support and understanding, I am likewise confident that the military security we seek can be achieved.—END

AIR FORCE SYMPOSIUM

Four top Air Force commanders examine the state of free world battlelines in both hemispheres at AFA's Miami Beach National Convention . . .

Storm Clouds in the Far East

Gen. Laurence S. Kuter, USAF
COMMANDER IN CHIEF, NORAD

TOO LITTLE is known, even within USAF, of problems of USAF overseas in the fields of geopolitics and foreign relations—and the influence, good or bad, we exert in those areas.

I am speaking from a background of a little over four years of recently completed duty as a senior USAF officer in the vast Pacific area.

The region about which I am talking extends from Alaska southward to include Australia and New Zealand by virtue of their membership in the ANZUS pact and from our West Coast westward to include Pakistan by virtue of its membership in SEATO. I am talking of an area of about one-half the globe in which live about three-fifths of the people on the earth.

Like the other half, this half of the world is marked by the Iron and Bamboo Curtains. On the free side of these curtains, airmen believe that the most immediate threat to the free world is the aggressive capability of about 10,000 Communist aircraft. They fly the flags of the USSR, North Korea, and Communist China, but free world airmen believe that they are all responsive to Communist directives from Moscow and can properly be viewed as a single force. These same free world airmen know that no single Far East or Asiatic country could possibly produce an air force which, alone and unsupported, could be significant when opposed by the Communist air forces.

Across the broad Pacific. Airman clears ice, snow from an F-86 Sabrejet fighter at Osan Air Base in South Korea.

In another part of the Far East, farmer on embattled Formosa is photographed before USAF Martin Matador missile.

On the other hand, all airmen know that the collective strength of the air forces can be significant indeed—and there you have the commanders of many air forces concerned with geopolitics and foreign relations in a very big way.

From another approach, we find the USAF, down to the last basic airman, a real factor in the foreign relations of the United States. Community relations overseas are foreign relations on a local scale. When a fighter-bomber crashes into a school house overseas, the relationship of the United States with that country is put to a severe test. The reaction of the Air Force base to such a disaster restores or prejudices our country's stature. The airman who fires a gun into a train is a grave liability to the United States. The noncom club that gives a scholarship is an asset. And so, steps forward in the President's people-to-people program advance American interest, and

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The Air Ocean: Global Horizons Unlimited

Gen. Curtis E. LeMay
VICE CHIEF OF STAFF, USAF

AEROSPACE power by its nature is global. One hundred percent of the earth's surface is covered with air—usable air expanding into space—the natural operating medium of aerospace power. The speed, range, mobility, and flexibility of aerospace power—which are constantly being improved by modern technology—allow us to take full advantage of this worldwide medium and to expand the scope of Air Force operations to a true global capability. As we move deeper in aerospace, our global horizons will become almost unlimited. . . .

There has been considerable controversy recently concerning the capacity of the armed forces of the United States for small wars. It has been alleged that the Air Force, in particular, has concentrated too heavily on its general war forces to the detriment of our small war capability. I feel that this reasoning is incorrect for many reasons.

One of the more significant of these reasons lies in the success of the Military Assistance Program. The continued growth of the economic and military strength of our allies and the direct and indirect benefits which accrue therefrom are a major factor in our local war capability. . . .

Assets such as bases and support capabilities as well as many additional items which comprise an effective small war readiness are direct results of the Military Assistance Program. Without these benefits, such operations as last year's deployment of units of the Tactical Air Command's Composite Air Strike Force to both the Mideast and Far East to assist our allies could not have been accomplished with speed and effectiveness. The delays which could have been encountered in these deployments under other circumstances might well have spelled failure—and chalked up more Communist successes.—END

NATO: 'It Takes Time to Build an Air Force'

Gen. Frank F. Everest
COMMANDER, TACTICAL AIR COMMAND

ONE OF the problems involved in working with allied air forces today is the actual level of experience which some possess at this time. It is somewhat below that which could be desired. It is, at the same time, being steadily and progressively improved.

For example, take the case of France. From the time of the fall of France in June 1940, the French Air Force as such ceased to exist. It is true that under General De Gaulle's Free France Committee in England there were resistance groups and some French Air Force personnel who escaped from France prior to its fall became a part of the allied forces during World War II. But the French Air Force, as an institution, got very little practical experience in World War II. . . .

In the case of Germany we have quite another situation. One can debate whether or not the high command in Germany always made proper use of its air forces. Nevertheless, the Luftwaffe did have an extensive group of people with a vast amount of personnel, practical experience in air combat and in the management of air forces under a variety of conditions. . . . After Germany regained its sovereignty in 1955 and programs were developed for the rebuilding of a German Army and a German Air Force, an effort was made to encourage members of the former Luftwaffe to accept commissions in the German Air Force. As a matter of fact, I think the goal of this recruiting was established at about a thousand.

The reason for their failing by so wide a margin to meet their quota is simply this: The whole German military structure was in considerable disrepute after World War II. The German nation as a whole looked on the military with considerable distrust. As a consequence, a member of the former Luftwaffe who had succeeded in reestablishing himself in civil life was loathe to give up those advantages and return to the military profession. . . . In other words, the incentive was not there for any great numbers of experienced personnel to return to the newly formed German Air Force. . . .

This can all be summed up by saying: It takes *time* to build an air force, and if you don't have experienced people you have to get along as best you can until they acquire experience. This is the situation we find in two large countries in Europe and to a varying extent it applies also to some of the other countries. . . .

Nevertheless, there is not the slightest doubt but that our own military people in Europe and those of the other NATO nations are effectively cooperating in the military missions assigned to them.—END

steps backward have adverse effects on foreign relations. The USAF is in foreign relations whether it likes it or not.

Let us take a quick walk through some of the free world's air forces, one at a time, and then conclude with my estimate of the picture as a whole.

PACAF has worked extensively with the air forces of five nations under the Military Assistance Program: Japan, Korea, Nationalist China, the Philippines, and Thailand. In Japan and Korea, unlike arrangements in Europe, the MAAGs have no training responsibility, and the training is done by the Fifth Air Force. This, I think, is good. We have our fighting force assisting their fighting forces. The results have justified the diversion of effort and attention by the Fifth Air Force.

The Japanese Air Self Defense Force has the biggest program of any country in this half of the world. They started from scratch some years later than other air forces. Their start was slow but sound. They are flying F-86Ds and doing well in them. They are standing alert in the air defense of Japan. Their new chief, Lt. Gen. Minoru Genda, a combat-ready all-weather interceptor pilot himself, is now heading a team to recommend the selection of an advanced plane to follow on behind the Sabre. The Japanese Air Self Defense Force is capable of operating, maintaining, and supporting any fighter weapon system in our inventory.

The Republic of Korea Air Force was born in combat and has been brought up during an uneasy armistice. They're small but they're very, very good. They have one F-86F wing which I would rate at the very top of close-support experts. They have trained and lived for years in the tense practice areas of the ground forces of the Republic of Korea and the United States this side of the demilitarized zone. They are combat ready.

The Chinese Nationalist Air Force is the showpiece of the Military Assistance Program in the Far East. Quantitatively, they aren't too impressive when counted against the 3,000 airplanes of the Chinese Communist Air Force just across the strait. Qualitatively, they believe they are the masters and proved it in battle less than a year ago. The overwhelming victory of the squadrons of the Chinese Nationalists in F-86Fs over very large formations of the Chinese Communists in MIG-17s is eloquent proof of greatly superior quality. I feel that too much public credit may have been given to the effectiveness of the Sidewinder missile over the Taiwan Strait. That's a very fine Navy-developed missile—make no mistake about it. I'm glad that the USAF has great numbers of them. However, over the Taiwan Strait only six were fired. Four knocked down MIGs. The balance, twenty-six MIGs, were knocked down by fifty-caliber machine guns fired by superb fighter pilots. Here the Military Assistance Program investment of many years was not only justified but paid off handsomely.

Today, the Philippine Air Force is standing alert side-by-side with the US Thirteenth Air Force in the air defense of the Philippines. Many of you have flown with Filipinos in our Air Force or theirs over the past years. I am confident that the Philippine Air Force can handle modern air weapons.

In Thailand, we find another free world air force operating American jet aircraft. I believe you would be surprised, as I have been, by the capability the Royal Thai Air Force has demonstrated in heavy maintenance for their F-84s and T-33s. I have walked through their compact, well organized depot at Don Muang just outside Bangkok and seen F-84s and T-33s going through a line for complete overhaul. US Air Force officers in the Joint

US Military Advisory Group and in the office of the Air Attaché have told me that the overhauled Thai Air Force jet aircraft are the cleanest they have ever flown. In my judgment, the Royal Thai Air Force has proved its competence to operate, maintain, and support more advanced jet aircraft.

In Cambodia, Laos, and Vietnam, you would see only liaison and light transport type aircraft, with a few F8Fs in vigorous anti-Communist hands in Vietnam. The Geneva accord prohibits our building a combat air force with jet aircraft.

It is true that each of these air forces, alone and unsupported, is insignificant, when compared with the monolithic dimensions of the Communist air forces across the Iron and Bamboo Curtains. It is equally true that the Pacific Air Forces of USAF, alone and unsupported, would be insignificant. Collectively, these forces have real significance.

However, it is impossible to describe or discuss the collective strength of the free world air forces in the Far East/Pacific as one can in the North Atlantic area under the cover of NATO. It is true that many of them enjoy the collective strength of the SEATO organization—Pakistan, Thailand, the Philippines, Australia, New Zealand, and the air forces which France, the UK, and the US have based in the Pacific Far East. However, in SEATO, you find no committed forces nor any form of allied command as you find in NATO, but rather a nucleus in which some limited military planning is under way. I view SEATO more as the collective organization of spirit and intent than the unification and integration of military forces. There does exist, however, the potential for creating such a force if its need is clearly demonstrated.

In the ANZUS pact, the United States, Australia, and New Zealand meet with defensive intent and commitments although there is no planned assignment of military units nor unified command planning in this grouping either.

The Korean Air Force is, of course, an active, vigorous element of the United Nations Command, and in that light is bound tightly into the collective strength of the United States and the other nations still obligated under the terms of the armistice agreement. Nationalist China and Japan, as most of the other nations in the Pacific Far East, are closely associated with the United States in our bilateral defensive treaties.

In my opinion, one of the most potent elements of collective strength of the free world in the air is the fact that the air forces, supported by the Military Assistance Program, are all new air forces. They have started from scratch with American equipment and, of the greatest importance, with American tactics, American techniques, operational doctrine, and general USAF concepts. Common tactical doctrine is a great contribution toward effective composite operational capability. . . .

Since April 1 of this year, I have traveled some 50,000 miles and visited a great majority of the countries in the Far East and Pacific. I have not only visited squadrons and subordinate commands of PACAF but I have seen many of the Asiatic leaders, political as well as military. In the past few weeks I have had the privilege of talking with the Air Staff of Pakistan; foreign relations committees of the Australian Parliament and Australian Air Force leaders; command and staff of the Far East Air Forces of the RAF in Singapore; the command and staff of the Royal Thai Air Force, the Prime Minister and the King of Thailand; the command and staff of the Philippine Air Force, President Garcia, and the minister of defense; the command and staff of the Chinese Nationalist Air Force, the Chinese minister of defense, and President Chiang Kai-shek; the Korean Air Force command and staff, the minister of defense, and President Syngman Rhee; the command and staff of the Japanese Air Self Defense Force and the minister of defense.

In contrast to the dismal picture you would have seen some years ago, the picture today, if not a rosy one, at least offers an impression of strength growing on a broad scale. The air forces of this area have gained stature. This growing strength in the air finds as its catalyst the uniform USAF doctrine of tactics and techniques.

(Continued on following page)

MATS: Unfortunately, It Is NOT Second to None

Lt. Gen. William H. Tunner
COMMANDER, MILITARY AIR TRANSPORT SERVICE

I WISH I could say that we have a military airlift capability second to none, but it would not accord with the facts. The truth is that, out of our force of 1,100 aircraft, less than half are used in the strategic air transport category and all but about two dozen of these are rapidly becoming obsolete. . . .

What MATS needs is a balanced strategic air transport fleet. . . . We do not have in our inventory today, immediately ready for use, a single high-speed, modern aircraft that we can put on alert status to fly in emergency support. . . .

It is only in the category of flying outsize cargoes that we are beginning to make some progress. Here, we have the C-133s, which are fulfilling a great need. For every C-133 we have placed in service, we have been able to retire five C-54s, and we have been able to increase our total cargo capacity and our effective deliveries in spite of it. . . .

It is the problem of functioning on a day-by-day basis for training that leads to so much misunderstanding of the role of military airlift, and that brings me to a second point.

The Secretary of the Air Force and the Chief of Staff have decided that our strategic airlift system in MATS must be exercised at the rate of five hours per aircraft per day. This means that the entire airlift system—planning, loading, maintaining, operating, and all the thousand and one factors in military air transport—must be exercised. . . .

The question arises, of course, whether these aircraft should carry adequate loads in their daily training missions. I do not ask, "Why?" I ask, "Why not?" If all this capacity for military personnel and military cargo were not used as our planes fly on their scheduled routes, it would be bad training, bad economy, and bad judgment. . . .

We also need commercial augmentation and we should buy as much as is necessary.—END

Politically, I believe the climate has taken a similar turn for the better. In Malaya you see a brilliant example of the peaceful turnover of territory by a colonial power to a well organized indigenous government. Except for a few diehards, the Communists have been driven out. The tin mines and the rubber plantations are in production. As you know, three small states emerged on the Indochina peninsula out of a territory that some experts had written off to Communist domination.

In South Vietnam, under President Diem, we have one of the most encouraging anti-Communist states in all Southeast Asia, cooperating vigorously with the United States and making economic progress while holding the Communist menace at bay. Cambodia leans more toward neutralism than vigorous alignment with forces of the free world, and Laos appears at the moment to be an area of Communist probes—which we must expect continuously in this part of the world. The important point is that none of these three states has been written off to communism and the forces of Ho Chi-minh are confined north of the seventeenth parallel.

In the Philippines we saw the rise of a truly great man, Ramon Magsaysay, and we saw his untimely death in an American-built airplane. While he lived, we saw integrity and grass roots leadership that cleared away the Huk menace and rehabilitated the dissidents. In the Republics of China and Korea there exist, as a result of US aid, the two toughest, best-equipped, and deeply determined military forces in Asia to deter any ill-advised Communist adventures. In Japan, I can only say that the progress is unbelievable. Our relations with Japan are the best that they have ever been. . . .

I believe these changes are all the more impressive when we consider that they have been achieved in an atmosphere that at the very least can be described as critical. All of us have heard dire predictions about becoming bogged down, about getting lost in the jungles of Southeast Asia. We have all been subjected to a drumming on the subject of wasting American dollars in the Far East.

We must appreciate today that there has been great accomplishment. This is worthy of some recognition. As I look at the over-all picture after four years in the Far East, I am convinced that not only has there been progress but that the future is promising for Southeast Asia, in fact for the entire area. Getting discouraged about Asia is the easiest of occupations. Let us not be victimized. It is not to the free world's best interests.

It would be easy to assume from what I have said that, if we are not already on "easy street," we will soon arrive at that happy state. This, of course, is not the case. The road ahead is tortuous and difficult. But the plain fact is that we have moved giant strides in the past ten years and, if we remain determined, I believe we can continue the progress.

Now what about the future? First, to be sure that I am not misunderstood, the battle is not won. It is far from over. The Communist strategy for Asia remains unchanged.

Imperialistic, international communism seeks to dominate the world. Insofar as Asia is concerned, the objective of the Communists is to neutralize American influence; they would like to embarrass us and cause us to withdraw.

To date certainly we have not done this. But the Communists hope that as a nation we will become fatigued—tired of the problems—and that ultimately we will pull out of the Far East. The Communists are patient. They rely upon the United States becoming exhausted with the complexities of the Orient.

This Communist policy of wearing people down has met with some success in the past. They are banking on it again today, especially in Korea and Vietnam—in fact, throughout the Far East.

Their over-all objectives—expulsion of free world forces and influences to be followed by complete domination of all Asia—remain unchanged. In pursuit of these objectives they will continue their encroachments, shifting their technique to fit the individual situation.

I think it is very safe to say that in the months ahead they will probe for soft spots. When they can find one that is inviting they will make a thrust—they will push. Without any doubt they will continue to create local crises. These will be expanded to whatever extent they feel will serve their objectives profitably. I am perfectly certain that we can expect to see them active and aggressive in the months and years ahead. . . . There is not the slightest reason to be surprised by a resurgence of fighting in the Taiwan Strait or by activity in any other area where they feel they can gain ground.

In addition to the Taiwan Strait, Laos is a danger spot. In Korea, I expect to see a continuance of the uneasy truce we have had with no overt military action.

Our military capability in conjunction with situations of growing local strength holds the Communists in check. It is for other US resources to play appropriate roles in assisting the people of Asia to a point where they logically can accept with safety greater shares of their own responsibilities.

This is not simply the granting of economic aid. We must patiently build in them a confidence that allows the development of healthy partnerships. We must work from the grass roots in cementing our ties, in developing their techniques of production, in assisting them in the development of their governing processes. It goes without saying that we must sponsor the development of technical know-how, we must be generous in passing along the sum of our experience in an effort to accelerate their development.

These new governments, still finding their way as they emerge from colonialism, have the pride and sensitivity of newly formed nations. In contrast with the older nations of Europe who may have passed their peaks, the potentials of these new nations are completely unknown. How far will they go? We can be sure of only one fact—the only way they can go is upward. Understanding and patience are essential and Americans are not characteristically patient people. It needs scarcely be added that the stakes are exceedingly high.—END

Generals Kuter, LeMay, Everest, and Tunner presented their views on the Air Force around the globe at the Air Force Symposium of the AFA Convention in Miami Beach. The above articles are extracted from their talks.

General Kuter became Commander in Chief of the North American Air Defense Command this past summer after an extended tour at the head of the Pacific Air Force. He held key posts in both the European and Pacific theaters in World War II.

General LeMay has been Vice Chief of Staff since 1957. He commanded the Strategic Air Command from 1948-57 and US Air Forces in Europe 1947-48. He headed heavy-bombing units in Europe and the Pacific during the war.

General Everest took command of the Tactical Air Command this summer after heading USAFE for two years. Commander of PACAF's Fifth Air Force in Korea, he also served in the Pacific during World War II.

General Tunner has been involved in most major US airlift operations since 1940. He took command of MATS in 1958, previously was DCS/Operations, Chief of USAFE.

PROCUREMENT SEMINAR

The men who administer the increasingly important Air Force materiel field spell out plans and policies in Miami Beach Convention and report on . . .

Tightening Up the Nation's Largest Business

Hon. Donald R. Jackson

DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE, MATERIEL

IT HAS been said many times that Air Force procurement is the largest single business in the nation. Obviously, the Air Force programming and procurement practices affect, directly or indirectly, a major segment of the nation's industry. It logically follows that it is important that we establish a common understanding of our management procedures which have such an impact on both the Air Force and industry. . . .

Our present weapon systems management procedures are an evolution and refinement of the procedures by which the Air Force has historically managed its programs. We will continue to emphasize and improve on the techniques and procedures for management as the varying situations demand.

Two areas of procurement have recently received increased attention in weapon system procurement. These two areas are "team proposals" and "subcontracting." Both are generically related to the problem of the composition and membership of the industrial structure established for a weapon system or a major subsystem.

Our original purpose in encouraging industry to submit team or group effort proposals was to increase the quality and completeness of proposals made to us. . . . The desirability for grouping of effort and capabilities grows out of the fact that recent developments in advanced systems have required integration within a widening spectrum of technology. The total technology and knowledge of the military arts for advanced weapon systems have moved forward in separate segments of industry.

One of the clearest demonstrations of this fact is that the Dyna-Soar project will group, for the first time beyond the experimental stage, the products of the ballistic and aerodynamic technologies. The benefit of the team or multicompany approach lies in the grouping of this effort prior to the systems proposal stage rather than aligning the effort after a systems contractor has been selected.

As systems have grown more complex, the interaction and relationship of all elements of a system have become critical. Our appraisal of a complete system proposal, therefore, requires an evaluation of each proposed subsystem. In order for industry to submit proposals which will permit a meaningful evaluation, team or multicompany alignments undoubtedly will continue to be made. This is desirable from two standpoints: First, to improve the quality and completeness of systems proposals which industry offers to the government. Secondly, to gain time through initiation of intercompany coordination and planning as early in the systems cycle as possible. Both of these objectives will continue to grow in importance in future systems competition.

As a practical and necessary preliminary to systems decisions and accomplishments, the team or multicompany approach has much to offer; but here we encounter some very real and important problems. At the root of the problem is the fact that there is no legal basis or definition of a "team." Our sole means of recognizing and of establishing a contractual relationship is by the historic and accepted "prime" and "subcontractor" relationship.

It would not be to the best interest of industry or to the government to undertake the cost and risks of establishing corporate forms of team responsibility prior to the awarding of any contract. The government must reserve the right to select from all proposals those subsystems which will best meet the requirement for a complete weapon system. From our experience to date with team proposals, we believe there will be very few cases of team alignment being supported by intercompany legal agreements, and we see no need for these legal alignments. We must recognize only the rights and relationship which can be established under present contracting authority between the government and a contractor. . . .

Our principal goal in procuring a new weapon system must always be to get the best possible system within a time period dictated by the requirement for the weapon. This means that we must make optimum use of competitive ideas, established capabilities, and facilities. We do not consider these objectives to be in conflict but rather that they are mutually supporting. In more specific terms, it means that the membership of "teams," the selection of products and sources for major subsystems, and the approval of the contract reflecting these, require joint input by the system contractor and the government. Again, let me say we reserve the right to approve or veto any proposals made to us that indicate an incompatibility with the fundamental goal I have just mentioned. We consider that this position encourages the aggressive use of initiative, maximum competitive opportunity, and the flow of cooperation which are characteristic of our industry economy.

Once we have set the basic pattern of subcontracting effort at the system and subsystem level, the subsequent actions in subcontracting are triggered. As development ideas are translated into structural concepts, the questions of specific hardware manufacturing capabilities and capacities arise. In this area, both in the interest of saving time

(Continued on following page)

and money, we insist on the joint review with the weapon system contractor of his manufacturing plan. This is commonly known as the "make-or-buy" plan.

Our principal reason here is that we have created a very large complex of specialized manufacturing capacity which we cannot afford to duplicate or neglect if it is needed. This area of concern is covered by our present make-or-buy policy which is established by the Air Force Procurement Instruction 53-101. Under this, prime contractors involved in cost-reimbursement and redeterminable contracts for more than $350,000, or in firm fixed-price contracts requiring additional government furnished facilities, are required to submit their proposed make-or-buy structures in advance of negotiations. This is an outline of a manufacturing plan, describing which of the major or critical components, assemblies, or subsystems a company plans to manufacture in-plant, and those which it proposes to place with subcontractors.

We want to establish this make-or-buy structure before a contract is let because of its obvious impact on the over-all cost, quality, and delivery of the product, and on the possible requirement for government-furnished industrial facilities. In addition, we want to assure ourselves that existing capabilities, including small business concerns, will be used to the maximum feasible extent, and that the prospective prime contractor is not planning to use this contract as a means of expanding into new areas of production where adequate subcontracting capacity exists. The proposed make-or-buy structure is a subject for negotiation, and when agreed to, is attached as an exhibit to the contract. The prime contractor may make changes in the structure, but he must advise of his intentions, in advance, which gives us an opportunity to assess the change and object, if occasion warrants. . . .

Finally, a few words regarding cost reduction. I realize this subject has been stressed many times in the past, but its importance is particularly critical now. Today, the fiscal year 1960 and 1961 budgets of the Air Force pose monumental problems. Industry will feel the impact in terms of further emphasis to work harder—and harder—on reduction of costs. This, of course, means that competition will become even keener than in the past. Success in obtaining contracts, as well as their continuance, may well depend upon the ability of primes as well as subcontractors to control their cost. Industry has already felt the impact of this problem. It will not be alleviated in the near future.—END

. . . Industry and USAF Must Be Able to Trust Each Other

Lt. Gen. Mark E. Bradley, Jr., USAF
DEPUTY CHIEF OF STAFF, MATERIEL

At the Procurement Seminar, left to right: Brig. Gen. Walter Graalman; Maj. Gen. Waymond A. Davis, Maj. Gen. Ben I. Funk, Lt. Gen. William F. McKee, in panel talk.

CONGRESS bases the appropriation of funds for the Air Force primarily upon three considerations:

- The type and proximity of the threat facing us.
- The strength of the national economy.
- The ability of the Air Force to use the money wisely and efficiently.

It is the third consideration—the ability of the Air Force to use its funds wisely—which I want to examine. This thought is highly important because it affects the relationship of the Air Force to Congress. Unless Congress is convinced that the Air Force handles its funds carefully, it will not be willing to grant the Air Force the sums it needs. The denial of funds would seriously affect the ability of the Air Force to execute its mission.

I am keenly aware of the fact that the Appropriations Committees of both houses of Congress seem to be convinced that the Air Force and industry are not managing the defense dollar as well as we might. We have only to look at the reports of the Senate Appropriations Committee for the past two fiscal years to see why I say this. In both cases the Committee expressed grave concern over spiraling defense costs. This year the House Appropriations Committee made a one percent across-the-board slash in the amount appropriated. The purpose of the slash was to obtain improved management of funds. The final defense appropriations approved by Congress carried a one-half percent reduction in funds for the defense effort.

Congress did this partly because of the recent reports of the General Accounting Office on the misuse of funds by contractors. Several contractors had to refund substantial amounts to the Air Force on the ground that the money they had received was not earned.

Industry can help the Air Force improve its position before Congress if it will cooperate in three problem areas. These, then, are the sore spots we want to eradicate. First of all, as partners we must be able to depend on each other for reliable and accurate information when we are negotiating contracts. Secondly, when we arrange letter contracts, we must be able to expect definitization of contracts without undue delay. And thirdly, we in the Air Force must have cooperation from contractors in reducing overhead costs. A fourth point relates to small business. We are doing pretty well there, but I want to encourage further progress.

As partners, industry and USAF must be able to trust each other fully during negotiations. Both of us must furnish the other with current and completely accurate information. Inaccurate or out-of-date information defeats the purpose of the incentive-type contract. This type of contract, properly used, benefits both the Air Force and industry. It benefits the Air Force because costs are substantially reduced. It benefits industry by making profits

commensurate with performance. It benefits the taxpayer by giving him more defense for his money.

It should not be necessary for one partner to require signed certificates attesting to the accuracy and currency of cost information. However, it now appears, from the facts furnished by the General Accounting Office, that USAF will have to require a certificate of accuracy.

We are acting in accord with the policy of requiring a certificate of accuracy already adopted by the Department of Defense. In the next revision to the ASPR (Armed Services Procurement Regulations) this requirement will be extended to include all first-tier "subs" where the sum involved is over $100,000 and where there is no effective competition. . . .

The second problem area is that of prompt definitization of letter contracts. Delays often occur because negotiators are reluctant to disclose information to our auditors and price analysts. As a result, negotiations over price are lengthy and time consuming. I think it is important for contractors to recognize that these delays cost them money. For example, as long as a letter contract is in effect, the contractor is paid seventy percent progress payments. However, if this contract is definitized as a cost-type contract, the contractor gets eighty percent of the allowable items of cost. That's a ten percent spread in financing which should not be overlooked. . . .

The third problem is concerned with overhead costs. . . . Overhead costs are troublesome because we are faced with a curious fact—although production runs have decreased, overhead costs have not. . . .

Why is it that overhead costs are not coming down as they should? I think the reason is that industry tolerates the overhead. It is losing the continuing of such overhead costs, not on firm business plus adequate R&D, but on the hope of future business. We have to become accustomed to the thought that production runs are not going to increase again. We're not going back to the good old days. It is, therefore, unwise to keep overhead in the hope of future business. . . .

There is one more topic on which I'd like to comment before closing this discussion. . . . Congress expects the Air Force to accept the responsibility to help keep our economy strong. One means of doing this is to distribute the work to the various levels of the industrial community. The Air Force must adhere to the basic procurement principles of quality, prompt delivery, and lowest price. At the same time, we must be sure that competent small business concerns are given every opportunity to share in our business.

It is interesting to note that in the direct Air Force purchasing in fiscal year 1959, the dollar value of contracts awarded to small business concerns was twenty-two percent higher than in fiscal '58. . . . The $920 million in prime contracts awarded in 1959 to small business was the highest figure since we started keeping such records about nine years ago.—END

Responsibility and Red Tape

Maj. Gen. W. A. Davis, USAF
DIRECTOR OF PROCUREMENT AND PRODUCTION, AMC

THE SCOPE and nature of industry's job have been enlarged and have grown by large increments of work formerly done in the government. Implicit in this reallocation and redistribution of work, however, is the frequently overlooked responsibility that industry has assumed in a fiduciary relationship with the government and public agencies which cannot be expressed and described in cold, technical, and legal language. The assumption of this type of responsibility means that the relationship cannot in any sense be maintained on a caveat emptor basis. We have truly, through these developments, established a partnership arrangement. . . .

Another facet of this responsibility has to do with costs and prices. When the government buys a complex unit, we are required to justify its cost. We are not permitted to establish an initial cost and let it remain for the production life of the article. In this area the weapon system responsibility entails a close pricing initially, with procedures established for periodic review of item costs. . . .

I caution you against interpreting what I have said as on the one hand exploiting the capacity of industry to act and on the other hand destroying that freedom by the imposition of red tape. I do not mean to convey this in any sense. What I am saying is that industry has assumed a tremendously larger role in giving us our advanced aerospace systems, and as a part of that increased role industry must have a more thorough understanding and grasp of the unstated responsibilities that accompany it.—END

The 'Weak Link' in Procurement

Lt. Gen. William F. McKee, USAF
VICE COMMANDER, AMC

IT IS apparent that the pricing of subcontracts has become, in some instances, a weak link in weapon system procurement. Added to the difficulties of accurately estimating costs on new types of materiel have been failures on the part of certain primes to dig for *complete, current, rock-bottom* cost estimates from their subcontractors. To put it bluntly, they were not spending Air Force funds as carefully as they spent their own in bargaining with the subcontractors. This was compounded by the failure of our Air Force people to exhaustively double check cost data at that level.

We are now committed to developing an extensive program to improve subcontract management. This will include the use of pricing teams; increased use of audits to obtain backup information; and the possible extension to subcontractors of the requirement for certification which will attest to the accuracy and currency of all materiel cost estimates. . . .

Until space age weapon system procurement has evolved to such a state, the Air Force has a deep responsibility for active stewardship and participation in *every* phase of procurement—including subcontracting—which affects the total cost and quality of our airpower. In intensifying our monitorship of subcontracting at this time, our interest is not to dictate, but to learn and to contribute to results. Industry and the Air Force together must exercise their pooled ingenuity and experience to develop reliable, consistent, and fair bases of pricing these new weapons.—END

A Ready Room Editorial

With Open Minds

HISTORY shows that civil wars, which pit brother against brother, are always bloodiest and leave the deepest scars. This has been true since Cain slew Abel.

But the fact that history tends to repeat itself in these matters does not make internecine strife any more sensible or palatable.

This is the conclusion that is dominating the matter of Gen. Curtis E. LeMay versus the National Guard Association.

General LeMay lit the fuse on September 25, when he told the second annual Reserve Forces Seminar, meeting in the Pentagon, that he favored one Reserve and was opposed to "a full-time military force under pay of the governor of a state." He reportedly used the phrases, "It's not efficient" and "We can't live with it." Sensitive Guardsmen present interpreted the remarks as a reflection on the efficiency of the Air Guard itself and on them as individuals.

Only a few days later they lashed back in a resolution drafted by the Air Affairs Committee of the National Guard Association and passed by the Association's national convention in San Antonio, Tex. The resolution demanded that "the qualifications and continued usefulness of this officer [General LeMay] in his present influential staff assignment be re-evaluated."

Prior to adoption of this resolution Secretary of the Air Force James H. Douglas, in response to a telegram from the President of the National Guard Association, Maj. Gen. William H. Harrison, had tried to pour oil on the troubled waters. His telegram to General Harrison said in part:

"General LeMay informs me that his recent remarks concerning the Air Force Reserve and the Air National Guard were intended only to stimulate dynamic thinking which would ensure vital and essential roles for their members in the era of growing reliance upon increasingly complex and unmanned systems."

The irate Guardsmen didn't buy this one as evidenced by one of the "whereases" in their resolution, which specifically stated:

"Excuses for such remarks (as being mere attempts to stimulate thought) are unacceptable, since stimulation of thought does not require distortion of truth."

That General LeMay's remarks, made in the context of a national Air Reserve Forces Seminar, were undiplomatic and unnecessary, or that the Guard Association's reaction, questioning the professional qualifications of one of the nation's outstanding military leaders, was emotional and equally unnecessary, few thoughtful members of all components would deny. But it is also difficult to escape the conclusion that a fresh look at present thinking regarding the future military role of the Reserve forces is desirable. And not a moment too soon.

For both the Reserve forces and the Regular establishment are caught between the Scylla of the technological revolution in weapon systems and the Charybdis of the national failure to recognize either the size or the cost of the effort needed to cope with this revolution, in the face of a growing and implacable threat. A sober look will reveal that the problems of Regular and Reservist are mutual, not conflicting, and must not be clouded by prejudice or self-interest.

Mr. Douglas, in his telegram to the Guard Association, referred to an official statement of Air Force policy issued by Gen. Thomas D. White, Chief of Staff, on September 21, 1959, and quoted it in full:

"The Air Force considers the Air Force Reserve and Air National Guard as useful and valuable parts of our over-all aerospace power and will continue to take advantage of their inherent potential. The Air Force not only intends to continue to support these components but also hopes to find new methods and new missions to make them even more useful."

This statement is reiterated in a paper, signed by Maj. Gen. R. M. Montgomery, Assistant Vice Chief of Staff, entitled "Guidelines for the Air Reserve Forces Review Group." This group *(see page 116)* is composed of Regulars and Reservists and is headed by Maj. Gen. Sory Smith, a Regular officer with long experience in working with the Reserve forces. Its charter provides a hunting license for "dynamic thinking," with objectives that include:

- "Determine valid and compatible roles, missions, organizational pattern, and utilization of the Air Reserve forces in support of the Air Force strategic concept for the time period through 1970 and beyond.
- "Review current Reserve forces programs, and where necessary, recommend revisions to achieve phased alignment with determined future roles, missions, and utilization."

Guardsmen and Reservists have been doing hard and constructive thinking along these lines for a long time. One has only to examine the work of the Air Reserve and Air Guard Councils of the Air Force Association to become acutely aware of this. In the Reserve Forces Review Group a new channel exists to funnel this kind of thinking into the Air Staff and the Secretariat. It should be utilized to the fullest.

Likewise, it is incumbent on the study group to welcome suggestions with open minds, cleansed of preconceived ideas. A great opportunity exists to meld the considerable capabilities of the Reserve forces into the operational framework of the Regular establishment, beyond mere augmentation and, perhaps, thereby make available additional money and people for the many tasks which Reservists readily admit can only be performed by full-time professional airmen.

Many boards have studied the Reserve forces problems with seemingly small success. But the time is ripe for this one and the nation will be the poorer if the opportunity is allowed to slip by.

Over-all unification of our national defense effort will remain a mere hope if the Air Force and its Reserve components fail to achieve it intramurally.

—JOHN F. LOOSBROCK

The READY ROOM

RESERVE AND AIR GUARD NEWS

You know the story about the reporter who interviewed Mrs. Lincoln one fateful night and asked, "But apart from that, Mrs. Lincoln, how did you like the show?"

We're reminded of this story in looking back over the second annual Chief of Staff's Air Reserve Forces Seminar, which was held in the Pentagon September 24 and 25. During the first day and a half of the two-day seminar, Air Force Secretary Douglas, Air Staff generals, and Reserve Forces leaders delivered a series of high-level briefings to the key Reservists in attendance from across the nation. A number of the talks stressed the importance of the Reserves as a force in readiness.

Then, on the afternoon of the second day, Gen. Curtis E. LeMay, Vice Chief of Staff, seemed to hurl cold water on both the seminar and the very concepts underlying the Reserve program itself. General LeMay's views on "one Reserve" and his conviction that the Reserves should leave combat roles to the active Air Force are covered in some detail in the article on the opposite page.

From the time they arrived at pickup points near their homes, the 200-plus seminar guests had been accorded VIP treatment. Airlift shuttled them into Washington. Senior Guardsmen and Reservists on duty in the Pentagon greeted them and hustled them off to the Sheraton Park Hotel by bus or staff car. At the hotel more senior officers were on hand with a cordial hello.

Secretary Douglas, lead-off seminar speaker, emphasized the importance of the Reserves as a back-up force and their responsibility to interpret Air Force activities to their neighbors. He also noted that USAF was faced with stepped-up responsibilities and an ever-tightening fiscal problem.

The seminar then reviewed the world setting in which the Air Force operates. A State Department official, Howard J. Ashford, Jr., presented a continent-by-continent political and diplomatic summary. Col. Charles A. North of Air Force intelligence followed with a detailed comparison of military and economic strength of the free world and the Communist bloc.

With these briefings as a backdrop, Maj. Gen. H. T. Wheless, USAF's Director of Plans, discussed Air Force objectives and future roles. "The primary role of the Air Force," he said, "is to develop the methodology and provide the forces required to ensure aerospace supremacy."

Lt. Gen. Roscoe C. Wilson, DCS/Development, next covered USAF's research and development programs. "Our forces of the future," he predicted, "will employ missiles, either ground launched or air launched, as the principal means of delivering firepower." But, he added, "We cannot yet foresee the day of solely push-button warfare."

He was followed by Maj. Gen. Howell M. Estes, Jr., Assistant DCS/Operations, who described the Air Force's strategic, tactical, and defense forces.

Lt. Gen. Truman H. Landon, DCS/Personnel, reported that most personnel problems of a year or two ago have been effectively resolved, thanks to congressional action on pay, medicare, survivors' benefits, and regular officer augmentation. "Selective retention" is today's major personnel issues, he said.

General Landon also had things to say about the role of Reserve officers on active duty and in wartime augmentation, as reported under the head "Career Road Map" later in this column.

Lt. Gen. Mark E. Bradley, DCS/Materiel, outlined logistic problems and contract negotiation and monitoring "which have become a science in themselves."

Maj. Gen. R. J. Friedman, USAF's Budget Director, discussed Air Force expenditures, observing that a very small slice of the budget pie can actually be devoted to new weapon systems each year.

That evening Secretary Douglas had everyone out to the Bolling AFB officers' club for a get-acquainted hour. General White, the Chief of Staff, was away on a foreign tour with Secretary of Defense McElroy, but most top Air Force leaders were there along with the Secretary to swap stories with the guests.

The following morning, seminar members competed with Pentagon habitues for seats in the auditorium since word had got around that General LeMay was first on the bill. But it turned out the Vice Chief was sitting in for the Chief in a Joint Chiefs of Staff meeting and his appearance had to be postponed until after the lunch was completed.

AFA President and Air National Guard Brig. Gen. Howard T. Markey, right, and Maj. Gen. Winston P. Wilson, ANG Chief, in conversation at the Reserve Forces Seminar.

Meanwhile Maj. Gen. Winston P. Wilson, Air Guard Chief, and Brig. Gen. Felix L. Vidal of the Air Force Reserve summed up Air Guard and Reserve accomplishments and prospects.

The Air Guard is "in formation" with USAF, General Wilson reported. He outlined the Air Guard's structure and mission—twelve wings in air defense, eight in tactical fighter roles, and four in tactical reconnaissance—plus three communications groups, eleven electronics engineering squadrons, and miscellaneous units.

General Vidal followed with a report on the Air Force Reserve. He called its training program "by far the best of the three services." He listed a number of possible future AFR missions, among them strategic airlift, aeromedical transport, bomb damage repair squadrons, air defense and strategic missile support, and operation of dispersal and recovery airfields.

When the meeting reconvened after lunch, General LeMay took the podium, apologized for being "out of phase" in greeting the guests barely before their departure time, dropped his bombs on target, added that he thought the seminar was valuable as a means of imparting USAF viewpoints to Reservists, and left amid surprised silence.

As it happened, Lt. Gen. William Hall, Commander, Continental Air Command, was next on the program. When he could make himself heard over remarks ricocheting through the auditorium, he told a story about an airman assigned to the lawn-watering detail who goofed off one

(Continued on following page)

afternoon. When the first sergeant caught up with him, the airman pointed out it had been raining cats and dogs all day. "So what," the sergeant retorted. "You got a raincoat, ain't you?"

General Hall explained that, unfortunately, he didn't have a raincoat and his prepared speech was all wet. He went on to discuss the Air Reserve and ANG, calling them "a very sizable national treasure." He said the personnel who make up the Air Reserve Forces represent an investment by the American people of about $11 billion. Aircraft, equipment, and bases represent another $3.5 billion.

The seminar then closed with brief remarks by Maj. Gen. Robert E. L. Eaton, Assistant Chief of Staff for Reserve Forces, and the premiere performance of a half-hour color movie, "Two Hats," showing Air Reserve and Guard participation in Exercise Dark Cloud/Pine Cone II at Fort Bragg, N. C., last spring. The film is now available through AFR and ANG channels for unit showing. General Eaton acted as top "host" throughout the seminar sessions.

The seminar was a smoothly executed, impressive operation. But it probably will be remembered most as the launch pad for a new debate on the Reserves.

Star Performances

Actually, twenty general officers are sitting as members of two boards in the Pentagon this month to discuss the subject of the debate—the Reserve Forces program.

Eleven of them, plus three colonels, are on a board named by General White to define what the requirements and missions of Reserve forces might be ten years from now. General LeMay referred to this board in his comments before the Reserve Forces Seminar.

The group is headed by Maj. Gen. Sory Smith, Fourth Air Force commander, and includes from the active Air Force Major Generals Daniel W. Jenkins, TAC; William K. Martin, SAC; and Alfred F. Kalberer, CONAC; and Brigadier Generals Jack G. Merrell, MATS; Prescott M. Spicer, ADC; and Emmett B. Cassady, AMC.

The Air Force Reserve is represented by Brig. Gen. John O. Bradshaw, Commander, 434th Troop Carrier Wing, Bakalar AFB, Ind., and Brig. Gen. Kenneth Stiles, mobilization assignee with DCS/Comptroller at Hq. USAF. Air Guard members are Brig. Gen. Donald J. Strait, Commander, 108th Tactical Fighter Wing, McGuire AFB, N. J., and Brig. Gen. Allison Maxwell, Chief of Staff for Air, Indiana ANG.

They are joined by Colonels Billy Dilworth and Gordon Doolittle, AFR and ANG members, respectively, on four-year EAD tours in USAF's Directorate of Plans.

The second board, which will convene November 9, is to recommend promotion policies and procedures for the Reserve Forces. It was set up by Secretary Douglas in response to a Senate request.

This group is headed by Lt. Gen. Bill Hall, CONAC Commander, and includes five major generals, three one-star generals, and a lone colonel. Major generals on it are Eaton; Wilson; Hal Maddux, Tenth Air Force Commander; Elvin Ligon, USAF's Director of Personnel Planning; and Clarence Shoop, Chief of Staff, California Air National Guard and chairman of the Air Reserve Forces Policy Committee of AFA.

Brigadier generals are Frank T. McCoy, Jr., mobilization assignee in the Office of the Secretary of the Air Force; John H. Foster, Commander, 433d Troop Carrier Wing, San Antonio, Tex.; and Howard T. Markey, Commander, 126th Fighter-Interceptor Wing, Chicago, Ill., and President of the Air Force Association. Junior member of this group is Col. John W. Richardson, mobilization assignee as Chief of Staff of the Tenth Air Force at Selfridge AFB in Michigan.

Career Road Map

General Landon told the Reserve Forces Seminar that the Air Force is working on an officer personnel pattern with service guarantees for both the Regulars and the Reservists.

USAF's present strength calls for 126,000 officers, he said, of which a maximum of 69,425 may be Regulars. From figures quoted by General Landon, it appeared that active duty promotion of Reserve officers in field grades would soon be virtually impossible because available spaces would be preempted by mandatory promotions of Regular officers.

But, he noted, Regular officer spaces are filled almost entirely by competition among junior officers who enter the Air Force as Reservists. For those not appointed to Regular status, USAF has asked Congress to approve "term retention contracts" which would guarantee a twenty-year retirement or a substantial cash settlement if they are separated before that time through no fault of their own.

"If we can have only 69,425 Regulars, the other 56,000 are nonetheless needed," General Landon said. "Our problem is to find inducements to retain them which will give them decent service incentives to take the place of the full career rewards offered to Regulars."

Since officers leaving active duty will supply the primary input into the Reserve forces, "it follows that the Reserve is based upon a trained officer corps—trained and experienced in the active force," he said.

ROPA fits nicely into the pattern, assuring promotion for Reservists including those on active duty, he noted, although the latter cannot take advantage of higher ROPA grades until they retire or switch to the Reserve forces.

"The flow of men, as individuals within this structure, from initial Reserve status to active duty for extended periods, then to career and semicareer status, and from either Regular or semicareer status back to the Reserve makes this, as I choose to call it, an integral Air Force officer career pattern," General Landon declared to the Seminar.

Tops Among ANG

Eight Air National Guard squadrons which compiled the best operational readiness gains in the past year among Air Guard bases with their type of aircraft received trophies from the National Guard Association at its general conference in San Antonio last month. They were:

F-86D/L, 199th Fighter-Interceptor Squadron, Hickman AFB, Honolulu; F-89, 114th Fighter Group (air defense), Sioux Falls, S. D.; F-86H, 104th Tactical Fighter Group, Westfield, Mass.; F-84F, 108th Tactical Fighter Wing, McGuire AFB, N. J.; RF-84F, three-way tie between 153d Tactical Reconnaissance Squadron, Meridian, Miss.; 160th TR Squadron, Montgomery, Ala., and 184th TR Squadron, Fort Smith, Ark.; Tactical Support, 130th Troop Carrier Squadron, Charleston, W. Va.

Units were judged primarily on the number of aircrew members and support personnel operationally ready on August 31 compared with their authorized strength. They were rated also on tactical evaluations conducted by ADC, TAC, and CONAC, and on flying safety programs, accident rates, and length of time since conversion to new aircraft types and missions.—END

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AFA NEWS

SQUADRON OF THE MONTH

Ogden, Utah, Cited for

effectively demonstrating the value of cooperative programming with local groups in telling the airpower story to the community.

Ogden, Utah, Squadron, in conjunction with the **Roy** and **Ogden Junior Chamber of Commerce** and the **Ogden CAP Squadron,** ran the 3d annual **Weber Valley Air Fair** on August 9 at Ogden Municipal Airport. It was the most successful of the series, attracting over 70,000 people to the gigantic display of ground and aerial aviation hardware.

The Air Fair is a tribute to the genius of **Ed Dayhuff,** who, while Commander of the Squadron, dreamed up the idea of sponsoring a program that would dramatically bring home to the community the **development of aviation by the military, civil, and commercial carriers, and the aviation industry.** The growth of this function over the years clearly indicates the interest of Utah people in aviation, due in great part to the fine efforts of the AFAers there.

Greater Ogden, Utah, community got a look at aerospace hardware during the mid-summer third annual Weber Valley Air Fair. Some 70,000 toured the Fair.

Brig. Gen. Bill Lee gets congratulations from Ruth Young and Frank Storm, Jr., on his completion of thirty years of service with the US Air Force.

Despite serious injury, Reservist Maj. Harold Seestadt, Lyle Sqdn., Michigan, is still helping unit. Friends: Col. J. McPartlin, and R. G. Saltsman.

The 1959 event, like all the others, featured the **USAF Thunderbirds,** the official aerial demonstration team, which numbers among its members a native of Utah, **Capt. John Crane.**

Static displays included those of **Marquardt Aircraft Corp., Thiokol Chemical Co., Litton Industries, Hercules Powder Co., United** and **Western Air Lines,** and **Southwestern Skyways,** all of which also contribute annually to the success of the Utah Airpower Symposium.

Big guns in the planning and operational aspects of the fair were **Roy Crossley,** Ogden Squadron Commander, and **Bob Campbell,** Chairman of the Chamber's Aviation Committee. **Robert Stewart,** Past President of the Roy, Utah, Junior Chamber of Commerce, was General Chairman.

Jimmy Stewart, whose name is familiar to most Americans, came home on September 19 and 20 to Indiana, Pa., where the city fathers renamed the municipal airport in his honor and held a huge dedication ceremony.

Carl Long of Pittsburgh, who received the coveted President's Trophy as **AFA's Man of the Year** in Miami Beach, represented the Association. He paid tribute to Stewart in his remarks, which followed those of **Lt. Gen. Manuel J. Asensio,** USAF Comptroller. Stewart was one of the early organizers of AFA, and served two terms as a Vice President. He was recently promoted to brigadier general in the Air Reserve.

When the **Pittsburgh Squadron** presented its "Know Your Air Force" program last year, one of the guests

(Continued on following page)

From left to right: AFA's Carl Long, USAF's Maj. Paul Shernisky, Lt. Gen. M. J. Asensio, and actor Jimmy Stewart at Pennsylvania airport dedication.

who made a big hit was **Brig. Gen. William Lee,** Commander, Amarillo AFB, Tex. On August 1, 1959, he retired from active duty after more than thirty years of service, and two members of the Pittsburgh gang traveled to Amarillo to be present.

They were **Ruth Young,** one of the organizers of the 1958 program, and **Cliff Zipf,** Secretary of the Squadron. During their stay in Texas, the Pennsylvanians were guests of **Frank Storm,** Commander of the Amarillo AFA Squadron.

General Lee was winding up a colorful and distinguished career with the USAF. We send our respects to him. Many AFA Convention registrants met him in Miami Beach, where he attended as a delegate.

The **Virginia Wing,** organized just eighteen months ago, has been serving notice on the larger AFA groups that it is in business and planning big things. **Bentley Hahn,** who served as the first elected Wing Commander, was succeeded in office this year by Tommy Tucker, Danville Clerk of Courts. Hahn then became Organization Director for the Wing, and has been burning up the state since.

Just before the 1959 Convention in Florida, the **Arlington Squadron** was formed by Hahn, and in late September an **Alexandria Squadron** charter was approved. Now Hahn is announcing plans for the **Falls Church** and **Fairfax County Squadrons.** Without the latter two, the Virginia Wing already boasts six Squadrons, and we expect that by the time the 1960 Convention rolls around, the Wing will be giving New York and some of the others a run for their money in voting strength.

Birmingham, Mich., has good reason to be proud of the Norman Lyle AFA Squadron, which has made an impact on community life in its first six months of existence. Its efforts have resulted in a trip to the Air Force Academy for a group of civic leaders, and a feature series of page one articles in the local paper on "Your Air Force Academy."

Robert G. Saltsman is Commander of this fine outfit, and advises us that the varied series of programs sponsored so far is just a beginning. Harold A. Seestadt, PR Director for the Squadron, is also a major in the Air Force Reserve, and despite his present physical condition *(see cut)* he's able to send us proof of the work the Squadron is doing.

—Gus Duda

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airman's bookshelf

That Others May Live

***Flight From Ashiya*, by Elliott Arnold (Knopf, $3.95)**

Reviewed by Capt. Frank W. Anderson, Jr., AFRes.

Few peacetime air operations are so hazardous as those of the USAF Air Rescue Service.

Dirty weather is often behind the emergencies to which they respond; flying in it for extended periods is nasty, tricky, and hazardous. Days of round-the-clock, nerve-eroding duty are the lot of ARS crews on many of their lifesaving missions.

The natural drama in such situations is overwhelming. Elliott Arnold chooses it as the core of his new novel. Mr. Arnold is well qualified to deal with the subject. He has written several top Air Force books including a nonfiction classic on ARS entitled *Rescue*.

Flight From Ashiya, set in Japan, covers a time period of just over twelve hours. At 0610 two SA-16 amphibs take off from Ashiya AFB to search the sea for a lifeboat containing four women and two children—sole survivors of a Japanese cargo vessel that has broken up, exploded, and burned in a typhoon. Then a British plane reports by radio that one of the two rescue planes has gone down and sunk in the vicinity of the lifeboat.

Wives, girl friends, and comrades of the men on the two aircraft congregate at Ashiya Base Operations. Which plane went down? Did the crew survive? Will the other get back from its flight into the tail of a raging typhoon? No one knows, no one dares guess.

The high spot of *Flight From Ashiya*, in several senses, is a detailed account of the heroic at-sea rescue efforts performed by the surviving plane's crew. Rich in suspense and excitement, it is good reading about flying and about men who can give that little bit beyond reason in a crisis.

Arnold's scenes flash back and forth between crowded Base Ops and the rescue amphib as it circles the lifeboat beyond radio contact with Ashiya. Arnold devotes substantial attention to the crew members and their loved ones waiting in Base Ops—and to the cargo of personal problems the crew takes aloft on its mission.

The pilot of the circling plane, the Inspector General of ARS in Japan on temporary duty, has his own battle to fight. He bears the Japanese a practiced hatred because his wife died in a Japanese prison camp from lack of medical care early in World War II. Now, risking his life to save Japanese women and children, he knows that in every decision he must lean over backward to fight his own feelings.

The copilot has a different kind of problem. Known as a pilot who has "lost his nerve," the copilot has never recovered from his remorse when vibrations from his rescue helicopter caused a snow avalanche to inundate a mountain village in Europe, burying the very people he had come to save.

The navigator has wife troubles and plans an early exit from the AF. The paramedic hopes he will get the chance to jump. Lone wolf, uncommunicative, he reaches terms with the world only in the few moments when he floats between airplane and mountainous, raging seas.

The book may be open to criticism on a number of grounds.

The flashback is a tried and true device for telling a story and simultaneously filling in background. It serves that purpose here, but the flashes are so numerous and sometimes so lengthy that they may actually detract from the "one-shot" incident on which the story is based.

Secondly, one can overdo another tried and true device—the agony of the loved ones waiting for news back at the base. Some also may find it tedious to read of another group of persons with airborne "problems."

For all of that, Arnold once again has captured in his pages a touch of the romance and reality of Air Force operations. The Air Force and Air Rescue Service are better known, and understood, for his efforts.

About the reviewer: *Managing Editor of the* Air University Quarterly Review, *Dr. Anderson received his Ph.D. in English literature from the University of North Carolina, where he also was a member of the faculty. Dr. Anderson has contributed to* Air Force/Space Digest *in the past. He has edited a distinguished aviation literature anthology,* Great Flying Stories.

Travail, Courage, Greatness

***There Shall Be Wings: A History of The Royal Canadian Air Force* by Leslie Roberts (Clarke, Irwin, Toronto, Canada, $5)**

Reviewed by Maj. Joseph Warner Angell, AFRes.

Leslie Roberts' unpretentious, skillfully organized historical narrative embraces, in the author's words, "The record of Canadians (in the air) in two world wars, between those wars, and since the second. . . ."

RCAF accomplishments are little known among Americans. But they are many. This book should be an eye-opener for a good number of us here south of the border.

How many of us, for example, know that the new Canadian-designed Avro Orendo jet is considered by many "the world's top first-line fighter aircraft?"

Or that Canada is the only country in the world to have on order an "absolutely modern long-range recon aircraft?"

Are we aware that the Canadian component in the First Air Division of NATO's Fourth Allied Tactical Air Force has been judged "the most efficient flying unit in NATO"?

Here's another interesting fact. The RCAF's Air Transport Command has long been flying large jet military transports on tightly scheduled runs across the Atlantic, while our own MATS hopes for a top echelon go-ahead to buy a modest number of up-to-date jet cargo planes.

The RCAF has also completed a gigantic and amazingly accurate aerial survey of every foot of Canada—which is larger than the continental US and Alaska combined.

Thus Canada's airmen made possible the siting and construction of the BMEWS, DEW, and other early-warning systems across the roof of North America. It enabled SAC bombers and NORAD interceptors to conduct precision operations in the strategically vital northern expanse of the western hemisphere.

The book's final chapter offers a brief, comprehensive analysis of political, military, and national sovereignty issues implicit in the international, interservice NORAD Command.

(Continued on page 125)

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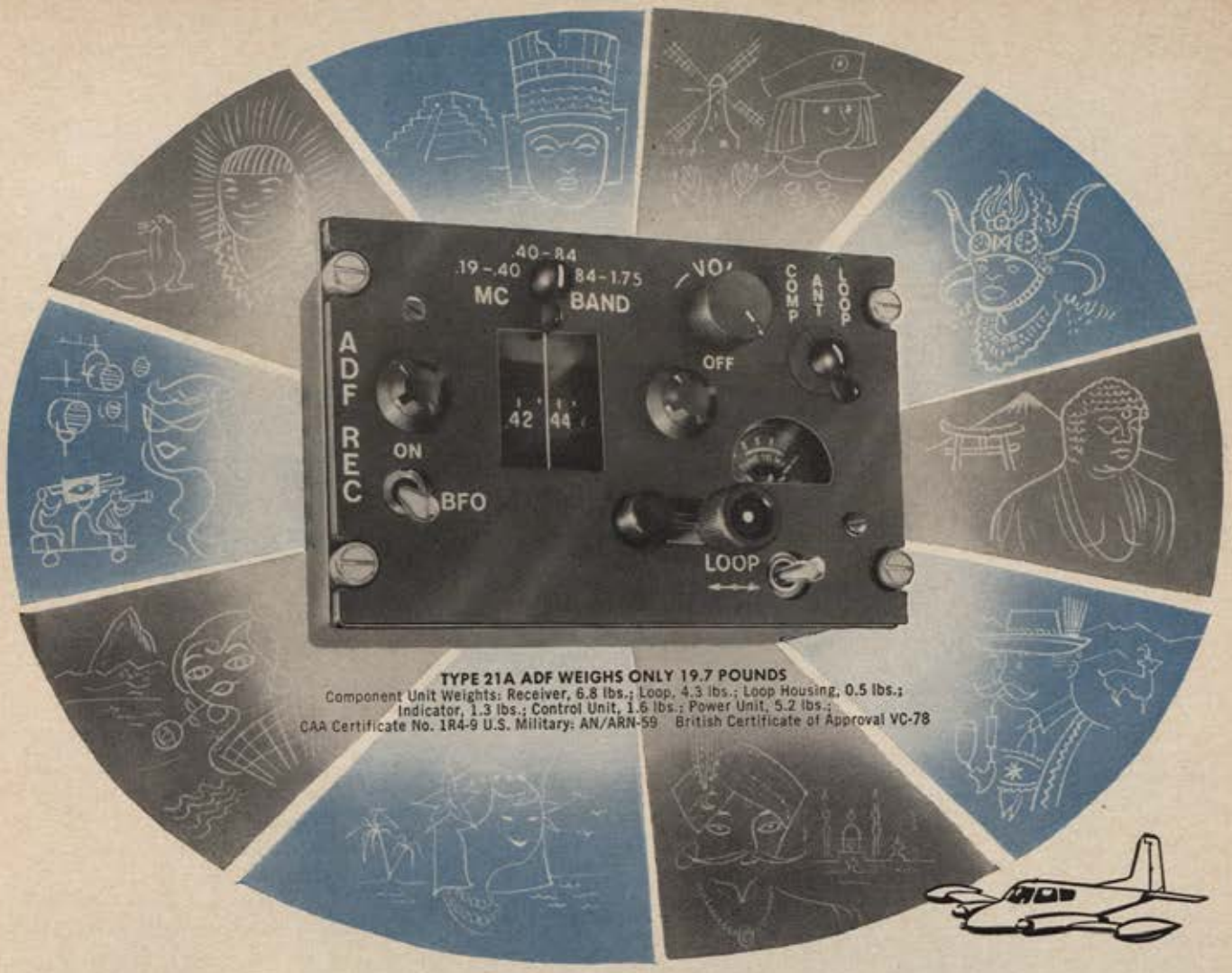

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It reveals, also, the seriousness, intensity, and sometimes foolishness with which our Ally to the north has debated on how best to come to terms with the realities of manned aircraft and unmanned missiles.

There Shall Be Wings provides, in addition, a justifiably proud account of the distinguished performance of Royal Canadian Air Force men in two world wars.

About the reviewer: *Mr. Angell, Ass't/Chief, USAF Historical Division since 1951, was a historical officer in the AAF during World War II. He is author of the "Crossbow" chapters in the official history,* The AAF In World War II, *and a series of controversial articles "Guided Missiles Could Have Won," in the* Atlantic Monthly. *A Professor of Military History and Theory at the Air University, Mr. Angell currently heads the AF Historical office at Hq. USAF.*

A Fiction Rundown

Drawing on a wide experience of Japanese life and Japanese-American relations, Walter J. Sheldon, author of the Korean air war novel *Troubling of a Star,* bases his new novel on delicate Air Force community relations problems in Japan. *Tour of Duty* (Lippincott, $3.95) is set at a fictitious air base in Japan. The natives on the one hand enjoy certain economic prosperity from the base, on the other they highly resent the American and his being there.

Former USAF officer George Leonard, now with *Look* Magazine, records an impression of stateside life and duty during World War II. His novel portrays the frustrations of those fly-boys who never drew combat but who nonetheless contributed to final victory. *Shoulder The Sky* (McDowell, Obolensky, $4.50) is set at a flying training air base in the deep south. It presents an intensely realistic profile of the typical flying instructor and his drab, monotonous world during the war. For spicy interest, Leonard mixes in the normal ingredients: liquor, sex, and entangled romances.

Freedom Comes High

The bizarre career of a former Nazi pilot and his determination to gain freedom is told in *Red Sky at Night: The Story of Jo Capka as Told to Kendall McDonald* (Roy, $3.50). Capka hated the Nazified Czechoslovakian Air Force, deserted to the French Foreign Legion, and later joined the French Air Force. He distinguished himself in fifty-six bomber missions against the Germans.

After World War II, Jo returned to his homeland, opened a flying school, and was arrested by the Communists on a trumped-up British spy charge. After spending seven and a half years in Communist prisons, Capka escaped to England where he is now living.

His biography outlines in vivid terms the price which one man paid for freedom.

Desk Reference Companions

The fortieth annual edition of *The Aircraft Year Book, 1959,* edited by James J. Haggerty, Jr. (American Aviation Publications, $6) marks improvement over previous issues. It represents a complete, detailed, and authoritative guide to military and civilian aviation and the aircraft industry. Main emphasis is on the year's progress in all segments of American aerospace efforts with pictures. It is an excellent reference volume.

(Continued on following page)

AIRMAN'S BOOKSHELF — CONTINUED

Each year Paul Wilkinson, Washington aviation writer, brings out a revision of his *Aircraft Engines of the World* (Paul Wilkinson, $15). This volume, one of the unique reference guides in aviation, is a gold mine of detailed fact. It covers in photo and statistical rundown engines of all types, of all nations of the world, including the Soviet bloc. This volume can be obtained by writing to the author at 734 15th St., N.W., Washington 5, D.C.

New Aerospace Books in Brief

Target for Tomorrow, by Dr. I. M. Levitt (Fleet, $4.95)—Fels Planetarium director studies development of rockets, missiles, and space satellites against a background of astronomy and the universe.

Space Guide, edited by Vincent F. Callahan Jr. (Washington Space Letter, 1420 New York Avenue, N.W., Washington, D.C., $10)—Description of NASA, its organization, operations, development, production, and procurement.

A Sky of My Own, by Molly Bernheim (Rinehart, $3.95)—Personal story of the flying grandmother, her training and experiences as pilot and instructor.

A Guided Tour Through Space and Time, by Eva Fenyo (Prentice-Hall, $3.50)—A practical simplified review of the scientific theories—relativity, speed of light, etc.—that will increasingly affect daily life in the future.

Surgeon at Arms, by Daniel Paul with John St. John (Norton, $3.95)—The story of a British airborne surgeon who parachuted into combat, was captured by the Germans, and escaped with the help of the Dutch underground.

Across the Sea of Stars, by Arthur C. Clarke (Harcourt, Brace, $3.95)—A collection of Clarke's science fiction including two complete novels, *Childhood's End*, and *Earthlight*, and eighteen short stories.

Airman's Guide (Stackpole, $3)—New, revised edition.

The Air Officer's Guide (Stackpole, $6)—New, revised edition.

Rocket Handbook for Amateurs, edited by Lt. Col. Charles M. Parkin Jr., USA (John Day, $5.95)—Guidebook for the rocket "bugs" and backyard technicians, treating the fundamental physics and technical aspects of rocketry, propellants, design, engines, construction, launch stands, and practical safe ways to conduct experiments.

Education and Military Leadership: A Study of the ROTC, by Gene M. Lyons and John W. Masland (Princeton Univ. Press, $5)—A study with emphasis on the postwar period. It takes the view that ROTC is changing from a training ground for qualified Reserves to a recruitment program for professional officers.

—Maj. James F. Sunderman

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2. For permanent total loss of sight of both eyes	$10,000.00	$12,500.00
3. For permanent total loss of sight of one eye	$ 5,000.00	$ 6,250.00
4. Loss of two limbs	$10,000.00	$12,500.00
5. Loss of one limb	$ 5,000.00	$ 6,250.00
6. Permanent total loss of sight of one eye and loss of one limb	$10,000.00	$12,500.00
7. Medical expenses not reimbursed by other insurance (irrespective of number of units) up to	$ 500.00	$ 500.00

As a non-profit activity for AFA members only the Travel Accident program offers a combination of low cost, wide coverage, and increasing benefits *that you can't match anywhere else.*

And you can protect your whole family, right now—just by returning the application blank enclosed with your check today.

SPECIAL NOTES—IMPORTANT

Send premium only for basic coverage (Maximum $25,000). Additional coverage will be added to your protection automatically as you renew each year.

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Limit of Liability: The Insurer's Aggregate Limit of Liability with respect to all insured persons holding certificates issued under this master policy while in any one aircraft shall not exceed $500,000.00. Should the total of the individual limits of liability with respect to such Insured Persons while in any aircraft exceed $500,000, then the amount applicable to each Insured Person shall be proportionately reduced to effect a proportionate distribution of the said Aggregate Limit.

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Underwritten by MUTUAL OF OMAHA
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Your Name _____

Address _____

Amount _____ yes no Option A _____ Cost

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If you want protection for family members, list the necessary information on an additional sheet, and mail with your application.

Application must be accompanied by check or money order. Send remittance to Travel Insurance, Air Force Association, Mills Building, Washington 6, D. C.

TRAVEL INSURANCE Air Force Association
Mills Building, Washington 6, D. C.

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This Is AFA

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Objectives

• To assist in obtaining and maintaining adequate airpower for national security and world peace. • To keep AFA members and the public abreast of developments in the field of aviation. • To preserve and foster the spirit of fellowship among former and present personnel of the United States Air Force.

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